MASTERING

# Emergency Medicine

## a practical guide


*Edited by*

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# Mastering Emergency Medicine

## A practical guide


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# CONTENTS

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# FOREWORD

It is an absolute pleasure to welcome this new book and to congratulate the editors on providing an excellent addition to the emergency medicine library.

The College of Emergency Medicine (CEM) examinations, both membership and fellowship, are rigorous and demanding. This is absolutely essential to ensure that the doctors who successfully pass these examinations are of a high calibre who will then deliver the highest standard of care to their patients. Setting the bar at this very high level also allows the quality and safety agenda to be comprehensively addressed by specialists in emergency medicine.

From the candidates' perspective, the examinations can appear somewhat daunting, even for the most talented and well prepared. The editors have assembled an outstanding group of contributors, who provide comprehensive coverage of the CEM syllabus. This book has been written by trainees who have successfully negotiated all the hurdles and crossed the finishing line, and as such they have a huge insight into the knowledge and approach required to be successful in the examinations.

The main focus of the book is the OSCE component of the CEM examinations. This is, of course, a great opportunity for candidates to demonstrate their clinical skills and competencies, which will subsequently be provided for patients in their care. The assessments in the OSCEs are therefore very realistic and relevant to day-to-day patient care.

This important link to everyday patient care means that the content of this book is also useful in a non-examination setting, as it discusses optimal approaches to a wide range of emergency department clinical scenarios appropriate for trainees in emergency medicine and adjacent specialties.

Many congratulations to the editors and contributors of this book, which will have an invaluable role for all emergency medicine trainees preparing for their CEM examinations.

Good luck!

JOHN HEYWORTH
*President, College of Emergency Medicine*

# PREFACE

The great challenge of emergency medicine is in the immense breadth of knowledge and clinical skills required for competent practice: knowledge and skills that overlap and incorporate aspects of virtually every medical specialty adapted for the emergency room environment.

In 2003, the newly formed College of Emergency Medicine (CEM) launched its own membership examination, the Membership of the College of Emergency Medicine (MCEM). This examination tests candidates' knowledge of basic sciences in Part A, clinical data interpretation in Part B, and clinical skills using Objective Structured Clinical Examinations (OSCEs) in Part C. Since its inception, the new MCEM examination has set a high standard and the gruelling OSCE circuit in particular has proved to be a real challenge for many aspiring emergency medicine trainees.

Unlike other postgraduate examinations, there are few resources for the emergency medicine trainee sitting the OSCE component of the CEM examinations. This book aims to fill that void by providing a comprehensive yet practical approach to the Part C examination, and in addition contains useful content for the OSCE component of the FCEM examination. We have included a breakdown of the CEM curriculum into core topics and examples of past OSCE stations, with the text guiding the reader through over a 100 practice OSCEs and providing essential background information, suggested approaches, revision checklists and sample score sheets. As such, this is a unique and essential revision aid to the MCEM Part C examination and beyond. Trainees in other acute medical specialties will also find this a useful hands-on guide for managing patients in the emergency department.

In putting this book together we have drawn on the experience of a wide range of contributors from the field of emergency medicine whose remit was to write each chapter with a strong focus on the attitudes, knowledge and clinical skills expected of a higher trainee in emergency medicine.

We hope that you will find this book useful both in revising for the MCEM and FCEM exams, but also as a useful resource to improve and consolidate your clinical skills in emergency medicine.

CT, MH, AP

# 1
# Surviving the CEM Examination

CHETAN R TRIVEDY AND ANDREW PARFITT

The objective structured clinical examination (OSCE) has become the standard form of assessment for the majority of undergraduate and postgraduate examinations. Many candidates find the prospect of performing simulated scenarios under the pressures of time and examination conditions quite stressful.

The aim of this book is to give the prospective candidate a structured approach to the OSCE component of the College of Emergency Medicine (CEM) examinations. The content of the book is based on the CEM syllabus, and the sample OSCE scenarios are representative of the core skills that can be examined at both Membership and Fellowship levels.

The CEM OSCE has been described as 'a bad day at the office', and this is a pretty accurate description, since the scenarios typify cases that the candidate is likely to come across on a daily basis. The only difference is the pressure of time and the added stress of examination conditions.

## PREPARATION TIPS

The importance of preparation cannot be overstated, and, unlike written examinations, cramming is not a realistic option for the OSCE assessment. Ideally, you should leave aside at least three months to prepare for the examination, of which the first month should involve developing an OSCE study group.

Unlike other types of examinations, preparation for which is usually self-directed, OSCEs should be tackled using a team approach. Setting up an OSCE study group is an essential part of the revision process and should be done early, since it often takes a few weeks for the team to gel together. The emergency department provides round-the-clock access to potential revision scenarios, and you should try to allocate as much time as you can spare around each shift to practise your clinical examination and history-taking skills.

You should take every opportunity to be observed by senior colleagues when you examine a patient, and should try to utilize other members of the emergency department team, who can provide constructive criticism on your verbal and non-verbal communication skills.

The vast majority of practical skills can be perfected within the emergency department, although it is often useful to practise in the skill laboratory or the resuscitation-training centre.

It is essential that you be familiar with the latest resuscitation guidelines, since you are almost certain to be faced with an OSCE based on the latest advanced life support (ALS), advanced trauma life support (ATLS) or advanced paediatric life support (APLS) guidelines.

Over the last few years, there has been an increase in the number of dedicated OSCE revision courses that allow the candidate to practise realistic OSCE scenarios under the scrutiny of the examiners. However, they are usually oversubscribed and often quite expensive, and so you should organize your study leave and budget as soon as you can.

## THE OSCE EXAMINATION

At present, the MCEM OSCE assessment consists of 18 stations and a number of rest stations. There are no sudden-death stations and you have to pass 15/18 stations to pass the examination. Each station is 7 minutes in duration and you will be directed through the OSCE circuit.

As the format of the examination may undergo modification, you should visit the CEM website for up-to-date information on the structure of the OSCE assessment. The site also provides sample OSCE mark schemes and advice on all components of the CEM examination.

## THE TEN GOLDEN OSCE RULES

1. Dress appropriately and be presentable – first impressions do count! It is acceptable to wear scrubs or smart attire. However, it is not acceptable to wear polo shirts and trousers in the examination.
2. **READ THE INSTRUCTIONS.** This cannot be overstressed, since many candidates will either misread or misinterpret the instructions. The marks are fixed and you can only score marks for what you are asked to do. If you are asked to examine the cardiovascular system, you will not get any marks for taking a cardiac history and you will waste valuable time.
3. If you are unsure about the instructions, ask the examiner to clarify them. If in doubt, reread the instructions.
4. Introduce yourself appropriately and confidently. Be yourself and pretend that this is just another patient in the emergency department. Always remember to decontaminate your hands with alcohol gel on entering and leaving each station.
5. Keep calm and collected at all times. You may be faced with an aggressive or difficult colleague or patient. The actors will have been primed to respond to your body language. You should not get aggressive or defensive and you should remain courteous at all times.
6. Talk through what you are doing unless the examiner asks you to present at the end of the OSCE. This also gives you the opportunity to talk through things that you would do in a real-life situation.
7. Engage your patient and develop a rapport with them. Ensuring their comfort and explaining what you are going to do before you do it will go a long way to enhancing your global score. A patient who is in pain should be offered analgesia.
8. There are no sudden-death stations. However, some candidates have a tendency to panic when things do not go to plan. This is very dangerous, since there is real risk of meltdown if you take your perceived poor performance and frustration from one station to the next. Do not assume failure, since it is very difficult to predict your performance for any given station; remember that you can fail three of the stations and still pass the examination.
9. Always conclude your station by ensuring that your patient has either follow-up or a management plan (if appropriate for the scenario).
10. Do not try to memorize mark sheets that you may have seen in books or courses. These are for revision purposes only and are likely to differ from the actual mark sheet.

## THE 'TRIP' AND 'FALL' PRINCIPLES IN THE OSCE

Experience has led us to believe that success in the OSCE is not wholly related to clinical knowledge or the ability to perform clinical skills. The ability to respond to both verbal and non-verbal cues is often underrated by many candidates. The use of technical jargon, mannerisms, poor eye contact, and lack of empathy or rapport with the patient often results in the candidate not communicating effectively, and we have coined the term TRIP to exemplify this:

**T**echnical jargon
**R**educed rapport with the patient
**I**ncoherency in communication
**P**atronizing

This term represents potential factors that may impair success in a history-taking or communication skill station.

Alternatively, the candidate may also FALL:

**F**ailure to recognize non-verbal cues from the patient
**A**ssuming failure
**L**ack of clinical knowledge
**L**ack of empathy with the patient

TRIP and FALL are important factors resulting in the candidate failing the OSCE station.

## NON-VERBAL COMMUNICATION

It is important that you listen carefully to your patient and ask open questions. Some patients may have hidden concerns that may not be obvious at first but that you should try to explore. Pay attention to the patient's body language as well as your own. If a patient is aggressive, there is usually a good reason, and you should pick up on their verbal and non-verbal cues.

## USEFUL RESOURCES

Recently, there has been an increase in the amount of Internet resources available for those sitting the MCEM/FCEM examination. The CEM website has some sample OSCE scenarios. In addition, there are web resources that give advice and useful revision tips. Examples of OSCE scenarios that have appeared before are listed at the end of this chapter. They should be used purely as a guide and not as an exhaustive list of OSCEs.

## OSCE TYPES

The OSCE scenarios can be divided into five broad categories; this list is likely to grow as examiners try to create more sophisticated OSCE scenarios.

### The clinical examination OSCE

This type of OSCE requires a well-rehearsed examination of a system, and it is essential that you practise examining all of the major systems. As this is a Membership examination, you should have a slick and systematic approach to your clinical examination. You should present your findings as you proceed and remember to leave enough time in your routine to summarize your findings as well outline your differential diagnosis, investigations and management. You should pay close attention to the instructions to ensure that you are performing the correct examination as opposed to what you have revised. Most of the clinical examinations will be on either actors or patients; therefore be courteous and watchful of their dignity, try not to cause any pain or discomfort while examining them, and ensure that you have decontaminated your hands before and after the examination. You will not be expected to perform an intimate examination on a real patient, but it is essential that you address the actor linked with the model as if they were the patient. Ask for a chaperone where appropriate and get consent to examine a child. These points may seem obvious, but they can significantly influence your global score.

### The skills OSCE

This type of OSCE involves performing a practical procedure in a very short time frame in what may seem to be a very artificial and surreal scenario. Nowhere else would you be expected to suture a wound or place a chest drain in

less than 7 minutes. It is therefore crucial that you not only practise the common skills but also get into the habit of talking through a skill as you are performing it. Although the majority of the marks are for performing the skill, do not forget to interact with the actor or manikin as if they were the patient, since there will also be marks for obtaining consent and outlining follow-up. Some candidates find this type of station difficult because very little time is allowed. The CEM syllabus lists the practical procedures that you need to be aware of; we have summarized these in Chapter 31.

## The teaching OSCE

The CEM examinations test not only your clinical skills as an emergency physician but also your ability to teach students or junior colleagues. This may seem a daunting prospect, since you not only have to know the subject matter but also have to pass on this knowledge in a constructive, non-judgemental and educationally approved manner. Whether you are asked to teach a medical student how to examine the ear or teach a patient how to use an inhaler, the principles are more or less the same. It is important that you appreciate that this type of OSCE is not just about how much you know of the subject matter but also about how you impart that knowledge; Table 1.1 outlines a generic approach to this type of OSCE.

**Table 1.1** A generic approach to the teaching OSCE

| Teaching a junior colleague | Teaching a patient |
|---|---|
| Find out how much they know about the particular skill | Review what the patient knows or has been told about their condition |
| Set the objectives for the teaching session clearly | Set the learning objectives |
| Demonstrate the skill in stages | Demonstrate and explain the skill, bearing in mind that you may be teaching a layperson |
| Stop after each stage and review that the student has understood what you have told them | Check that the patient has understood |
| If there is any misunderstanding, review the previous steps | Repeat steps for clarification |
| Ask the student to perform the skill | Ask the patient to perform the skill |
| Review the skill and provide feedback | Review and provide feedback |
| Encourage questions | Encourage questions |
| After dealing with any queries, plan for the next session | Arrange follow-up for the patient |
| Try to give pointers for resources that the student can use to prepare for the next session | Give an advice leaflet or written instructions |
| It is important that you are not judgemental or patronizing and that you do not spend your valuable minutes quizzing or berating the student | It is important that you are not judgemental or patronizing and that the patient is happy with your management |

## The communication skills OSCE

Good communication skills are essential in emergency medicine, and several stations in the CEM will be specifically designed to test your ability to communicate with a patient, colleague or other members of the multidisciplinary team. In addition, these stations also test your negotiation and diplomacy skills.

- Break bad news to a patient or family member.
- Explain a proposed treatment or condition.
- Make a difficult referral.
- Deal with a complaint.
- Deal with a failing colleague.
- Negotiate a management plan with a patient.
- Deal with a confidentiality/consent issue.

It is difficult to learn communication skills from a book, and the easiest way is to get a colleague to observe you and provide feedback. You should pay particular attention to your body language, since this is an important form of non-verbal communication. Silence is also an effective means of communication, and it is important that you give the patient ample opportunity to talk without interruption. Try to summarize what the patient has said to you back to them to ensure that your facts are accurate.

## The history-taking OSCE

Taking a concise and accurate medical history is integral to success in the CEM examinations. As there is pressure of time in the examination, your questioning should be focused while not appearing to be an inquisition for the patient. Remember that, in addition to marks for asking clinical questions, there will also be marks from the patient/role player for your communication skills.

## HOW TO USE THIS BOOK

As with all examination preparation texts, this book is only a guide to the type of OSCEs that may appear in the CEM examinations. Although it is primarily aimed at those sitting the MCEM examination, it should be also be a useful base for those preparing for the FCEM, since there is a significant overlap in the type of OSCEs. The CEM syllabus is extremely diverse and is continually remodelled, and so it is essential that you be aware of any additions or amendments.

It is also important to point out that this book does not prepare you with the core clinical knowledge required to pass the examination and is specifically aimed at providing the candidate with a number of mock OSCE scenarios to practice. Useful facts and guidelines have been included where possible, but, given the breadth of knowledge covered in the syllabus, it is impossible to provide essential facts for every topic or to cover every scenario. There are several core texts in emergency medicine, which should be used in conjunction with this OSCE-based revision guide.

The scope of this book is to give the candidate a broad overview of the potential OSCE scenarios that may be tested in the examination and a guide on how to approach these OSCEs. Do not make the mistake of rote-learning the mark sheets, since they are only guides and not validated mark sheets.

Marks are given for specific points/areas that you address appropriately. In addition, the actor/patient/student can give a score, usually out of 5, and the examiner can give a global score out of 5.

The scoring for each section of the mark sheet is as follows:
0 = inadequate/not done
1 = adequate
2 = good

It is crucial to appreciate that this is an arbitrary marking system that is a rough guide to your performance

and does not in any way represent the official college score sheets. You should use the marks to see how your performance progresses as you step up your revision.

The key is to use this book as a template on which to base your revision and not as a substitute for seeing as many patients as possible in the emergency department.

## PAST OSCE SCENARIOS

### Chapter 2: Resuscitation

- Airway management
- Advanced life support (ALS) management – patient in systole
- ALS management – 34-week pregnant patient, involved in a motor vehicle collision
- ALS management – defibrillation technique and safety
- ALS management – pulseless electrical activity (PEA)
- ALS management – postresuscitation care
- ALS management – pulseless ventricular tachycardia (VT)
- ALS management – tricyclic antidepressant overdose and ventricular fibrillation
- ALS management – ventricular fibrillation
- Basic and advanced airway management (including endotracheal intubation)
- Transfer a patient with a head injury and reduced consciousness for a CT scan

### Chapter 4: Wound management

- Suturing a laceration wound using the 'no-touch' technique
- Handwashing scenario

### Chapter 5: Major trauma

- Advanced trauma life support (ATLS) scenario
- Clinical examination of an immobilized patient with a potential cervical spine injury
- Demonstrate a log-roll and spinal examination in a trauma scenario
- Manage a patient with a haemothorax following a motor vehicle collision
- Place and suture a chest drain

### Chapter 6: Musculoskeletal emergencies

- Focused upper limb examination to assess nerves, vascular supply and tendons following a laceration injury
- Hand examination (neurovascular plus tendons)
- History, examination and management of a shoulder injury
- Knee joint examination and management
- Plaster cast application for a Colles fracture

### Chapter 8: Abdominal emergencies

- Focused gastrointestinal history and general systems enquiry
- Focused history and management of a rectal bleed
- Traveller's diarrhoea – history and advice
- Cirrhosis of liver – history and management

### Chapter 9: Genitourinary system

- Genitourinary history, clinical diagnosis and management
- Haematuria assessment

## Chapter 10: Ophthalmology

- Acute red eye assessment and management
- Perform fundoscopy and make a clinical diagnosis
- Teaching a medical student to use an ophthalmoscope
- Examine a patient with an ocular injury

## Chapter 11: ENT conditions

- Perform otoscopy and make a clinical diagnosis in a child or adult

## Chapter 12: Maxillofacial emergencies

- Assault with facial injuries – examination
- Facial fractures examination

## Chapter 13: Obstetrics and gynaecology

- 15-year-old girl requesting 'morning-after' emergency contraceptive pill
- Bimanual pelvic examination in female patient
- Management of a lost/split condom in a female
- Pelvic inflammatory disease history (sexual history)

## Chapter 14: Respiratory emergencies

- Haemoptysis – take a history
- Mild asthma management and demonstration of inhaler technique
- Respiratory system examination and management of a patient with chronic obstructive pulmonary disease (COPD)

## Chapter 15: Cardiological emergencies

- Assessment and management of chest pain (history consistent with acute myocardial infarction)
- Cardiovascular examination
- Interpretation of an ECG
- Teach a student how to interpret an ECG
- Full cardiovascular examination and clinical diagnosis

## Chapter 16: Neurological emergencies

- Acute onset of severe headache
- Cranial nerve examination for new-onset left-sided weakness
- Assessment of a patient presenting with foot drop
- History and management of subarachnoid haemorrhage
- Perform a mental state examination
- Patient presenting with sciatica – examination of lower back and appropriate neurological testing
- Traumatic neck pain – examine peripheral neurology and give management plan

## Chapter 18: Toxicological emergencies

- History and management of a patient with acute confusion (recreational drugs)
- Management of deliberate overdose of paracetamol

## Chapter 19: Renal emergencies

- Renal colic – take a history

## Chapter 20: Endocrine emergencies

- Explain diabetes to a patient
- Thyroid examination and endocrine assessment
- Take a history of a patient with thyrotoxicosis

## Chapter 22: Infectious diseases

- Needlestick injury involving a 'high-risk' patient
- Needlestick injury involving a 'low-risk' patient

## Chapter 23: Dermatology

- Scabies – diagnosis and management

## Chapter 24: Oncological emergencies

- Terminal illness – discussion and management with the family

## Chapter 25: Rheumatological emergencies

- Acute painful and hot knee joint (history and clinical diagnosis)

## Chapter 26: Paediatrics

- Advanced paediatric life support (APLS) scenario – 18-month-old child with supraventricular tachycardia
- APLS scenario – meningococcal septicaemia
- APLS scenario – obstructed airway
- APLS scenario – trauma
- Limping child – take an appropriate history
- Non-accidental history (communication)
- Explain inhaler technique to a parent

## Chapter 27: Psychiatric emergencies

- Acute confusional state
- Assessment of suicide risk (and appropriate referral/follow-up plan)
- Psychiatric history and mental state assessment
- History from a confused patient and further management decisions
- History from a manic patient

## Chapter 30: Communication skills

- Communication – investigate polypharmacy in an elderly man
- Communication – no neurosurgical intervention recommended for a comatose patient
- Communication – the orthopaedic registrar refuses to see a patient with a cervical spine injury
- Communication – unwell patient with advanced cancer and ascites refusing further treatment
- Communication (to the patient's relative) – withdrawal of treatment
- Counsel a patient with missed fracture, recalled by letter (the patient may be very angry)

- Counselling parent – reasons for not prescribing antibiotics for upper respiratory tract infection (URTI) in a 3-year-old
- Refusal of blood transfusion – Jehovah's Witness (consent issue)
- *N*-Acetylcysteine in a paracetamol overdose – explain indications and its action to a nurse

## Chapter 31: Practical skills for the emergency department

- Aspiration of simple pneumothorax
- Femoral nerve block
- Insertion of an internal jugular central venous catheter
- Insertion of urinary catheter for acute urinary retention
- Intraosseous needle insertion in a young child
- Safely secure a correctly inserted chest drain (and appropriate advice to ward staff)
- Spontaneous pneumothorax and method of chest drain insertion

## Chapter 32: Management skills

- Clinical decision unit patient selection and management plans – paper exercise
- Performing a clinical board round
- Triage process and methodology

## Acknowledgement

We would like to acknowledge Paul Hunt for his permission to reproduce these past OSCE scenarios from the MCEM website.

## USEFUL WEBLINKS

- College of Emergency Medicine website: www.collemergencymed.ac.uk
- MCEM website: www.mcem.org.uk

# 2 Resuscitation

CHETAN R TRIVEDY AND RUSSELL BARBER

## CORE TOPICS

- Airway management
- Cardiac arrest/peri-arrest
- Shock
- Coma

Resuscitation is clearly an important topic as far as the practice of emergency medicine and the CEM examinations is concerned. There are likely to be a number of advanced life support (ALS), advanced paediatric life support (APLS) and advanced trauma life support (ATLS) scenarios in the examination.

To cover the whole breadth of potential scenarios is outside the scope of this book, and you are strongly advised to be familiar with the latest resuscitation guidelines. It is also useful to speak to your local resuscitation training officer regarding training before the OSCE.

The scenarios presented in this chapter will attempt to highlight some of the approaches to tackling a resuscitation-type OSCE.

### SCENARIO 2.1: MAINTAINING AN AIRWAY

A 20-year-old woman known to have epilepsy has been brought into the resuscitation department following a prolonged seizure. She has been given 10 mg of diazepam rectally.

Initial observations are:

BP 116/78 mmHg
Pulse 90 bpm regular
Pulse oximetry 94% on 15 L of $O_2$ via a non-rebreath mask
Temperature 38.1 °C
GCS 9

Using the manikin provided, demonstrate how you would initially manage this patient. You will be assessed predominantly on your airway skills, although you will not be expected to perform endotracheal intubation. You have an ALS-trained nurse to assist you.

## SUGGESTED APPROACH

When there is time for preparation, effort should be made to assemble and utilize the available staff and subspecialties. You should ask for the emergency airway trolley, and all equipment should be checked and drugs prepared. In this scenario, an ALS-trained nurse is available. Do not fail to delegate tasks appropriately. Likewise remember to gather information from the ambulance crew.

The airway is the first step in every primary survey within the hospital setting, and this essential skill should be well rehearsed and fluent.

The mnemonic 'HATS' is a useful guide to prioritize the methods used to secure the airway; you should move down the list sequentially:

**H**ands (jaw thrust/chin lift)
**A**irway adjuncts (oropharyngeal/nasopharyngeal airway)
**T**racheal intubation (gold standard)
**S**urgical airway (failed intubation)

### Step 1: Examination of the oropharynx (with clearance if necessary)

Look into the oropharynx to reveal any removable obstruction such as vomitus, blood clot or food bolus. The airway should be cleared by suctioning vomitus from the airway using wall-mounted suction, a wide-bore catheter and direct vision. Magill's forceps can be employed to remove large food boluses; however, the finger sweep is not recommended, since it may further compromise the airway through trauma or by compaction of any foreign body, not to mention the risk of entrapping your fingers between clenched teeth! It is important to bear in mind that opening the airway before clearing it can lead to migration of contaminants further along the respiratory tract. Each manoeuvre should be followed by reevaluation for evidence of improved airway patency.

### Step 2: Assessment of the degree of airway patency

Assess the degree of airway patency by listening for signs of airway obstruction and feeling for expiration against the side of your cheek. These can be done simultaneously.

Obstruction may be partial or complete and may arise from either the upper or lower airway (Table 2.1). In an unconscious or postictal patient, such as in this scenario, obstruction is most likely to arise from the pharynx. As a result of loss of muscle tone, and exacerbated by the supine position, the tongue and jaw slide backwards, obstructing the airway at the level of the pharynx.

### Step 3: Manual airway opening (and application of oxygen)

The simplest and most readily available equipment to open an obstructed upper airway is your hands. Either a head-tilt chin lift or jaw thrust manoeuvre can be employed instantly. A head-tilt chin lift should be avoided in cases of C-spine injury.

After every intervention, the airway should be re-evaluated. In most cases, such manoeuvres will improve or at least convert a complete obstruction to a partial obstruction.

### Step 4: Manual airway opening using simple adjuncts

Initial techniques may not be effective. In such cases, an oropharyngeal airway or nasopharyngeal tube should be inserted (Figures 2.1 and 2.2). In this scenario, where the patient is at risk of further seizures and clenching their teeth, a nasopharyngeal tube may be more appropriate. It is less likely to be expelled during moments of improved GCS and is well tolerated even in the awake patient. Placement of an oropharyngeal airway in a patient with an intact gag reflex may induce vomiting.

**Table 2.1** Partial and complete airway obstruction

| Examination | Partial | Complete |
|---|---|---|
| 'Looking at the chest' | Respiratory excursion of the chest | Paradoxical ('see-saw') movement of the chest and abdomen |
| | | Indrawing at the chest and neck due to negative pressure distal to the obstruction |
| 'Listening' | Stridor | Silent |
| | Snoring (pharyngeal occlusion by the soft palate or tongue) | Silent |
| | Gurgling | Silent |
| 'Feeling' | Movement of respiratory gases felt on expiration | No movement of respiratory gases felt |

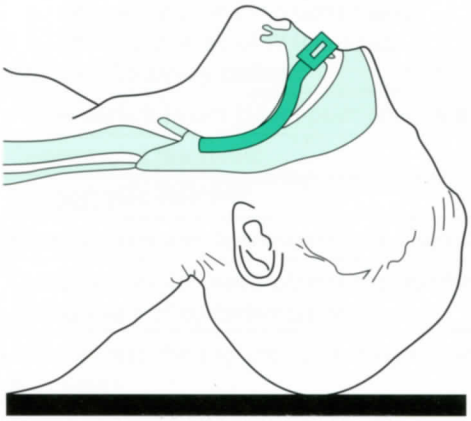

**Figure 2.1** Oropharyngeal airway.

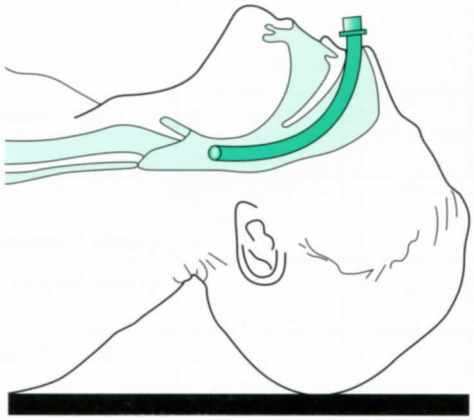

**Figure 2.2** Nasopharyngeal airway.

The oropharyngeal airway is sized by estimating the distance from the upper central incisors to the angle of the jaw. In adults, it is inserted upside down into the roof of the mouth. It is rotated through 180° around the back of the tongue, following the curvature of the palate until the flange is in line with the anterior aspect of the teeth.

The size of the nasopharyngeal tube can be estimated as the diameter of the patient's little finger; however, this may be unreliable, and as a rule a size of 6–7 mm is suitable for most adults. A safety pin is placed through the flange to prevent unwanted proximal migration along the nasopharynx. Lubrication of the tube aids insertion, which should be through a patent nasal orifice. The tube is guided bevel end down along the floor of the nose. Gentle rotation of the tube is often useful. A correctly sized nasopharyngeal tube is less likely to stimulate vomiting. Airway patency should then be re-evaluated following insertion.

## Step 5: Left lateral position

Utilization of the left lateral position aids in expelling vomit and secretions, as well as facilitating airway patency and maintenance. If active vomiting occurs, the bed can also be positioned head down to further prevent bronchial aspiration.

*It is important to note that, although the simple airway manoeuvres and adjuncts described above can maintain the airway, they do not protect it – the ultimate means for doing this is a cuffed endotracheal tube passed beyond the vocal cords.*

Although this OSCE has been designed to test your ability to manage a compromised airway, you would continue with your evaluation of breathing, circulation and disability. Complete the station by suggesting further investigations into the aetiology of seizures, and transfer for imaging or to a more appropriate place.

If the patient needs to be transferred for a CT scan of the head, they may need to be electively intubated to protect the airway while they are supine and isolated within the scanner. Likewise, intubation is needed if the patient's condition deteriorates or there is inadequate ventilation or oxygenation, and you should ask for anaesthetic back-up in the event that rapid sequence induction (RSI) becomes necessary.

It is worth mentioning the role of a laryngeal mask airway (LMA) in airway management. Although this is an option, it is of limited use in this scenario. While an LMA causes less stomach insufflation compared with a bag–valve mask, it provides no protection from aspiration and may direct vomit from the oesophagus into the airway. Successful placement is unlikely in this patient with some pharyngeal tone, and attempting to place an LMA in the presence of an intact gag reflex will provoke vomiting.

## Scoring Scenario 2.1: Maintaining an airway

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Carries out an equipment check and asks for the airway trolley | 0 | 1 | 2 |
| Delegates roles | 0 | 1 | — |
| Makes a rapid assessment of the airway:<br>1. Looks into the orpharynx:<br>• removes foreign body or vomitus lying in the airway<br>2. Listens for signs of partial or complete obstruction:<br>• stridor<br>• snoring<br>• gurgling<br>• movement of air<br>3. Looks at the chest for:<br>• paradoxical chest excursion<br>• indrawing of the chest | 0 | 1 | 2 |
| Immediate management (can ask assistant):<br>1. Places the patient on high-flow oxygen<br>2. Suctions airway<br>3. Organizes monitoring (ECG, oximetry and blood pressure)<br>4. Secures IV access and takes bloods<br>5. Draw up 2–4 mg of IV lorazepam<br>6. Sets up airway trolley | 0 | 1 | 2 |
| Places patient in left lateral position with or without head-down tilt | 0 | 1 | — |
| Demonstrates jaw thrust | 0 | 1 | 2 |
| Demonstrates chin lift | 0 | 1 | 2 |
| Correctly sizes and demonstrates the insertion of an oropharyngeal airway | 0 | 1 | — |
| Correctly sizes and demonstrates the insertion of a nasopharyngeal airway (being aware of contraindications) | 0 | 1 | — |
| Demonstrates the bag-and-valve mask technique (one- or two-handed technique) | 0 | 1 | 2 |
| Discusses use of LMA | 0 | 1 | — |
| Calls for anaesthetic back-up for RSI if airway deteriorates | 0 | 1 | — |
| Reassesses the airway for signs of obstruction | 0 | 1 | 2 |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/25** | | |

## SCENARIO 2.2: EMERGENCY INTUBATION

A 68-year-old man is blue-lighted to the emergency department after having collapsed in the street. He is making a poor respiratory effort. He is currently being oxygenated via a bag–valve mask with an oropharyngeal airway in situ. His observations recorded by the ambulance crew are:

BP 80/60 mmHg
Pulse 120 bpm
Oxygen saturation is unrecordable on 15 L of $O_2$, and he is cyanosed
He has a GCS of 6

Make an assessment of this patient's airway and demonstrate how you would perform an endotracheal intubation on the manikin. You have an ALS-trained nurse to assist you.

## SUGGESTED APPROACH

The situation that you are presented with – a patient with a GCS of 6 who is being oxygenated with a bag–valve mask and has undetectable saturations on 15 L of $O_2$ – is suggestive of imminent full respiratory arrest. You should identify this and call for help (invariably in the examination, the anaesthetist will be unavailable). Ask the nurse to apply monitoring.

Do not assume that the airway is patent because there is an oropharyngeal airway already in situ and ongoing bag–valve ventilation. Assess the airway for obstruction, confirm that the oropharyngeal airway is the appropriate size, and confirm successful ventilation with bag–valve ventilation (a two-person technique may be needed). The use of an LMA is an option. In this scenario, the bag–valve mask continues to be inadequate and intubation should be considered. Ventilation should continue, since some degree of oxygenation may be occurring while you prepare for intubation, but you should be aware of gastric insufflation.

### Equipment

- Size 3 or 4 Macintosh laryngoscope (curved blade)
- Cuffed endotracheal tubes (sizes 7 and 8)
- Wide-bore suction and tilting bed
- 10 mL syringe for inflating the cuff
- Gum elastic bougie and stylet
- Aqueous gel lubricant
- Pillow
- Magill's forceps
- Ribbon or tape to secure the endotracheal (ET) tube
- Colorimetric end-tidal $CO_2$ monitor
- Anaesthetic drugs
- Emergency drugs (adrenaline and atropine)
- Difficult-airway set

Before you commence intubation, you should already have a back-up plan (plan B) in the event that you cannot intubate and cannot ventilate the patient. It is crucial that your team members be aware of this plan and so can prepare accordingly.

The three major situations encountered in the emergency department are:

1. A rapid sequence induction (RSI) where the patient is awake and unstarved (a full stomach). Measures are made to reduce the risk of aspiration, with a minimum delay between the patient being awake and asleep with cuffed tube in trachea.
2. Intubation where the patient is obtunded or is suspended. In these circumstances, the patient will not need to be sedated or paralysed.
3. Failed intubation where the patient cannot be ventilated or intubated.

## The emergency intubation

It is worth being aware of the '10 Ps' of ET intubation before you plan your procedure:

1. **P**reparation
2. **P**lan for failure (failed intubation drill)
3. **P**ositioning the head
4. **P**re-oxygenation
5. **P**re-treatment
6. **P**rotection from aspiration (cricoid pressure)
7. **P**aralysis with induction
8. **P**lacement of the ET tube
9. **P**roof of correct ET tube placement
10. **P**ost-intubation placement

## Preparation

It is essential that you have the right equipment and staff for the planned procedure. You should:

- Have a back-up plan if you run into difficulties.
- Have the patient on full monitoring (ECG/BP/pulse oximetry).
- Check all of the equipment (suction/laryngoscope/ET tube cuff).
- Ensure that there is intravenous access and the cannula is patent.
- Ensure that the emergency drugs are drawn up and labelled.
- Ensure that you have a trained assistant.

## Plan for failure

The importance of having a back-up plan in the event that you cannot intubate the patient cannot be overstressed. If you are not comfortable in executing your back-up plans B, C or even D then you should really question whether you are the right person to be intubating the patient.

The failed-airway algorithm according to the Difficult Airway Society guidelines is shown in Figure 2.3. This algorithm is primarily intended for anaesthetists performing elective intubation, but suitably adopted it is also a useful drill for managing a difficult airway in the emergency department.

## Positioning the head

The goal of positioning the head is to have the oral, pharyngeal and laryngeal inlets positioned in a straight line facilitating direct laryngoscopy. The ideal position is achieved by placing a pillow under the patient's head and extending the head on the neck in a 'sniffing the morning air' position (Figure 2.4). This is the optimum position for intubation; however, a neutral position and in-line immobilization must be maintained when you suspect a C-spine injury.

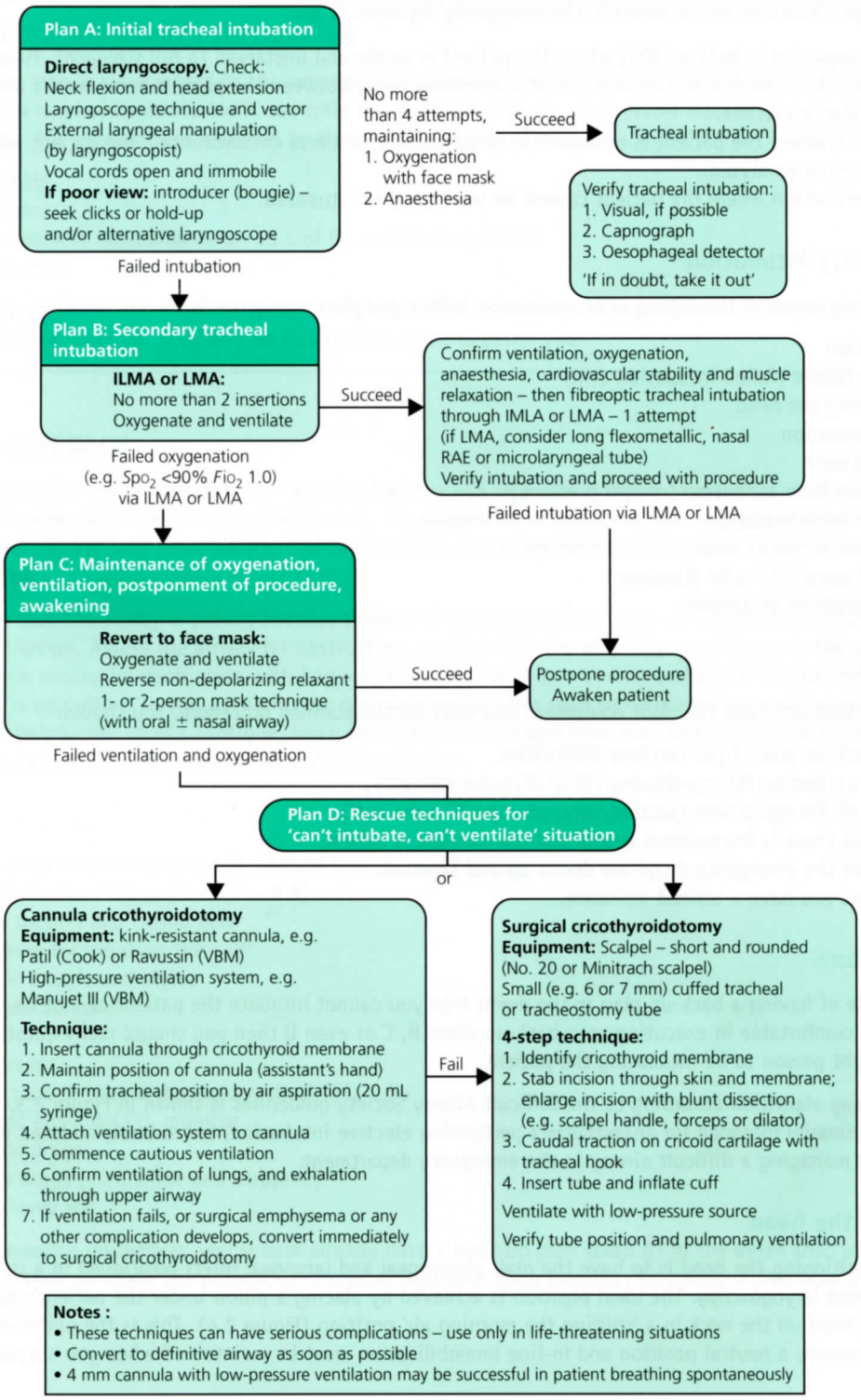


**Figure 2.3** Failed-airway algorithm. LMA, laryngeal mask airway; ILMA, intubating LMA.

Reproduced with kind permission from Difficult Airway Society. *Difficult Airway Society Guidelines. Strategy for intubation by direct laryngoscopy, no predicted airway problem, no risk of regurgitation*. Reading: Difficult Airway Society, 2004 and Difficult Airway Society. *Failed Ventilation*. Reading: Difficult Airway Society, 2004.

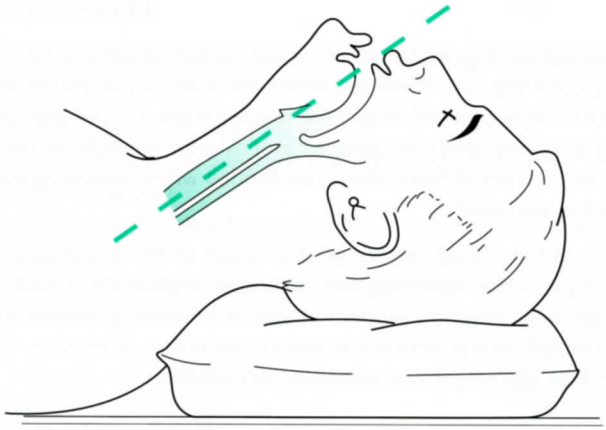

**Figure 2.4** 'Sniffing the morning air' position of head.

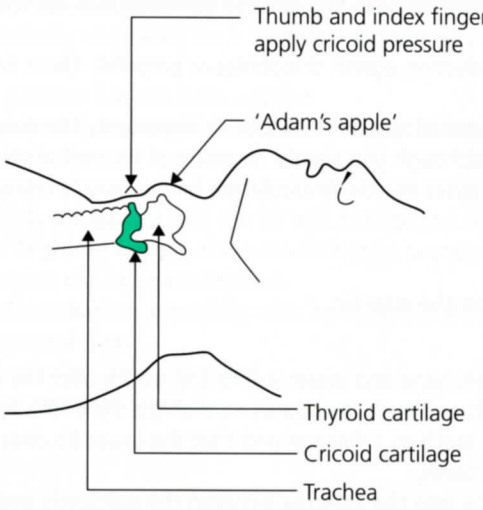


**Figure 2.5** Sellick's manoeuvre.

## Pre-oxygenation

Pre-oxygenation is performed with the patient breathing 100% oxygen through a tight-fitting non-rebreathing facemask for 3 minutes. This allows replacement of nitrogen-containing air with oxygen, and acts as an oxygen reservoir delaying the onset of hypoxia in cases of prolonged apnoea or difficult intubation. After each failed attempt at intubation, the patient should be pre-oxygenated.

In this scenario, pre-oxygenation is not possible, since there is failure to oxygenate despite mechanical ventilation.

## Pre-treatment

Some situations require medications to attenuate the hypertensive response to larygnoscopy:

- lidocaine
- opioids (e.g. fentanyl or alfentanil)

These are not normally given in a crash induction, where the priority is securing the airway quickly and safely.

## Protection of the airway

Protection of the airway from aspiration of gastric contents is only achieved when a tube is positioned within the trachea, with no leakage of air around the cuff. However, before the tube can be placed within the trachea, cricoid pressure must be applied to reduce the occurrence of passive regurgitation. Cricoid pressure (Sellick's manoeuvre, Figure 2.5) should be applied by a trained assistant using anteroposterior pressure on the cricoid cartilage at the onset of induction. The full 44 newtons of force should be applied when neuromuscular blocking agents are administered or when the patient is obtunded.

The complete circumferential ring of the cricoid compresses the lumen of the oesophagus against the sixth cervical vertebra. It does not prevent active vomiting, and continued application in such circumstances can result in oesophageal rupture. This is the only situation in which it should be released prematurely, and the bed tilted head down with the patient on the left lateral position to reduce aspiration. Otherwise, the cricoid should only be released after confirmed correct tube placement and adequate cuff inflation.

## Paralysis with induction

- Only those trained in RSI and who routinely perform these techniques should administer muscle relaxants and anaesthetic agents, owing to contraindications and adverse complications associated with their use in the emergency setting.
- Give an appropriate intravenous induction agent: thiopental or propofol. These both cause hypnosis and amnesia.
- To ease laryngeal intubation, high-speed muscle relaxation is important. The drug of choice in most circumstances is suxamethonium, although you should be aware of its contraindications. Suxamethonium is a depolarizing muscle relaxant and causes muscle fasciculation before muscle relaxation.

## Placement of the ET tube

You will be asked to demonstrate this on the manikin.

- Stand behind the patient.
- Hold the laryngoscope with your left hand and insert it into the mouth over the right side of the tongue.
- Sweep the tongue from right to left and push it upwards so that the tip of the epiglottis comes into view.
- Make sure that you do not use the teeth as a fulcrum and that the lower lip does not get caught between the blade of the laryngoscope and the teeth.
- Advance the tip of the laryngoscope into the valecula between the epiglottis and the tongue.
- To visualize the vocal cords, lift the contents of the oropharynx by moving the laryngoscope along the central axis of the handle.
- If you have a good view of the cords, you should insert the ET tube with your right hand so that it passes between the vocal cords into the trachea, ensuring that the cuff has passed beyond the vocal cords.
- In most adults, the tube will usually lie between 22 and 24 cm at the level of the incisors.
- Stabilize the tube until it is taped or tied in place.
- Connect the tube via a catheter mount and ventilate the patient with 12–15 L of oxygen.
- The cuff should be inflated until no audible leak of ventilation gases is heard to pass around the cuff.

## Proof of correct ET tube placement

It is imperative that you ensure that the ET tube is in the correct place and at the correct depth, by (in chronological order):

- direct visualization of the tube passing through the cords
- compliance of the reservoir bag on manual ventilation and fogging of the tube
- symmetrical expansion of the chest wall
- auscultation of the chest bilaterally for breath sounds and auscultation over the epigastrium to exclude oesophageal intubation
- attachment of an end-tidal $CO_2$ monitor (capnograph or calometric)
- obtaining a chest X-ray to ensure placement of the tube above the carina and below the level of the cords

## Complications

- Aspiration of gastric content – the risk is higher if:
  - there has been recent ingestion
  - gastric emptying is delayed secondary to trauma, pain, diabetes or opioids
  - the lower oesophageal sphincter is incompetent owing to obesity, pregnancy or hiatus hernia
  - the patient has been manually ventilated for a long time before performing the RSI, since this inflates the stomach
  - the appropriate cricoid pressure has not been applied
- Inability to intubate, exacerbated by trauma from repeated attempted intubations.
- Intubation of the oesophagus.
- Dislodgement of the tube.
- Bronchial intubation: commonly a tube inserted too far will occlude the right upper main bronchus, resulting in collapse of the lung section. If placed further, the entire left main bronchus may not be ventilated, leading to collapse of the lung and a higher risk of pneumothorax.
- Tracheal stenosis – prolonged intubation, especially with an inflated cuff, and more common in children who have soft, more easily damaged tracheas.
- Severe hypoxia if prolonged attempts are undertaken.
- Chipping, loosening or dislodgement of teeth.

## Post tube placement

The tube should be secured and the level at the central incisors noted in case of tube migration. The patient should be carefully monitored, and, once they have been stabilized, a portable chest X-ray should be performed to ensure that the main bronchus has not been inadvertently intubated.

The above description should allow you deal with an OSCE scenario where you are asked to secure an airway in the emergency department.

## Scoring Scenario 2.2: Emergency intubation

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate induction | 0 | 1 | — |
| Assigns roles to team members | 0 | 1 | — |
| Asks for the airway trolley to be set up | 0 | 1 | — |
| Appreciates that patient is in extremis and asks for the on-call anaesthetist | 0 | 1 | — |
| Makes a rapid assessment of the airway:<br>1. Looks for:<br>• foreign body in the airway<br>• central cyanosis<br>• paradoxical chest excursion<br>2. Listens for signs of obstruction<br>3. Auscultates chest bilaterally<br>4. Checks chest expansion | 0 | 1 | 2 |
| Asks for an experienced assistant | 0 | 1 | — |
| Immediate management (can ask assistant):<br>1. Places patient on high-flow oxygen<br>2. Suctions airway<br>3. Sets up monitoring (cardiac/sats probe and BP)<br>4. Secures IV access and takes bloods; checks blood sugar<br>5. Sets up airway trolley<br>6. Prepares difficult airway kit (LMA/surgical airway) | 0 | 1 | 2 |
| Checks equipment (laryngoscope/suction/ET tube) | 0 | 1 | — |
| Positions patient's head appropriately, 'sniffing the morning air' (pillow under head) | 0 | 1 | — |
| Holds the laryngoscope correctly with the left hand | 0 | 1 | — |
| Suctions airway | 0 | 1 | — |
| Avoids trauma to lips and teeth | 0 | 1 | — |
| Mentions use of bougie or stylet if the vocal cords are difficult to visualize | 0 | 1 | — |
| Places ET tube correctly beyond the vocal cords (22–24 cm at the level of the anterior teeth) | 0 | 1 | — |
| Inflates the cuff with air | 0 | 1 | — |
| Checks position of the ET tube (needs 3/5):<br>1. Equal chest expansion during ventilation<br>2. Auscultates the chest bilaterally<br>3. Fogging of the ET tube<br>4. $CO_2$ capnography<br>5. Chest X-ray | 0 | 1 | 2 |
| Discusses failed intubation drill (senior help/LMA/intubating LMA (ILMA)/ surgical airway) if unsuccessful | 0 | 1 | 2 |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/26** | | |

## SCENARIO 2.3: CARDIAC ARREST

A 30-year-old man is brought to the emergency department with a displaced fracture of his left femur following a motor vehicle collision. Your consultant has just performed a femoral nerve block with bupivicaine to ease the pain. As you are writing up your notes, you notice that the patient has become unconscious. Your F2 and ALS-trained nurse are at hand to assist you.

Manage the resuscitation of this patient.

## SUGGESTED APPROACH

This OSCE tests your ability to effectively run a cardiac arrest. The following may have contributed to the arrest:

- hypovolaemia (splenic tear or fractured pelvis)
- fat embolism arising as a result of the fractured femur
- cardiac tamponade following blunt chest trauma
- bupivicaine toxicity
- anaphylactic reaction to the local anaesthetic

It is essential that you be aware of the latest ALS resuscitation guidelines; these are available on the Resuscitation Council (UK) website (www.resus.org.uk/pages/mediMain.htm).

- After checking that it is safe to approach, you should check if the patient is responsive by employing the shake-and-shout regime: gently shake the patient by the shoulders and ask loudly if they are OK.
- If there is no response, shout for help and put the patient on their back.
- At the same time, open the airway and look for the presence of any foreign bodies.
- You should spend no more than 10 seconds looking, listening and feeling for any signs of life:
  - Look for chest wall movement.
  - Listen for breathing.
  - Feel for air on your cheek.
  - The carotid pulse can be checked at the same time as the chin lift manoeuvre.

If there is no sign of life, you should start cardiopulmonary resuscitation (CPR) immediately. Ask one of your team to put out a crash call by dialling 2222 and clearly indicating to the operator that you would like an adult cardiac arrest team to your location. However, some emergency departments have a policy of managing their own arrest calls and you should be aware of your local policy.

Ask your nurse to start CPR with 30 chest compressions followed by 2 breaths. The chest compressions should be carried out by placing your hands on the lower half of the sternum in the midline. You should aim at a rate of 100 compressions a minute and compress the chest by 4–5 cm.

Meanwhile you should insert an oropharyngeal airway and ventilate, ideally with a bag–valve mask and 100% oxygen. You should ask for an intubation trolley to be set up as soon as help arrives so that the airway can be secured.

While CPR is in progress, ask one of your team to attach the defibrillator pads to the chest and if possible secure a large-bore intravenous cannula. The standard positions for the placement of the pads are as follows:

- One pad is placed under the right clavicle on the chest and the second is placed at the site of the left mid-axillary line at the level of the fifth intercostal space.
- Alternatively the pads can be placed in an anteroposterior position over the left precordium and on the back just below the left scapula.

Bloods should be taken:

- full blood count (FBC)
- urea and electrolytes (U&E)
- bone profile
- coagulation screen
- glucose
- group and save

An arterial blood gas (ABG) is also useful in the immediate assessment of any electrolyte and metabolic disturbances. This should not interfere with CPR.

After the defibrillator pads have been attached to the chest, pause momentarily to check the rhythm, which can be either shockable or non-shockable:

**shockable:**

- ventricular fibrillation (VF) (Figure 2.6)
- ventricular tachycardia (VT) (Figure 2.7)
- pulseless VT
- torsades de pointes

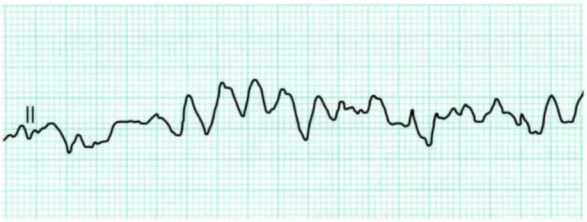

**Figure 2.6** Ventricular fibrillation.

**Figure 2.7** Ventricular tachycardia.

**non-shockable:**

- asystole (Figure 2.8)
- pulseless electrical activity (PEA) (Figure 2.9)



**Figure 2.8** Asystole.

**Figure 2.9** Pulseless electrical activity.

## Shockable rhythms

As the name suggests, these rhythms may respond to electrical cardioversion, and successful defibrillation is defined as termination of the rhythm 5 seconds after delivery of the shock, accompanied by the return of spontaneous circulation.

As soon as you confirm a shockable rhythm on the monitor, you should give a single shock of 150–360 J biphasic (360 J monophasic). You should then resume chest compressions without checking the pulse or rhythm and continue CPR for another 2 minutes before checking the monitor. The first dose of adrenaline is given after you have diagnosed a shockable rhythm and just before the third shock. It is important to remember the sequence:

1. Drug
2. Shock
3. CPR
4. Check rhythm.

You will be assessed on your ability to defibrillate safely, and so you should know how to use the defibrillator and know the safety precautions:

- Ensure that your team know that you are going to shock the patient.
- Ask the oxygen to be moved away from the patient and ask everyone to stand well clear from the patient and the trolley **(WARNING 1)**.
- After selecting the energy level, you should warn those around you that you are **'Charging!' (WARNING 2)** as you charge the machine.
- Make a concerted effort to look around you to make sure that the field is clear and even say 'Top clear', 'Bottom clear', 'I'm clear', **'Shocking!' (WARNING 3)** just before you deliver the shock.
- As soon you have delivered the shock, commence CPR immediately (30 : 2) without looking for the monitor or feeling for a pulse.

The adult ALS protocol for both shockable and non-shockable rhythms from the Resuscitation Council (UK) is reproduced in Figure 2.10.

## Non-shockable rhythms

These rhythms are managed with a combination of CPR and pharmacological agents. Give 1 mg of adrenaline (10 mL of 1:10 000 adrenaline solution) as soon as you have confirmed the rhythm and you have secured intravenous access.

Complete 2 minutes of CPR and then check the rhythm. If there is no change in the rhythm, commence the second cycle of CPR. Give 1 mg of adrenaline at the end of the second cycle; adrenaline should continue to be given every 3–5 minutes, assuming that there is no change in the rhythm. CPR should be continued until the airway is secured, following which you should perform continuous compressions.

If you are confronted with a non-shockable arrest, you must exclude reversible causes, which include the following ('4H and 4T'):

- **H**ypovolaemia
- **H**ypoxia
- **H**ypothermia
- **H**ypo/hyperkalaemia (metabolic disturbances)

- **T**hromboembolism
- **T**amponade
- **T**oxins
- **T**ension pneumothorax

If the patient is in asystole, check the gain function on the defibrillator followed by the leads to ensure that the trace is not a result of an artefact; also look carefully for P waves, since this may be ventricular standstill, which may respond to cardiac pacing.

Furthermore, if the patient goes into VF while you are in the middle of a compression, do not stop to defibrillate – finish the cycle and prepare to defibrillate as described.

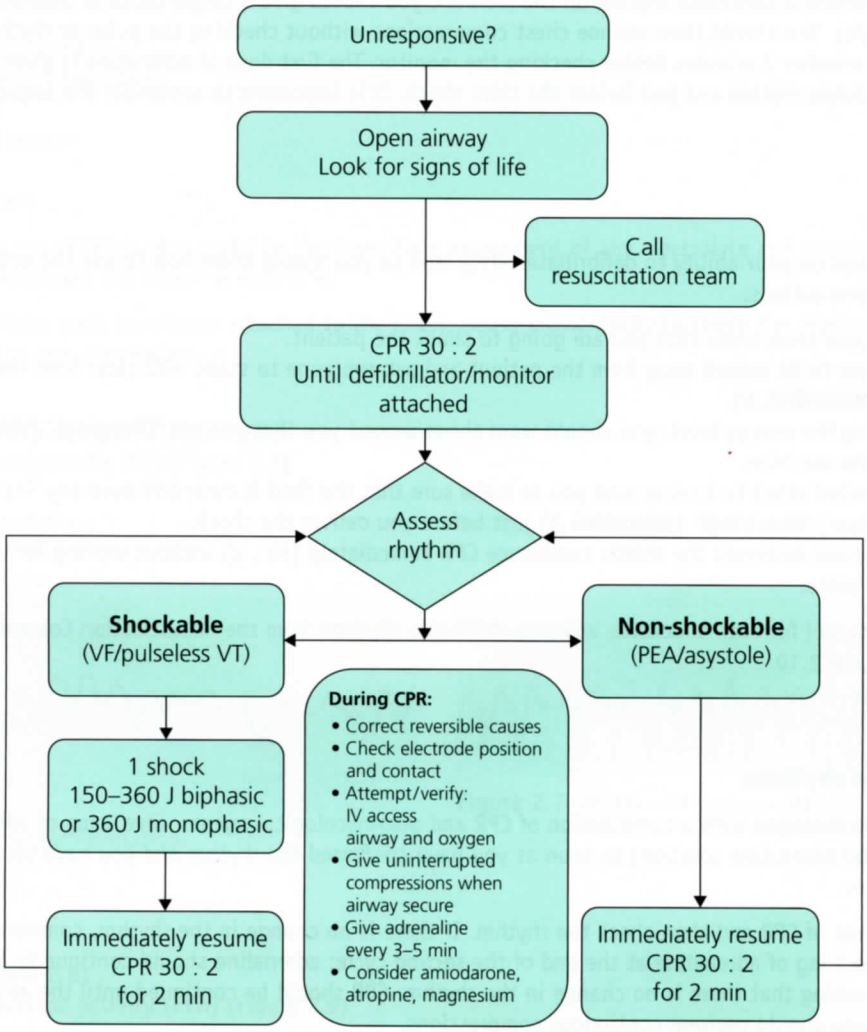


**Figure 2.10** Adult advanced life support protocol.
Reproduced with kind permission from Resuscitation Council (UK). *Algorithms in Resuscitation Guidelines 2005*. London: Resuscitation Council (UK), 2005.

## Special circumstances

You may be asked to resuscitate a patient under special circumstances where the resuscitation protocol may have to be amended. There will usually be a clue in the history, and you should read the details of the scenario carefully.

In this case, you are told that the patient has just been given a femoral nerve block with bupivicaine, which is a potentially cardiotoxic local anaesthetic agent. An overdose of local anaesthetic or intravascular injection may precipitate cardiac arrest.

The Association of Anaesthetists of Great Britain and Ireland (AGBI) guidelines for the management of severe local anaesthetic toxicity (available at: www.aagbi.org/publications/guidelines.htm) suggest that:

- Prolonged resuscitation may be required, since treatment of local-anaesthetic-induced cardiac arrest may take more than 1 hour.
- Cardiopulmonary bypass should be considered.
- Arrhythmias may be very refractory to treatment.

As local anaesthetics are lipophilic, the guidelines suggest treatment with lipid emulsion (20% Intralipid). The initial dose of 20% Intralipid is 1.5 ml $kg^{-1}$ over 1 minute together with starting an infusion at 0.25 ml $kg^{-1}$ $min^{-1}$. Two further bolus doses of 1.5 ml $kg^{-1}$ can be given and the infusion rate doubled after 5 mins and continued until cardiac output and cardiovascular stability return.

The guidelines also suggest that Intralipid should be available whenever procedures involving potentially cardiotoxic doses of local anaesthetic are performed.

Other arrest scenarios with special circumstances that you should be aware of are summarized in Table 2.2.

**Table 2.2** Cardiac arrest scenarios with special circumstances

| Special circumstance | Modification in ALS protocol in a cardiac arrest |
|---|---|
| Hyperkalaemia | • Treat the hyperkalaemia with 10 mL of 10% calcium chloride<br>• 50 mmol (50 ml of 8.4%) of sodium bicarbonate<br>• 50 mL of 50% glucose and 10 units of short-acting insulin<br>• Haemodialysis |
| Hypokalaemia | • Replace potassium (2 mmol $min^{-1}$ over 10 min, followed by a further 10 mmol over 10 min) |
| Hypercalcaemia | • Fluid replacement<br>• Diuresis with furosemide 1 mg $kg^{-1}$<br>• Haemodialysis |
| Hypocalcaemia | • 10–40 mL of 10% calcium chloride |
| Opioid overdose | • Naloxone 400–800 mcg IV or 1–2 mg via the ET tube |
| Tricyclic antidepressant overdose | • Sodium bicarbonate or hypertonic saline |
| Hypothermia | • Active warming<br>• Withhold adrenaline until core temperature > 30 °C. Double the time interval between doses in the temperature range 30–35 °C. Follow the normal protocol once temperature > 35 °C<br>• Arrhythmias may not respond to shocks until core temperature > 30 °C<br>• Consider cardiopulmonary bypass<br>• Consider prolonged resuscitation until core temperature > 30 °C |
| Penetrating chest trauma | • Resuscitative thoracotomy may be performed following penetrating trauma if it can be done within 10 min of loss of cardiac output<br>• The success rates for blunt trauma are poor, and thoracotomy can attempted if the patient arrests in the emergency department following blunt trauma to the chest |
| Pregnancy | • Tilt the patient on her left side by 15°<br>• Ask for an urgent obstetric opinion and consider performing an emergency caesarean section. This should only considered if the fetus is believed to be viable |

## Scoring Scenario 2.3: Cardiac arrest

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Safe approach | 0 | 1 | — |
| Confirms cardiac arrest:<br>1. Shake and shout<br>2. Shouts for help<br>3. Performs chin lift<br>4. Assesses airway<br>5. Checks airway (10 s) and pulse simultaneously | 0 | 1 | 2 |
| Confirms cardiac arrest and calls crash team; knows number 2222 | 0 | 1 | — |
| Starts CPR with 30 : 2; demonstrates correct landmarks for compressions as well as correct rate and depth | 0 | 1 | 2 |
| Uses airway adjunct and bag–valve mask to ventilate patient | 0 | 1 | — |
| Asks for cardiac, oxygen monitoring | 0 | 1 | — |
| Ask for defibrillator pads to be attached to the chest; demonstrates position | 0 | 1 | — |
| Asks assistant to secure IV access and take bloods and an ABG (does not interrupt CPR) | 0 | 1 | — |
| Correctly identifies rhythm: either VF or VT | 0 | 1 | — |
| Excludes the reversible causes ('4H and 4T') | 0 | 1 | 2 |
| Follows shockable rhythm algorithm | 0 | 1 | 2 |
| Defibrillation with single shock (150–200 J) with biphasic machine; must demonstrate safe technique | 0 | 1 | 2 |
| Continues chest compressions instantly | 0 | 1 | — |
| Reviews monitor after 2 min of CPR; if still in VF/VT gives second shock (150–360 J) | 0 | 1 | — |
| Gives adrenaline before third shock and then on alternate cycles (drug–shock–CPR–check) | 0 | 1 | 2 |
| Is aware that local anaesthetic toxicity may be responsible for cardiac arrest | 0 | 1 | — |
| Suggests prolonged resuscitation<br>Use of Intralipid<br>Cardiopulmonary bypass | 0 | 1 | 2 |
| Confirms return of output | 0 | 1 | — |
| Arranges for ITU review | 0 | 1 | — |
| Plans post-resuscitation care:<br>1. Intubation<br>2. Bedside echocardiography<br>3. Central venous catheter<br>4. Arterial line<br>5. Hypothermic resuscitation | 0 | 1 | 2 |
| Runs resuscitation effectively, engaging team members | 0 | 1 | 2 |
| **Global score from examiner** | | /5 | |
| **Total score** | | /35 | |

## SCENARIO 2.4: HEAD INJURY

You are asked to attend a trauma call. A 30-year-old unrestrained passenger has been ejected from a motor vehicle involved in a head-on collision. He is brought in by a paramedic crew; he is intubated and ventilated and his C-spine is immobilized. He has obvious facial lacerations and a frontal haematoma.

His observations are:

BP 85/50 mmHg
Pulse 95 bpm
Saturation 96% on 100% oxygen
GCS E1 M3 V1
Temperature 37.6 °C
Pupils are equally size 3

Carry out a focused assessment of the patient and outline how you would manage him in order to optimize his cerebral perfusion. You have an ALS-trained F2 to assist you.

## SUGGESTED APPROACH

This man has a serious head injury; however, this should not distract attention from any of the other major systems. Some of his management has already begun, but the approach to the patient should not deviate from the usual systematic ABCDE approach.

Aggressive management of his traumatic brain injury is essential in preventing secondary brain injury through regional or global ischaemia. This involves:

1. Maximizing blood oxygen content
2. Maintaining cerebral blood delivery (cerebral blood flow) by:
   (a) maintaining the driving mean arterial pressure (MAP)
   (b) facilitating venous drainage from the head to prevent a rise in intracranial pressure (ICP)

### Assessment of the airway and C-spine and prevention of hypoxia

- Confirm tracheal intubation, since tube displacement often occurs during transfer.
- Ensure that the ET tube is sufficiently inflated to prevent gastric aspiration.
- Deliver high-flow inspired oxygen and aim for a saturation of >95% or >13 kPa.
- Secure the ET tube using tape rather than a tie. Venous drainage above the head and neck can be restricted by using a constricting ribbon tie.
- Check that the C-spine is adequately immobilized as the patient is intubated and that it cannot be clinically cleared; the patient may require suitable imaging (CT neck).

### Assessment of breathing and prevention of hypoxia

- Examine the chest for any evidence of an endobronchial intubation or other chest injury such as a pneumothorax. These should be treated immediately.
- Normocapnia should be the goal in order to maintain cerebral blood flow, and you should avoid hypoventilating or hyperventilating the patient. Arterial blood gas (ABG) and capnography should be used to adjust the respiratory rate and tidal volume on the ventilator.

## Assessment of circulation and maintenance of cerebral blood flow

- Hypovolaemia should be corrected and you should aim for MAP > 90 mmHg. Hypotension will significantly impair cerebral perfusion. You should avoid fluids containing glucose unless the patient is hypoglycaemic.
- Correct anaemia: you should aim for a target haemaglobin of 8–10 g $dL^{-1}$ and a haematocrit of 0.30. This is a compromise between maximizing blood oxygen content and maintaining blood flow by reducing blood viscosity.
- Cushing's sign (raised blood pressure with bradycardia) is a poor prognostic indicator.
- Invasive monitoring should be performed using central venous access and an arterial line.

## Assessment of disability and prevention of a rise in ICP

- Ideally, the bed should be tilted in a head-up position 15–30° (with the head in the neutral position) in order to facilitate venous return.
- The patient should be prevented from coughing or straining while intubated, since this will raise the ICP. This can be achieved by the use of hypnotics and analgesics, and occasionally paralysis may be helpful. Hypnotics also reduce cerebral oxygen requirements, but at the expense of MAP.
- The pupils should be assessed for size and reactivity to light. With the patient sedated, the neurological examination is often difficult.

## Control the environment

- Avoid hyperthermia, since this increases the cerebral metabolic rate: for every 1 °C rise in temperature, there is a 9% increase in the metabolic rate. You should aim for a core temperature of 36 °C.
- Aim for tight glycaemic control.
- The patient should be catheterized.
- The patient should be turned regularly to prevent pressure sores.

## Scoring Scenario 2.4: Head injury

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Puts out a trauma call | 0 | 1 | — |
| Checks the airway and ET tube placement and that the cuff is blown up | 0 | 1 | 2 |
| Ensures that the C-spine is immobilized and cannot be clinically cleared | 0 | 1 | 2 |
| Places patient on high-flow oxygen and full monitoring | 0 | 1 | 2 |
| Checks chest for air entry and other chest injuries:<br>• haemothorax<br>• pneumothorax<br>• flail chest | 0 | 1 | 2 |
| Asks to perform an ABG to check $Pco_2$ (aim for normocapnia) | 0 | 1 | — |
| Obtains IV access, and obtains routine bloods and checks blood sugar | 0 | 1 | 2 |
| Corrects hypotension and anaemia | 0 | 1 | — |
| Suggests invasive monitoring with central venous line and arterial line | 0 | 1 | 2 |
| Is aware of Cushing's sign as a poor prognostic indicator | 0 | 1 | — |
| Examines pupils and observes for abnormal posturing:<br>1. Decorticate<br>2. Decerebrate posture | 0 | 1 | 2 |
| Performs a detailed secondary survey | 0 | 1 | 2 |
| Suggests tilting the head of the bed up at 15–30° | 0 | 1 | — |
| Nurses patient at 36 °C | 0 | 1 | — |
| Suggests tight glycaemic control | 0 | 1 | — |
| Places a urinary catheter | 0 | 1 | — |
| Arranges for an urgent CT scan of head and C-spine | 0 | 1 | — |
| Asks for anaesthetic assistance for transfer to CT | 0 | 1 | — |
| Requests neurosurgical review for patient | 0 | 1 | — |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/32** | | |

# 3
# Anaesthetics and Pain Relief

PETER JAYE, RUSSELL BARBER AND CHETAN R TRIVEDY

## CORE TOPICS

- Pain relief
- Local anaesthetic techniques
- Concious sedation

The curriculum for this subject contains a number of topics that are amenable to testing using OSCEs. We have selected five scenarios, with accompanying reviews of the responses. These OSCEs all include more than just a pure clinical assessment; it is in these additional sections of the OSCE that the differentiating marks lie. The pass/fail distinction is often based on the scoring in these areas.

### SCENARIO 3.1: ANALGESIA AND CONFLICT RESOLUTION

You have been asked to review a 39-year-old man who tripped and fell over. He has been in the department for approximately 45 minutes. The triage nurse did not feel that there was any bony injury, but asked the F2 to organize an ankle X-ray as a precaution. You have reviewed his films and have found that he has an undisplaced fracture of the fibula.

The F2 has already placed a cannula in the right antecubital fossa and there is 1 L crystalloid running over 6 hours.

The patient's pulse is 100 bpm, BP 140/90 mmHg and $O_2$ saturation 100% on a non-rebreath mask. His partner is upset about the time delay in dealing with his pain, and demands that he needs morphine and should be seen privately since the NHS is not managing him adequately.

Take a focused history from the patient and outline your management plan. You do not have to examine the patient.

## SUGGESTED APPROACH

This OSCE neatly illustrates the assessment of clinical skills alongside the management of conflict. The clinical skills in this OSCE are those required of a good F2, but in the presence of conflict these simple skills become significantly more difficult to complete. This reflects your actual clinical practice and therefore adds validity to the use of this technique to assess performance.

Clinically, an understanding of the analgesic ladder is required, alongside alternatives to analgesics for pain relief.

The more complex aspect of this OSCE is dealing with conflict. As with many other OSCEs in this book, there are certain key attributes or behaviours that will allow the candidate to score highly. This particular scenario tests the candidate's ability to deal with an angry relative and a patient in pain, as well as the clinical aspects of pain management.

## Objectives

- To deliver pain relief in a safe and effective way to this patient with a fibular fracture.
- To understand the analgesic ladder (Figure 3.1).
- To demonstrate an understanding of additional techniques such as splinting and the use of nitrous oxide in providing pain relief.
- To resolve conflict effectively in a non-judgemental way.

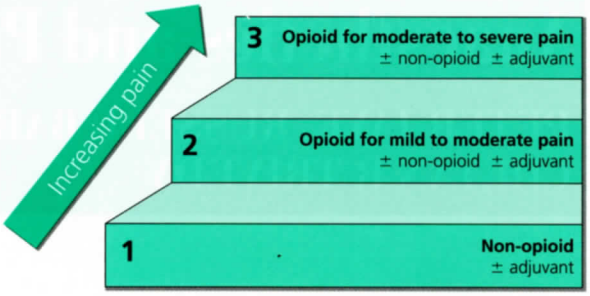


**Figure 3.1** The WHO pain ladder.

Start the OSCE by trying to provide the patient with suitable analgesia, since this is the only thing that is likely to settle him so that you can get an adequate history. Make an assessment of the pain score – most patients understand the simple 0–10 scale. This should be recorded on the observation chart to assess the efficacy of the analgesia that you give.

Begin with simple analgesia, as well as adjuvant treatment measures such as splinting the leg. The patient can be given nitrous oxide/oxygen (Entonox) to facilitate splinting. You may find that this does not improve the situation and you may resort to opiates; it would not be unreasonable to give morphine. However, you should take a focused medical history to ensure that there are no contraindications for prescribing opiates. You may be pressurized by the partner, who insists that morphine be prescribed from the outset. You should try to explain to them that the patient will not be denied morphine but that you would like to try other measures to control the pain as well.

You should inform the examiner that, once the pain has eased, you would like to make a detailed assessment of the injury. Although you are not expected to examine the patient in this scenario, you should at least state your intention to do so.

It is likely that you will be met with aggression when you explain that there is a fracture on the X-ray, since the patient was told at triage that there was no fracture. It is imperative that you weather the storm and absorb their anger and frustration. The use of silence is helpful, and you should wait for the patient/partner to pause before you explain the nature of the injury and outline your management plan.

It is important that you show empathy and do not underplay the patient's symptoms. You should try to explain how different painkillers work and offer appropriate analgesia. You should also discuss adjuvant treatment, such as splinting the leg in a below-knee plaster of Paris back slab in an attempt to increase comfort.

If you manage successfully to address the patient's pain, the request for a private referral may be withdrawn. However, if it is still requested, you should offer to look into it and discuss it with the orthopaedic team on call. The key is to engage the partner as well the patient and not to be distracted by the partner's anger and insistence on intravenous opiates.

## Scoring Scenario 3.1: Analgesia and conflict resolution

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Confirms patient's identity and introduces self | 0 | 1 | — |
| Confirms relative's relationship to patient | 0 | 1 | — |
| Confirms patient's consent to discuss case with partner | 0 | 1 | — |
| Makes quick assessment of injury | 0 | 1 | — |
| Asks about level of pain | 0 | 1 | — |
| Deals with patient's concerns appropriately | 0 | 1 | 2 |
| Deals with partner's concerns appropriately | 0 | 1 | 2 |
| Asks about previous medical history | 0 | 1 | — |
| Asks about drug history | 0 | 1 | — |
| Asks about allergies | 0 | 1 | — |
| Asks about alcohol and illicit drug use | 0 | 1 | — |
| Utilizes nitrous oxide | 0 | 1 | — |
| Utilizes splinting | 0 | 1 | — |
| Requests opiate analgesia | 0 | 1 | — |
| Gives opiate analgesia in an appropriate fashion | 0 | 1 | — |
| Responds appropriately to patient's requests for further pain relief | 0 | 1 | 2 |
| Deals appropriately with partner's requests for private intervention | 0 | 1 | 2 |
| Deals with conflict regarding pain relief in a non-judgemental way | 0 | 1 | 2 |
| Gives oral analgesia as follow-up | 0 | 1 | — |
| Provides appropriate management plan | 0 | 1 | 2 |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/36** | | |

## SCENARIO 3.2 TEACHING LOCAL ANAESTHESIA

You have been asked by your consultant to describe the risks of local anaesthesia and the techniques to avoid them to a fourth-year medical student. You will not have to demonstrate any techniques.

## SUGGESTED APPROACH

This is a teaching OSCE, where some of the marks are for imparting your knowledge of the adverse effects of local anaesthesia in a structured manner. You should start by ascertaining how much the student knows about local anaesthesia and whether they have seen it used before. You should then proceed to identify the objectives of your teaching session.

## Objectives

- Demonstrate an understanding of the indications for the use of local anaesthesia.
- Demonstrate an understanding of the complications of local anaesthesia.
- Demonstrate an understanding of the toxicity of local anaesthetic agents (lidocaine).
- Demonstrate an understanding of the management of lidocaine toxicity.

After going through the objectives and reviewing areas that the student should know, you should complete the OSCE by proving the student with a reference or resource to do more reading on local anaesthesia and make a plan to meet up again.

You should encourage questions as you go along; you may be prompted by the student with the following questions:

- What are the indications for the use of local anaesthesia?
- Are there any complications?
- How do you treat the complications?
- What are the correct doses of the anaesthetic?
- Are they different for children?

## Complications of local anaesthesia

### *Technique-related*

- Direct nerve trauma
- Bleeding
- Haematoma
- Infection
- Intravascular injection
- Damage to surrounding structures (tendons, pneumothorax)

### *Drug-related*

- Anaphylactoid
- Methaemoglobinuria (prilocaine)
- Toxicity by intravascular injection
- Toxicity by overdose and systemic absorption

## Systemic toxicity

Systemic effects usually occur when blood concentrations of local anaesthetic increase to toxic levels. Adding a vasoconstrictor (e.g. adrenaline) can reduce the systemic absorption of an anaesthetic, thus increasing the maximum safe dosage

For lidocaine, the maximum safe dose is 3 mg per kg of body weight; 7 mg $kg^{-1}$ can be used if the solution has adrenaline added.

### *Signs and symptoms of systemic toxicity*

The progression of lidocaine toxicity correlates well with ascending serum levels, with initial benign symptoms developing at 5 µg $mL^{-1}$, deteriorating into life-threatening cardiac arrest at levels above 25 µg $mL^{-1}$ (Table 3.1). Therefore the development of tinnitus, light-headedness, circumoral numbness, diplopia and a metallic taste in the mouth indicate the onset of toxicity and possible impending development of severe symptoms.

**Table 3.1** The systemic effects of lidocaine toxicity

| Dose of lidocaine (μg mL$^{-1}$) | Presenting symptom |
|---|---|
| 5 | • Light-headedness<br>• Circumoral paraesthesia<br>• Slurred speech<br>• Tinnitus |
| 10 | • Convulsions<br>• Loss of consciousness |
| 15 | • Coma<br>• Myocardial depression |
| 20 | • Respiratory arrest<br>• Cardiac arrhythmia |
| >25 | • Cardiac arrest |

### *Treatment of lidocaine toxicity*

- Stop the injection of local anaesthetic.
- Apply appropriate airway manoeuvres and give oxygen.
- Support respiratory failure with mild hyperventilation. Respiratory acidosis exacerbates local anaesthetic toxicity.
- With severe lidocaine toxicity, intubation does not require anaesthetic drugs.
- Treat convulsions with benzodiazepines.
- Treat hypotension with fluids and inotropes such as adrenaline.
- Treat ventricular arrhythmias with amiodarone.
- Treat bradycardia with atropine or glycopyrrolate.
- Ensure effective CPR.
- CPR should be prolonged, because full recovery has occurred after local anaesthetic toxicity.
- Consider the use of Intralipid in local-anaesthetic-induced cardiac arrest or circulatory failure that is unresponsive to standard therapy.

### *Avoiding toxicity*

- Use the correct dosage.
- Use the aspiration technique.
- Regional nerve blocks can be used to anaesthetize large areas with relatively little local anaesthetic.
- The appropriate use of adrenaline as a vasoconstrictor can reduce the overall dose of lidocaine.
- Use ultrasound.

### *Avoiding local effects*

- A slow injection will reduce the pain.
- The use of a fine needle will minimize the risk of soft tissue trauma as well as reducing the pain during infiltration.

## Scoring Scenario 3.2: Teaching local anaesthesia

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Checks student's level of knowledge | 0 | 1 | — |
| Outlines objectives of the session | 0 | 1 | 2 |
| Discusses indications for local anaesthesia | 0 | 1 | |
| Mentions local side-effects, including:<br>• Pain<br>• Local infection<br>• Nerve trauma<br>• Haematoma/ecchymosis<br>• Local irritation<br>• Tendon injury | 0 | 1 | 2 |
| Outlines strategies to minimize pain (slow infiltration) and tissue irritation (buffered pH) | 0 | 1 | — |
| Mentions signs of nerve laceration (paraesthesias, shooting or sharp stinging sensations, and excessive pain during needle insertion) | 0 | 1 | 2 |
| Discusses management and prognosis of nerve laceration (withdraw needle) | 0 | 1 | — |
| Mentions mild CNS signs of toxicity (tinnitus, light-headedness, circumoral numbness, diplopia, metallic taste in the mouth, nausea and vomiting) (at least 3) | 0 | 1 | 2 |
| Mentions moderate CNS signs of toxicity (nystagmus, slurred speech, localized muscle twitching or fine tremors, hallucinations) (at least 3) | 0 | 1 | 2 |
| Mentions severe CNS signs of toxicity (seizure activity, respiratory depression, coma) (at least 3) | 0 | 1 | 2 |
| Mentions cardiovascular signs of toxicity (myocardial depression and peripheral vasodilation) | 0 | 1 | 2 |
| Mentions maximum doses of lidocaine:<br>*Adult*<br>• 3 mg $kg^{-1}$<br>• 7 mg $kg^{-1}$ with adrenaline<br>*Child*<br>• 1.5–2.5 mg $kg^{-1}$<br>• 3–4 mg $kg^{-1}$ with adrenaline | 0 | 1 | 2 |
| Adequately describes the appropriate management of toxicity (airway, oxygen, management of seizures and arrhythmias) | 0 | 1 | — |
| Reviews information given and allows questions | 0 | 1 | — |
| Provides the student with learning resources and arranges next teaching session | 0 | 1 | — |

*Continued*

**Scoring Scenario 3.2** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Provides clear and effective teaching; is not judgemental or patronizing | 0 | 1 | — |
| **Score from role player** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/35** | | |

## SCENARIO 3.3: FEMORAL NERVE BLOCK

A 34-year-man presents with a fracture of the shaft of the right femur. He has been given some opiate analgesia, but you feel that a femoral nerve block will be beneficial. An F2 asks if they can watch. Perform a femoral nerve block on the manikin, teaching the F2 what you are doing.

## SUGGESTED APPROACH

Of note in this OSCE is the relatively small number of marks available for knowing how to perform a femoral nerve block. This OSCE marking scheme is easily adapted to various practical procedures. If the examiner wished to assess a digital nerve block for instance, there would be almost no change to this marking scheme. The only things that would need to be adapted are the instructions to the actor and candidate. In view of this, it is appropriate to focus on the generic aspects of the OSCE, these being primarily patient-focused. Check the patient's understanding and consent, and respond appropriately to their questions.

The second generic aspect to this OSCE involves the teaching component. This is often used in OSCEs for two main reasons. It allows a technique that is technically difficult to simulate to be tested. It facilitates the marking process, since it gets the candidate to vocalize their technique throughout the OSCE. With some simple techniques, it is relatively easy to score marks, even if your knowledge is poor.

Primarily use an open, questioning technique with your student. Remember that, in this artificial format, the student will have a very good idea what is expected of him, as he has tested this station a number of times before. So ask 'What do you know about this technique?', 'Do you know of any complications associated with this procedure?', 'What approach would you use?', etc. Your student may well have been primed to respond as little as possible, but remember that you might be the first to try this technique – and even if you are not, it is very difficult for the student to remain monosyllabic throughout.

Although the instructions ask you to explain the procedure to the F2, do not forget the patient or the manikin (which should be treated as if it were the patient). You should explain to the patient what the procedure involves and gain consent not only for the procedure but also for you to talk through the process with your junior colleague. This should be done before you launch into the finer points of the femoral nerve block with the F2. You should also ensure that you retain your rapport with the patient as you proceed.

### Single-shot femoral nerve blockade

#### *Indications*

As a sole nerve block, it provides analgesia for a fractured femoral shaft.

#### *Contraindications*

- Patient non-compliance.
- Allergy to local anaesthetic.
- Suspected neurological deficit of the injured limb, where the nerve block may interfere with clinical assessment.

### *Preparation*

Sterile drape, gloves and skin preparation. The patient should have a working venous cannula in situ and adequate monitoring.

### *Position*

The patient lies on their back with legs flat but ankles spread slightly apart. The foot of the leg to be anaesthetized should be slightly externally rotated; however, the patient may find this uncomfortable.

### *Puncture site (after intradermal local anaesthetic)*

This should be 2 cm distal and 1 cm lateral to the arterial pulsation, approximately in the region of the inguinal fold (Figure 3.2). The needle should be angulated 30° cephalad. Distal to this point, the femoral nerve divides into anterior and posterior branches: the anterior (superficial) branch supplies sensation to the skin of the anterior and medial thigh; the posterior (deep) branch supplies the quadriceps muscles, the medial knee joint, and the skin on the medial side of the calf and foot (via the saphenous nerve).

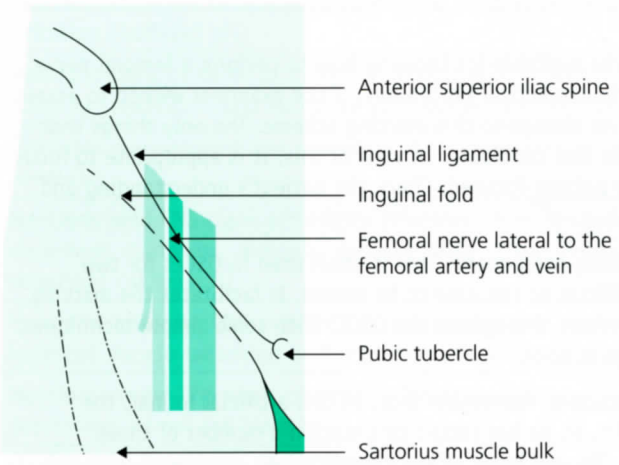


**Figure 3.2** Surface anatomy for a femoral nerve block.

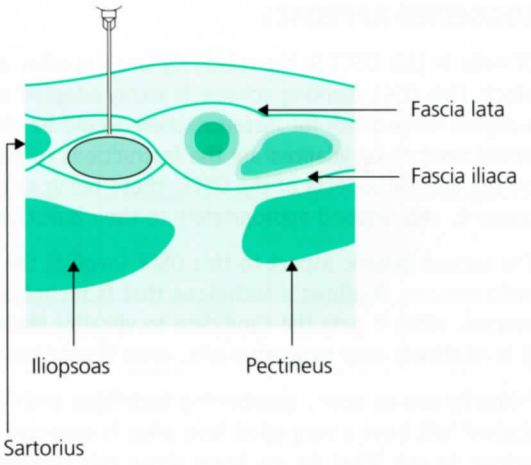


**Figure 3.3** Anatomical layers and neighbouring structures.

### *Precision*

Gentle advancement of the needle should produce two distinct fascial 'pops'as the needle penetrates the fascia lata and fascia iliaca (Figure 3.3).

A negative aspiration helps exclude vascular cannulation.

Gently inject a volume of 15–30 mL of bupivicaine or laevobupivicaine (maximum 2 mg per kg body weight).

- Stop injecting if there is resistance, since this suggests intraneural injection.
- Stop injecting if severe sharp pain is felt, since this may indicate intra-sensory-nerve injection. The absence of pain does not exclude intra-motor-nerve injection.

The use of a nerve stimulator has been associated with a higher success rate, better quality of blockade and lower incidence of nerve injury. This technique requires the use of an insulated needle, nerve stimulator and electrode to provide a stimulating current; the electrical current required to trigger muscle contractions correlates with the distance of the needle tip from the nerve. Close proximity to the femoral nerve will cause contraction of the quadriceps muscle group, and the patella will 'dance' at 1 mA. The current should be reduced in a stepwise manner, with needle reorientation if patella dance is lost. When contractions are still visible at 0.3–0.5 mA, the needle should be sufficiently close to the nerve. To exclude intraneural injection, contractions should not occur at less than 0.3 mA. Without movement of the needle, contractions should be recommenced with a current of 0.3–0.5 mA. After a negative aspiration, local anaesthetic can be administered. Contractions are lost after 1 mL of local anaesthetic has been injected.

## Scoring Scenario 3.3: Femoral nerve block

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Introduces self to patient | 0 | 1 | — |
| Checks patient understanding | 0 | 1 | — |
| Gains consent for procedure | 0 | 1 | 2 |
| Checks consent for teaching | 0 | 1 | — |
| Outlines the objectives for the session | 0 | 1 | 2 |
| Explains indications for nerve block to F2 | 0 | 1 | — |
| Explains contraindications to F2 | 0 | 1 | — |
| Asks patient about any allergies and explains signs of lidocaine toxicity to patient | 0 | 1 | 2 |
| Positions patient appropriately and places them on monitoring; ensures that there is intravenous access | 0 | 1 | — |
| Uses appropriate aseptic technique (handwashing/sterile pack) | 0 | 1 | — |
| Uses universal precautions | 0 | 1 | — |
| Uses appropriate equipment (selects appropriate local anaesthetic, knows the safe dose, checks expiry date) | 0 | 1 | — |
| Describes anatomy correctly | 0 | 1 | 2 |
| Describes appropriate position for injection | 0 | 1 | — |
| Describes appropriate technique for injection | 0 | 1 | — |
| Uses appropriate teaching technique | 0 | 1 | 2 |
| Maintains verbal contact with patient throughout procedure | 0 | 1 | — |
| Deals with patient's questions appropriately | 0 | 1 | — |
| Comments on patient's prognosis | 0 | 1 | — |
| Gives the student learning resources and arranges further teaching opportunities | 0 | 1 | — |
| **Score from student/patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /35 | |

## SCENARIO 3.4: CONSCIOUS SEDATION

You are asked to see a 75-year-old patient who has fallen in the park. The X-ray shows a displaced fracture of the right tibia and fibula. You have decided to reduce the fracture under conscious sedation. You have an ALS-trained nurse to assist you. Assess this patient's suitability for conscious sedation and talk through your procedure with the examiner. You are not required to physically examine the patient.

## SUGGESTED APPROACH

The aim of this OSCE is for the candidate to demonstrate that they can assess a patient for a sedation procedure and that they are competent in sedating a patient in the emergency department.

You should start the OSCE by reviewing any relevant investigations that you may be given (X-ray or bloods). Proceed to take a relevant medical history, focusing on any illnesses that could compromise the procedure:

- previous complication with sedation or anaesthesia
- family history of adverse reactions to anaesthesia
- allergies and regular medications
- history of significant respiratory disease
- history of thyroid disease or high blood pressure (contraindicated in sedation with ketamine)
- significant myocardial ischaemia or recent myocardial infarction
- significant liver impairment or excessive alcohol intake (which may impair the metabolism of benzodiapines such as midazolam)

You should ascertain when the patient last ate or drank prior to planning an elective sedation in the emergency department.

Other factors that you need to consider are:

- adequate monitoring facilities
- anaesthetic back-up and resuscitation facilities where the sedation should be performed – it is not acceptable to sedate patients in the plaster room
- adequately trained staff, as well as enough staff to sedate the patient (two appropriately trained doctors and a trained nurse is the bare minimum)
- secured intravenous access

The choice of sedative drugs will vary according to local policy and the type of sedation required. In general, morphine and midazolam are commonly used in the emergency department; there is a trend towards the use of other agents such as propofol and ketamine, but at present these are not routinely used by most emergency departments.

Tell the examiner that you would ideally like to perform a physical examination and assess the airway in case the patient requires intubation. You should be aware of the Mallampati scoring system (Figure 3.4): a patient with a Mallampati score of 3 or 4 has the potential for a difficult intubation, and this needs to considered before you commence the sedation.

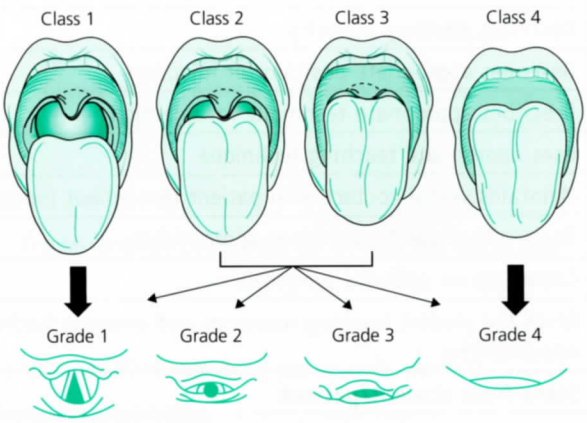


**Figure 3.4** Mallampati grading.

As the patient will be sedated for the procedure, you should give them a full explanation of the procedure as well as its side-effects and those of the sedation and obtain written consent for the procedure.

In this OSCE, again, remaining patient-focused will increase your mark.

There are various important features of sedation that you need to be aware of. Remember that in the emergency department setting we are aiming for conscious sedation, and any practitioner who performs such a procedure should be aware of the guidelines produced by the Royal College of Anaesthetists: *Implementing and Ensuring Safe Sedation Practice for Healthcare Procedures in Adults* (available at: www.rcoa.ac.uk).

## Levels of sedation

Sedation is the depression of a patient's awareness of the environment and reduction of their responsiveness to external stimulation.

There are various levels of sedation on progression towards general anaesthesia:

1. **Minimal sedation (anxiolysis)** is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected.
2. **Moderate sedation/analgesia ('conscious sedation')** is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.
3. **Deep sedation/analgesia** is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained.

You need to be aware of the level of sedation likely to be required for a given procedure and the variation in individual patient resposes to the same medication.

## Medications

The medications used during sedation typically have additional beneficial effects, which are as important as sedation. These include:

- anxiolysis: relief of trepidation or agitation with minimal alteration of sensorium
- amnesia: lapse in memory for a period of time
- analgesia: relief of pain without an altered sensorium

### *Midazolam*

Midazolam, a lipophilic molecule, crosses the blood–brain barrier with ease, producing sedation in less than 5 minutes. The total dose in adults is 0.02–0.1 mg per kg body weight. The initial paediatric dose is 0.05–0.15 mg $kg^{-1}$ by intravenous or intramuscular injection. The duration of action is about 30 minutes, although sedation may be prolonged in elderly patients. Midazolam is metabolized by the hepatic microsomal system and therefore is not affected by renal failure. Remember to exercise caution in patients with liver cirrhosis, since midazolam is hepatically metabolized.

### *Morphine*

Morphine is the oldest and most established agent for pain management in the emergency department. In its intravenous form, it has a rapid onset of action. Its duration of action, however, can be as long as 3–4 hours. The dose is 0.1–0.15 mg $kg^{-1}$ (5–10 mg initially for adults), with additional doses as needed. The primary adverse effect

is hypotension, explained partially by histamine release. Administering the medication slowly can minimize this effect. Respiratory suppression can also occur, and its risk increases with coadministration of sedative agents.

### *Fentanyl*

Fentanyl is a very potent synthetic opioid, and one of the commonly used analgesic adjuncts in the emergency department. It crosses the blood–brain barrier rapidly and thus has a rapid onset of analgesia (<90 s). However, the serum levels decline rapidly owing to tissue redistribution, making the duration of action about 30–40 minutes. Fentanyl has minimal cardiovascular effects such as hypotension. Respiratory depression is uncommon, but is potentiated when fentanyl is used in combination with benzodiazepines. The intravenous dose is 2–3 mcg $kg^{-1}$ (50–200 mcg in adults), titrated in 50–100 mcg increments. Fentanyl is the preferred drug for analgesia in short procedures and in cases of trauma with potential hemodynamic compromise.

## Monitoring

A suitably trained individual, present throughout the procedure, must have a defined responsibility for monitoring patient safety and making a written record. This individual may not be present as you enter an OSCE, but you should still say that this is what you require for safe sedation. If this individual is not available because there are insufficient actors/examiners, you will be told that that person exists, and you will have scored points. This is true for any OSCE for which you feel you need extra staff. Remember to request their presence and do not just make do. Once told that they are 'virtually' there, however, you should proceed with the OSCE.

A pulse oximeter should be attached to the patient until discharge from the unit is contemplated. Monitoring of blood pressure and the ECG may not be necessary in young healthy patients, but is essential in older patients, especially if there are any cardiovascular problems. However, for the purposes of the examination, all patients should be fully monitored.

## Oxygen therapy

While in reality some make an argument for applying oxygen only when required, in sedation for the purposes of the examination apply it to all patients, according to the recent British Thoracic Society guidelines (see Chapter 14).

It is useful to have a working knowledge of the American Society of Anesthesiologists (ASA) physical status classification system to risk-stratify patients receiving sedation for surgical procedures:

- class 1: a normal healthy patient
- class 2: a patient with mild disease
- class 3: a patient with severe disease
- class 4: a patient with severe disease that is a constant threat to life
- class 5: a moribund patient who is not expected to survive without the operation

ASA class 3 or more has been proved to be an independent risk factor for adverse outcome in patients undergoing general anaesthesia, and it is not our practice to attempt conscious sedation of these patients within the emergency department.

## Postoperative monitoring

It is essential that you tell the examiner that the patient will have to be suitably monitored following the completion of the procedure. They should ideally be discharged into the care of another adult and be advised not to drive or operate machinery. The patient should be given written instructions.

## Scoring Scenario 3.4: Conscious sedation

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Introduces self to patient | 0 | 1 | — |
| Reviews X-ray | 0 | 1 | — |
| Suggests transfer to resuscitation to perform sedation | 0 | 1 | — |
| Asks for additional doctor to assist procedure | 0 | 1 | — |
| Takes focused medical history:<br>• allergies/medications<br>• respiratory problems<br>• cardiac problems<br>• high blood pressure<br>• previous adverse reaction to anaesthesia<br>• liver impairment | 0 | 1 | 2 |
| States intention to carry out physical examination, including Mallampati scoring | 0 | 1 | — |
| Explains procedure to patient | 0 | 1 | 2 |
| Obtains consent for sedation and procedure | 0 | 1 | — |
| Puts patient on full monitoring and oxygen | 0 | 1 | — |
| Checks that cannula is patent | 0 | 1 | — |
| Ensures that resuscitation equipment and drugs are available:<br>• airway trolley<br>• suction<br>• naloxone<br>• flumazenil<br>• suitable resuscitation trolley with head tilt-down function | 0 | 1 | 2 |
| Chooses appropriate drugs:<br>• midazolam<br>• morphine | 0 | 1 | — |
| Carries out appropriate sedation and manipulation of the fracture | 0 | 1 | — |
| Ensures adequate postoperative recovery and gives adequate instructions:<br>• driving<br>• discharge with adult<br>• follow-up for injury | 0 | 1 | 2 |
| **Score from patient** | | **/5** | |
| **Global score from examiner** | | **/5** | |
| **Total score** | | **/28** | |

It is possible to build on the sedation and safety theme and create a more complex OSCE scenario in which you are asked to review a patient who has been oversedated in the emergency department by one of your junior colleagues without proper supervision. The key to this scenario is not only to manage the pseudo-resuscitation scenario but also to look at the clinical governance issues related to the incident.

## SCENARIO 3.5: OVERSEDATION

You are urgently called to see a 29-year-old woman by a staff nurse who is concerned about the management of this patient. She is being sedated by an F2 without supervision. You understand that an orthopaedic SpR asked the F2 to sedate the patient for the manipulation of a distal radial fracture. The F2 was asked by the SpR to give 10 mg of morphine and 10 mg of midazolam and await his arrival.

On arrival, the patient is not responding to voice, but responds to pain. Her oxygen saturation is 94% on air, BP 110/70 mmHg and pulse 70 bpm regular.

## SUGGESTED APPROACH

This is almost a resuscitation OSCE, and could easily appear in Chapter 2.

Oversedation and consequent loss of verbal responsiveness equates with general anaesthesia in terms of the level of patient care required. You should start with resuscitation of the patient and ask for additional anaesthetic assistance if required. Ask your assistant to set up the airway trolley in preparation.

The priority should be the airway. You should perform a rapid assessment of the airway and check for the presence of an obstruction. If the airway is obstructed, be prepared to perform basic airway measures (chin lift/jaw thrust, as well as inserting an oropharyngeal airway). If the patient tolerates the airway, they may need to be artificially ventilated with a bag–valve mask. This patient is at particular risk of aspiration, since she may not have been fully starved for what was not an elective procedure.

It is important to find out exactly what has been given and when. In this case, the patient's reduced level of consciousness is due to a combination of morphine and midazolam, and you may need to administer reversal agents, which are discussed below. Ask for the patient's medical history to see if there are any medical reasons for the adverse event.

While you secure the airway, you should ask your colleague to listen to the chest and support the circulation with fluids if the patient is hypotensive.

If the patient does not respond to the reversal agents or her level of consciousness drops further despite administration of the reversal agents, you should suggest that she be intubated in order to protect the airway; ideally, this should be done by an anaesthetist. However, it is likely that your OSCE patient will recover after administration of naloxone.

### Reversal agents

#### *Flumazenil*

Flumazenil is a competitive antagonist of the benzodiazepine class of drugs. The onset of action is within 1–2 minutes after intravenous administration, with peak effects within 10 minutes. The duration of action is dose-related, but it is typically shorter than that of longer-acting benzodiazepines. Repeat dosing may be required. The total recommended dose in adults is 1 mg, which will sustain reversal for up to 48 minutes. Flumazenil is generally given in increments of 0.2 mg, titrated to effect. One must exercise caution in patients receiving long-term benzodiazepine therapy, because seizures can occur.

### *Naloxone*

Naloxone is a competitive opioid antagonist. The onset of action following intravenous administration is rapid, with effects appearing within 2–3 minutes. The duration of action is dose-related. The initial dose in adults is 0.4 mg intravenously. It can be repeated to a total dosage of 2 mg. This antagonist may have shorter duration of action compared with that of the longer-acting opioids. In that case, the patient may need multiple doses. If the patient is exhibiting signs of respiratory depression before the end of the procedure, one can give 0.1–0.4 mg for partial reversal. Virtually no side-effects occur when naloxone is given for procedural oversedation.

## Conflict resolution and clinical governance

This scenario has great potential for a management-type OSCE in which there is not only a clinical governance issue where a junior is performing a potentially unsafe sedation on their own on the instructions of a speciality team – the examiners could also add a degree of conflict between the F2 and the nurse or the orthopaedic SpR, making it a highly sophisticated OSCE. After the patient has been stabilized, you should suggest that you talk to all those concerned to ascertain the facts. This is a serious clinical incident, and you should encourage the F2 to complete a clinical incident form.

You should also explain to the patient what happened, with full disclosure, and ensure that their injury is appropriately followed up.

You should avoid blaming the F2 or the orthopaedic SpR, but should suggest that the F2 be made aware of the departmental protocols on sedation and may need to undergo more sedation training under supervision. You should also suggest to the examiner that the departmental guidelines should be reviewed to ensure that future sedations in the emergency department are performed by an appropriate number of adequately trained staff. This could be extended to inform other specialities of the sedation protocols in the emergency department. Although a scenario of this complexity may be beyond the scope of the MCEM examination, there is no reason why it could not be turned into an FCEM OSCE.

## Scoring Scenario 3.5: Oversedation

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Recognizes airway obstruction | 0 | 1 | — |
| Attempts simple airway manoeuvre | 0 | 1 | — |
| Gives supplemental oxygen | 0 | 1 | — |
| Applies appropriate monitoring | 0 | 1 | — |
| Ensures that suction is available | 0 | 1 | — |
| Ascertains appropriate history | 0 | 1 | — |
| Ascertains the skill level of all the team members | 0 | 1 | — |
| Utilizes simple airway adjunct | 0 | 1 | — |
| Gives effective ventilation with bag and mask | 0 | 1 | 2 |
| Utilizes all team members effectively | 0 | 1 | — |
| Requests antagonist agents | 0 | 1 | — |
| Asks for patient's relevant past medical history | 0 | 1 | — |
| Gives opioid antagonist appropriately | 0 | 1 | — |
| Gives benzodiazepine antagonist appropriately | 0 | 1 | — |
| Ensures appropriate fracture management | 0 | 1 | — |
| Provides appropriate support to F2 | 0 | 1 | — |
| Provides appropriate follow-up plan for patient, including full disclosure | 0 | 1 | 2 |
| Recognizes major issues involved: patient safety, clinical governance, teaching and supervision | 0 | 1 | 2 |
| **Global score from examiner** | /5 | | |
| **Total score** | /26 | | |

# 4
# Wound Management

SAVVAS PAPPASAVVAS AND CHETAN R TRIVEDY

## CORE TOPICS

- Closure of wounds
- Wound infections
- Special wounds (puncture wounds, animal bites and amputations)
- Tetanus immunization schedules

### SCENARIO 4.1: DOG BITE

A 35-year-old man has presented to the emergency department in severe pain. He was attacked by a pit bull terrier 3 hours ago and has sustained multiple bites to his right forearm.

Carry out a history and examination of the wound and outline your management.

## SUGGESTED APPROACH

Dog bite injuries are a common presentation to the emergency department and, although usually not life-threatening, they can result in significant morbidity, disfigurement and psychological trauma. The outcome is influenced by correct early management.

Start by clearing the airway and assessing the breathing and circulation.

Look for any life-threatening injuries.

Hypovolaemic shock is uncommon in isolated distal upper limb injuries unless there is a tear to a major vessel or an amputation injury. It should be managed actively by transfusing warm fluids/blood and instigating urgent surgical intervention to stop further bleeding.

Take a focused history of the events surrounding the injury

### Mechanism and timing of injury

Factors that should be considered include:

- breed of dog
- rabies risk (low in the UK)
- site of injury

Timing of injury is also important, since an ischaemic injury beyond 6 hours may result in permanent nerve injury, as well as loss of function.

## Patient factors

These include:

- medications and allergies
- vaccination status (tetanus)
- past medical history (immunocompromised state)
- hand dominance and occupation

Pain control should be one of the priorities, and the limb should be splinted and elevated while intravenous access is obtained. Analgesia should be prescribed in accordance with the degree of pain

## Examination

Carry out a secondary survey, which involves a top-to-toe inspection looking for other bite injuries.

The limb should be completely exposed and a detailed musculoskeletal, neurological and vascular examination should be carried out. A detailed description of the assessment of the upper limb is given in Chapter 5.

Removal of the splint may result in further haemorrhage; this should be controlled by applying direct pressure.

Fractures of the long bones caused by a dog's powerful jaw muscles may present with crepitus deformity and tenderness on palpation, and these should be treated in the same way as compound fractures.

The site and the size of the wounds should be recorded and, if possible, photographs should be taken for documentation.

You should conduct a neurological assessment of the motor and sensory components of the median, ulnar and radial nerves. The presence of neurological deficit coexists with vascular injuries in up to 50% of cases. A two-point discrimination test may be positive, and there may be hypoaesthesia and weakness in the affected area.

A detailed vascular examination should be carried out, including an assessment of the pulses as well as measurement of the capillary refill time (CRT). A delay in the CRT greater than 3 seconds may be indicative of vascular compromise. A handheld Doppler ultrasound scanner may also be used to assess the blood supply.

You should be aware of compartment syndrome (CS) as a potential complication of any soft tissue injury to a limb. This may present as a tense soft tissue swelling within the boundaries of the compartment on either surface of the forearm.

### *Signs of compartment syndrome*

These include:

- **Pain**: this is often disproportional to the injury, and the patient may complain of severe pain on passive and active movement of the affected limb.
- **Pallor**: the hand may be swollen, pale and cold, with the fingers held in a claw position – extended metacarpophalyngeal (MCP) joints and flexed proximal interphalyngeal (PIP) joints.
- **Absent pulse**: a loss of the pulses is a late sign for CS, and the pulses are initially present.
- **Perishing cold**: progressive ischaemia can result in cold peripheries and an increase in CRT.
- **Paralysis**: this is another late feature of CS, which occurs as a result of hypoxic nerve damage. It is usually reversible with time.

You should appreciate that CS is a surgical emergency and tissue necrosis may occur within 12 hours. Urgent surgical decompression should be arranged to prevent complications, which include ischaemic contractures and rhabdomyolysis.

## Investigations

Urgent bloods should be sent: full blood count (FBC), urea and electrolytes (U&E), coagulation screen, creatine kinase (CK), as well as a group and save.

An X-ray of the affected limb should be taken to look for fractures as well as fragments of tooth.

Wound swabs should be taken (*Pasteurella multocida* is the most common organism isolated from infected wounds).

## Management

High-flow oxygen should be provided if indicated. Intravenous fluids should be given if the patient is hypotensive or tachycardic.

The wound should be debrided with copious amounts of 0.9% saline and covered with an iodine-soaked gauze dressing. It should be explored under local anaesthetic to look for tendon damage and to remove devitalized tissue. However, if there are extensive wounds with underlying damage to the neurovascular structures, they should be explored under general anaesthetic.

A limb that has its neurovascular status compromised represents a time-critical surgical emergency that should prompt an urgent surgical referral.

Patients with CS should also be referred for an urgent decompression fasciotomy.

Primary closure should be avoided where possible, to minimize the risk of infection.

Broad-spectrum intravenous antibiotics should be given (co-amoxiclav).

Anti-tetanus immunization (passive or active) may be necessary, depending on the patient's tetanus status.

### *Tetanus-prone wounds*

- Wounds sustained over 6 hours before intervention.
- Any wounds that have:
  - a significant degree of devitalized or necrotic tissue
  - bites or puncture wounds
  - features of contamination
  - signs of infection

### *Immunization schedule*

The typical UK tetanus immunization timetable is:

1. Primary three vaccines administered at 2, 3 and 4 months of age
2. Fourth vaccination given 3 years after the primary course (preschool)
3. Fifth and final vaccination given between ages 13 and 18

The triple vaccine containing diphtheria/typhoid/tetanus (DTP) is preferred.

If the patient has received a full five-dose course of tetanus vaccine, or is up to date with their tetanus immunization schedule, no further doses of vaccine are required. However, if the risk of tetanus is high because the wound is heavily contaminated, human tetanus immunoglobulin (250 or 500 iu) should be given intramuscularly.

If the immunization schedule is not up to date or the status is unknown, a booster dose of tetanus vaccine should be given, and the patient should receive further doses so that they complete their course of vaccinations. In addition, immunoglobulin should be given for any injury defined as a tetanus-prone wound.

## Additional points

Unless there are child protection issues, it is the responsibility of the patient to inform the police/RSPCA.

You should complete the station by arranging appropriate follow-up and advice regarding wound infection and CS.

## Scoring Scenario 4.1: Dog bite

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Gels-in with alcohol gel | 0 | 1 | — |
| Appropriate introduction | 0 | 1 | — |
| Rapid assessment of ABC and appropriate management | 0 | 1 | — |
| Suggests measures to achieve pain relief:<br>• splints and elevates limb<br>• nitrous oxide<br>• oral analgesia<br>• IV morphine/paracetamol | 0 | 1 | 2 |
| Takes a focused history:<br>• timing of injury<br>• sites of injuries<br>• breed of dog<br>• past medical history<br>• allergies<br>• tetanus status<br>• occupation/hand dominance | 0 | 1 | 2 |
| States intention to conduct a general inspection to exclude additional injuries | 0 | 1 | — |
| Exposes limb and examines wound:<br>• Comments on neurovascular status<br>• Deals appropriately with haemorrhaging<br>• Assesses motor function<br>• Photographs and swabs wound<br>• Soaks or wraps wound with disinfectant/iodine | 0 | 1 | 2 |
| Suggests exploration under local anaesthetic or referral to plastic surgeons for further management | 0 | 1 | — |
| Suggests that primary closure should be delayed | 0 | 1 | — |
| Advises on tetanus vaccination | 0 | 1 | 2 |
| Suggests antibiotics | 0 | 1 | — |
| Arranges follow-up and gives wound-care advice | 0 | 1 | — |
| Gels-out with alcohol gel | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /27 | |

## SCENARIO 4.2: SUTURING A WOUND

You have been asked to review a 24-year-old man who has come to the emergency department with a 4 cm laceration on the right side of the forehead after being accidentally head-butted while playing football. He has been seen by the F2, who has excluded a head injury as well any fractures to the facial skeleton. You assess the patient and feel that the wound needs suturing.

Carry out an examination of the wound and close it on the model provided. Demonstrate your hand-washing techniques.

## SUGGESTED APPROACH

Suturing is a core skill for any emergency department physician, and ideally this station should not pose a problem for the trainee. However, the prospect of suturing a piece of foam in less than 7 minutes while pretending that it is attached to a real patient is another matter. The key to this station is not just placing the sutures but also talking through the skill and demonstrating to the examiner that you know how to manage lacerations in the emergency department. In addition, do not forget that there will be marks for effective hand hygiene as well as your ability to assess the wound and administer local anaesthetic. It is essential that you talk through your skill and say what you are doing as you go along. Again do not forget that, although you are suturing a foam pad, you are meant to treat it as if it were part of a patient. There will also be marks for your communication skills and arranging follow-up for the patient.

As you enter the station and introduce yourself, demonstrate your hand-washing technique as described at the end of this chapter. You may not have to physically do it, but should at least state your intention to perform a thorough hand washing.

Offer analgesia as appropriate.

Although you have not been asked to take a medical history, you should ask a few questions that may have direct bearing on your management. You can do this while you are getting your equipment ready or washing your hands.

- Is the patient allergic to local anaesthetic or iodine?
- Do they have a history of poor wound healing/scarring (keloid)?
- Do they use steroids?
- Do they have a history of immunosuppression or diabetes?

Emergency department physicians can suture most facial lacerations under local anaesthetic. However as the aesthetic result is a major concern with these types of injuries, it is essential that you be aware of injuries that may need referral to a specialist such as a plastic or maxillofacial team. These include:

- injuries crossing the vermillion border of the lip
- any laceration involving the eyelid
- any facial laceration with marked tissue loss
- infected wounds
- patients who have a history of scarring or poor wound healing

Explain to the patient that you would like to examine the wound, and then close it under local anaesthetic. Verbal consent is usually sufficient, but you should document that informed consent was taken, as well as any warnings on

side-effects or complications. These include:

**Early**

- pain
- bleeding
- swelling/bruising

**Late**

- scarring
- infection

Prepare your equipment, including:

- a sterile dressing pack
- non-dissolving 5/0 sutures
- suture pack
- sterile gloves
- sterile saline and syringes
- sterile drapes
- local anaesthetic (1% lidocaine)
- chlorhexidine- or iodine-based disinfectant

Set up your equipment after washing your hands. It is essential that you use an aseptic technique and ask for an assistant if required to drop equipment onto your sterile field.

After you have donned your sterile gloves, the area around the wound edges should be cleaned with disinfectant and draped, creating a sterile field.

Administer local anaesthetic. You should be aware of the maximum safe dose of lidocaine and should state that you would aspirate before you inject, to prevent intravascular injection. You should suggest using a regional nerve block such as a supra-orbital nerve block. This would not only minimize any tissue distortion, which may arise from directly infiltrating the wound, but also reduce the overall amount of local anaesthetic required.

Wait for approximately 5 minutes before testing the area to make sure that it is adequately anaesthetized. Once this achieved, you should proceed to clean out and suture the wound.

Debridement is crucial for successful closure, and, after removing any obvious foreign bodies, you should perform a thorough irrigation with copious amounts of 0.9% saline to flush the wound. This should be repeated until the wound is free from any debris.

Explore the wound, and remove any ragged margins or devitalized tissue before proceeding to close the wound.

## Wound closure

It is likely that you will have to place two or three simple interrupted sutures on a model. You should practise your suturing skills, bearing in mind the following points:

- Hold the instruments correctly – although this may seem obvious, it is surprising how many of us lapse into bad habits as the years go by.
- Take adequate bites through the wound edge 5 mm from the margin.
- Do not hold or palm your needle (no-touch technique).
- Space your sutures evenly.
- Avoid trauma to the soft tissues by excessive handling.
- Evert the wound edges.
- Ensure that all your knots lie on the same side of the wound.
- If the wound is deep, suggest that you would close it in layers.
- Dispose of all sharps safely.

## Follow-up

The wound can be dressed with a light non-adhesive dressing, although facial wounds are often left uncovered.

The patient should be given clear written instructions on wound care and should be advised to return to have the sutures removed in 5–7 days if they are on the face. The patient should be advised to use sunblock over the wound to minimize scarring.

Tetanus vaccination should be discussed, and administered if appropriate.

Wash your hands with alcohol gel as you leave the station.

## Scoring Scenario 4.2: Suturing a wound

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Gels hands with alcohol gel with appropriate steps | 0 | 1 | — |
| Introduces self appropriately | 0 | 1 | — |
| Offers analgesia as required | 0 | 1 | — |
| Enquires about mechanism (excludes glass in the wound with an X-ray if necessary) | 0 | 1 | — |
| Takes a focused medical history – asks about:<br>• allergies to local anaesthetics<br>• diabetes/steroids/immunosupression<br>• scarring (keloid) | 0 | 1 | 2 |
| Explains procedure and complications, and obtains consent:<br>• pain/swelling<br>• bleeding<br>• infection<br>• scarring | 0 | 1 | 2 |
| Prepares equipment (selects 5/0 non-absorbable sutures for the face) | 0 | 1 | 2 |
| Hand hygiene and sterile gloves | 0 | 1 | — |
| Anaesthetizes the area – aspirates, and is aware of maximum doses (3 mg $kg^{-1}$ lidocaine without adrenaline, 7 mg $kg^{-1}$ with adrenaline) | 0 | 1 | — |
| Indicates a 5 min wait for local anaesthetic to work | 0 | 1 | — |
| Explores the wound and carries out a through irrigation and debridement of the wound | 0 | 1 | — |
| Prepares a sterile field | 0 | 1 | — |
| Places sutures:<br>1. Holds instruments correctly<br>2. Does not handle needle with hands<br>3. Does not traumatize soft tissue<br>4. Takes equal bites with needle<br>5. Everts wound edges<br>6. Sutures are equally spaced<br>7. Knots lie to one side<br>8. Sutures are not too tight | 0 | 1 | 2 |
| Disposes of sharps | 0 | 1 | — |

*Continued*

**Scoring Scenario 4.2** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Gives appropriate wound-care advice:<br>• suture removal in 5–7 days<br>• use sun cream to minimize scarring | 0 | 1 | — |
| Gives appropriate head-injury advice | 0 | 1 | — |
| Discusses tetanus vaccination | 0 | 1 | — |
| Gels hands with alcohol gel | 0 | 1 | — |
| **Score from patient** | /5 | | |
| **Global score from examiner** | /5 | | |
| **Total score** | /32 | | |

## HAND HYGIENE

This is an important topic; it has been tested in the examination and is of much current interest. You should start by removing watches, bracelets and rings. Sleeves should be rolled up so that the arm is exposed to the elbows.

Hand washing is carried out using soap and water and can be divided into six distinct steps (Figure 4.1). Each step is made up of six repetitions and should not last more than 10 seconds. At the end of the hand-washing cycle, the hands should be washed and dried.

**Step 1:** Palm to palm

**Step 2:** Backs of hands

**Step 3:** Interdigital spaces

**Step 4:** Fingertips

**Step 5:** Thumbs and wrists

**Step 6:** Nails

**Figure 4.1** Hand washing.

# 5 Major Trauma

HARITH AL-RAWI

## CORE TOPICS

- Major trauma
- Head injury
- Chest trauma
- Abdominal trauma
- Maxillofacial trauma

The management of major trauma is a major topic and is a near-certainty in the CEM OSCE. The key to the major trauma OSCE, regardless of the scenario, is a systematic and methodical approach to management. The advanced trauma life support (ATLS) method is the internationally accepted approach to major trauma. You should therefore ensure that if you are not ATLS-trained you at least read the *ATLS Student Course Manual* before your OSCE, since much of what is expected is contained in this manual.

To review the entire ATLS manual is beyond the scope of this chapter, the objectives of which are to provide guidance on how to:

- approach patients presenting with major trauma
- perform primary and secondary surveys
- take an 'AMPLE' history
- clear the C-spine and read a C-spine X-ray

### SCENARIO 5.1: PRIMARY SURVEY (TENSION PNEUMOTHORAX)

You are informed of an urgent priority call. The ambulance crew has a 21-year-old man who was involved in a motor vehicle collision. He is an unrestrained driver who hit a tree and sustained chest injuries. His systolic blood pressure is 80 mmHg, pulse rate 120 bpm and GCS 10. The expected time of arrival is 5 minutes.

How would you prepare yourself in those 5 minutes and how would you manage this patient as the trauma team leader. You have an ATLS-trained nurse and an F2.

## SUGGESTED APPROACH

This is a common scenario, which you should have already experienced many times before you sit your OSCE. There are two elements in this OSCE: preparation and management.

Starting with preparation, the information provided implies that the driver has sustained major trauma, so the first step is to put out a trauma call and assemble a trauma team. You will be the team leader, and ideally you would have at least two doctors (one being an anaesthetist) and two nurses, but in the examination you will probably have just two helpers. You need to allocate your team to their roles so that one member takes care of airway and breathing and another takes care of circulation, drugs and monitoring. You, as the team leader, will step in only if absolutely necessary, since as you should be overlooking and running the management. Also in preparation, you need to check your equipment and departmental space. This patient should go to the resuscitation area; if it is full, you need to make space for him and provide adequate monitoring. You should check that you have proper airway equipment (laryngoscopes, airway and endotracheal tubes) and that it is working; you will also need intravenous cannulae, syringes, blood sample tubes, warmed saline or Hartmann's solution, and other pieces such as nasogastric tubes, chest drains, Foley catheters and a difficult-airway trolley.

For the purposes of the examination, delegate roles to your team; you will probably have to check the equipment yourself. Remember to check your suction and oxygen supply. You should not spend more than a minute doing this, since the remaining time will be spent on managing your casualty.

The second part of the OSCE involves the recognition and management of any life-threatening conditions. In major trauma, patient assessment comprises a primary survey followed by a secondary survey. The secondary survey will be discussed in the context of Scenario 5.2; the remaining discussion here will be limited to the primary survey.

### The primary survey (ABCDE)

#### *(A) Airway maintenance with cervical spine protection*

This is the first priority, and you should make a rapid assessment of the airway. While you are doing this, ask one of your assistants to put on full monitoring, which will usually consist of pulse oximetry, ECG leads and a blood-pressure cuff.

You should look for the following when assessing the airway:

- Is the patient talking?
- Is there any stridor/snoring/gurgling?
- Is there any sign of airway obstruction or facial trauma?
- Do simple manoeuvres (jaw thrust or chin lift with no head tilt) relieve the obstruction?
- Does an oropharyngeal or nasopharyngeal airway help?
- If the above measures do not improve the airway, is a definitive airway needed?
- Is the C-spine immobilized?
- Does the patient have a hard collar with sandbags/blocks and tape applied?

Make sure that the patient has high-flow oxygen provided via a facial mask with a non-rebreathing reservoir bag (and that they are fogging the mask). In the examination, the chances are that you will be addressing a manikin, so you should get into the habit of asking questions, making observations and verbalizing what you are doing as if the manikin were a real patient. Do not forget to introduce yourself to the patient, and make sure that you explain what you are going to do as you would in real life. As well as reassuring the patient, this will demonstrate to the examiner that you are calm and are in control of the scenario.

It is essential that if you identify a problem with the airway, you fix it before you move on to assessing the breathing. Whenever you make any intervention, you must go back and reassess the airway. Assessment and management of the compromised airway are discussed in detail in Chapter 2 and will be excluded from the discussion in this chapter.

## *(B) Breathing and ventilation*

Expose the chest and inspect closely for any evidence of any external injuries:

- **Look for:**
  - penetrating injuries
  - bruising (especially around the heart)
  - evidence of rib fractures or a flail chest
- Is the chest moving symmetrically?
- Is there accessory muscle use?
- What are the respiratory rate and saturations?
- Is the trachea central?
- Is the patient cyanosed/pale?
- Is the jugular venous pulse (JVP) raised?

- **Feel for:**
  - tender areas on palpation
  - surgical emphysema (suggesting a pneumothorax)
  - fractured ribs
  - dullness/resonance on percussion

- **Listen for:**
  - absent/abnormal breath sounds

Before moving on to circulation, you should deal with any problems associated with breathing (see Table 5.1).

## *(C) Circulation with haemorrhage control*

- **Look for:**
  - any sign of external haemorrhage – apply pressure to control the bleed
  - the colour of the patient
  - bruising over the chest

**Note:** A depressed sternal fracture may result in cardiac contusion.

- **Feel for:**
  - the peripheries to see if they are cool
  - What is the pulse rate? Is it weak and thready?
  - Measure the blood pressure.
  - Assess the capillary refill time.
  - Perform abdominal and pelvic examinations.

**Note:** A fracture of the femur or pelvis may account for significant blood loss.

- **Listen for:**
  - muffled heart sounds suggesting a pericardial effusion

Make sure that the patient has two large-bore cannulae, that blood samples have been sent (for full blood count, urea and electrolytes, blood sugar, clotting, and cross-match 4 units) and that there is 1 L of warm saline/Hartmann's solution running. The patient should also have an ECG as soon as possible to exclude any myocardial damage or small complexes, which may be present in a cardiac tamponade.

### *(D) Disability*

This involves a focused assessment of the patient's neurological status. This is often difficult to assess in those who have a reduced level of consciousness or are intoxicated. However, it is essential to pick up a significant head injury.

- Calculate the Glasgow Coma Scale (GCS < 8 equates to loss of the gag reflex and is an indication for endotracheal intubation).
- Examine pupil size and reaction.
- Look for the presence of lateralizing signs.
- Do not forget to check the patient's blood sugar.
- Look for external signs of a head injury.
- Leakage of cerebrospinal fluid (CSF) from the ears/nose is also indicative of a severe head injury.
- Is there evidence of seizures?
- Is there abnormal limb posturing (as a consequence of intracerebral haemorrhage).
- Is the breathing pattern normal?

### *(E) Exposure and Environment control*

The patient should be completely exposed in preparation for the detailed secondary survey. Following complete removal of the patient's clothes, both the front and back of the patient should be assessed after log rolling.

Make sure that the patient is covered adequately after exposure. Check their temperature.

## Intervention in the primary survey

In the OSCE, it is highly likely that you will have to make one or more crucial interventions in order to stabilize the patient; this could be at any stage during your assessment in the primary survey. However, from reading the scenario, you should have a reasonable idea of what the problem might be. It is important that every time you make an intervention, you go back to the airway and restart your assessment. If you detect a pneumothorax, you should decompress it immediately and then arrange for a formal chest drain. You would be expected to know the relevant anatomical landmarks, explain the procedure to the patient and obtain the patient's verbal consent for it. The examiner will ask you to talk through the intervention; it is crucial that, once you have completed it, you ask to review the observations to see what impact the intervention has had on the patient. It is entirely possible that you may not get beyond assessing the breathing or circulation in the OSCE, particularly if you have a patient with a pneumothorax that needs to be treated. This should not put you off – the key is to keep going through your systematic assessment and treat any life-threatening injuries as you find them. Only once you are confident that the patient is stable do you move on to the secondary survey.

The examiners could choose a number of life-threatening conditions that require prompt intervention, and you should be familiar with diagnosing and managing the life-threatening conditions that can occur following a major motor vehicle collision (Table 5.1).

## Imaging in major trauma

There will also be marks for arranging appropriate investigations. The trauma series consists of:

- lateral C-spine
- chest
- pelvis

The timing of the request for imaging is important, since it should not compromise the primary survey. Imaging should never delay life-saving treatment – more lives are saved by operations than by scans. A mode of imaging that you may consider specifically for this scenario is the focused assessment with sonography for trauma (FAST) scan, which is an effective tool for detecting free fluid in the abdomen. If you suspect that the patient has a head injury or that their C-spine cannot be clinically cleared, a CT scan of the head and/or neck should be organized. If the mechanism or the ECG is suggestive of myocardial injury, it may be prudent to organize a bedside echocardiogram.

**Table 5.1** Potential life-threatening emergencies associated with a major motor vehicle collision

| Potential critical event identified in the primary survey | Intervention required in OSCE |
|---|---|
| **Airway** | |
| Airway obstruction | Manage airway with adjuncts/ET tube/surgical airway |
| Significant C-spine injury | Demonstrate placement of collar and blocks |
| **Breathing** | |
| Tension pneumothorax | Immediate needle decompression, and arrange for a formal chest drain with an underwater seal |
| Haemothorax | Insert a chest drain |
| Haemopneumothorax | Insert a chest drain |
| Flail chest | Splint chest |
| **Circulation** | |
| Cardiac tamponade | Pericardiocentesis |
| Aortic dissection | Stabilize/CT and urgent vascular referral |
| Cardiac contusion | Bedside echocardiogram |
| Hypovolaemia from an abdominal injury (liver/spleen) | FAST scan/direct peritoneal lavage |
| Hypovolaemia from a bony injury (pelvis/femur) | Splint pelvis or traction-splint for the fractured femur |
| **Disability** | |
| Head injury | Manage head injury (see Scenario 2.4) |
| Reduced GCS and compromised airway | Maintain obstructed airway (see above) |
| Spinal injury | Demonstrate safe log roll technique/manage spinal shock |
| Seizures | Treat seizures as well as cause (see Scenario 2.1) |
| **Exposure** | |
| Hypothermia | Treat hypothermia |

## Scoring Scenario 5.1: Primary survey (tension pneumothorax)

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction and handover | 0 | 1 | — |
| Puts out a trauma call, assembles the team and states that he/she will be team leader | 0 | 1 | 2 |
| Checks the availability of the equipment required; asks for patient to be put on oxygen and monitoring | 0 | 1 | — |
| Assesses the airway and makes appropriate use of airway adjuncts | 0 | 1 | — |
| Ensures that the C-spine is immobilized | 0 | 1 | — |
| Assesses 'B' and identifies the presence of a tension pneumothorax (auscultates appropriately) | 0 | 1 | — |
| Suggests immediate needle thoracocentesis; demonstrates landmarks accurately | 0 | 1 | 2 |
| Suggests formal underwater sealed chest drain:<br>• Describes landmarks accurately<br>• Explains procedure to patient<br>• Administers local anaesthetic<br>• Places drain in situ and connects appropriately to underwater seal<br>• Secures drain appropriately | 0 | 1 | 2 |
| Rechecks observations following intervention | 0 | 1 | — |
| Assesses 'C':<br>• Pulse<br>• Central capillary refill<br>• Blood pressure<br>• ECG<br>• External blood loss/abdomen/pelvis/femur | 0 | 1 | 2 |
| Gives warms fluids or O-negative blood if appropriate | 0 | 1 | — |
| Assesses 'D' accurately:<br>• GCS<br>• Pupils<br>• Blood sugar<br>• Abnormal breathing pattern | 0 | 1 | 2 |
| Assesses 'E' accurately:<br>• Checks temperature<br>• Exposes patient | 0 | 1 | — |
| Suggests appropriate imaging (trauma series):<br>lateral C-spine/chest/pelvis | 0 | 1 | — |
| **Effective team leader skill and use of team members** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/29** | | |

## SCENARIO 5.2: SECONDARY SURVEY

You are called by your F2 to attend to the resuscitation area immediately, since he is unable to cope with a patient on his own. The paramedics have just brought in a 35-year-old woman who has jumped from her third-floor flat and sustained head injuries. The paramedics say that her pulse is 65 bpm, her blood pressure 124/84 mmHg and her GCS 10. Her C-spine has been secured with a collar and blocks.

How would you manage this patient and proceed to perform a secondary survey. There are the F2 and an ALS-trained nurse to help you.

## SUGGESTED APPROACH

This represents a rather more complex type of scenario that would be suited to a double 14-minute OSCE scenario as is encountered in the FCEM examination. It requires you not only to review the primary survey performed by an F2 on their own (a management issue in its own right) but also to proceed to perform a secondary survey.

The initial preparation and assessment are the same as described for Scenario 5.1. However, when you assess 'D', you will find that this patient has a GCS of 6 with unequal pupils; on discovering this, you must suggest that this patient needs a definitive airway (patients with GCS < 8 need a definitive airway). At this stage, you should check to see if a trauma call has been put out and should request an anaesthetist. If the examiner wishes you to demonstrate your airway skills, you will be told that the anaesthetist is unavailable and you should proceed to secure the airway. As this OSCE is also about the secondary survey, the primary survey and intervention should be relatively straightforward, allowing you to complete the primary survey and move on to the secondary survey.

As you conclude your primary survey, you must suggest that this patient needs a full trauma series (which includes a lateral C-spine X-ray, a chest X-ray and a pelvic X-ray). In this particular scenario, a CT head is also required, and you should ensure that the patient is stable and safe for transfer to the CT scanner. For the purpose of the OSCE, you may have to arrange and oversee the transfer of the intubated patient for a CT scan.

The secondary survey does not begin until the primary survey has been completed. It is a complete head-to-toe evaluation of the trauma patient, i.e. a complete history and physical examination, including a reassessment of all vital signs.

In awake patients able to verbalize, you should take an 'AMPLE' history:

**A**llergies

**M**edications currently used

**P**ast illnesses/Pregnancy

**L**ast meal

**E**vents/Environment related to the injury

In comatose patients, as much of this information as possible should be obtained from family, friends or ambulance crew.

In this case, any features suggesting that the patient has a psychiatric history are important. The possibility that the patient has taken a deliberate overdose is also important with regard to their management. If you suspect deliberate self-harm, paracetamol and salicylate levels should be checked in addition to the routine bloods.

## The secondary survey

To avoid missing an injury, each region of the body is completely examined; a simple way of achieving this is to divide the body into:

- head and neck
- trunk
- pelvis
- limbs

### *Head and neck*

The whole scalp, eyes (including visual acuity and fundoscopy), ears, nose, mouth, facial bones and neck are all thoroughly examined. Mention to the examiner that you would look for foreign bodies in any lacerations, as these can easily be overlooked.

### *Trunk*

The chest, abdomen and back, including the spine, are all assessed thoroughly. You may be asked to perform a log roll in order to examine the back and/or clear the C-spine. You will have to ensure that you have the appropriate number of people to perform the log roll.

### *Pelvis*

Carefully and gently assess the pelvis for any injury or deformity. If you suspect that the patient has an unstable pelvis, you should splint it temporarily. In an adult scenario, you should suggest that you would examine the genitalia as well as performing a digital rectal examination and a vaginal examination (with an appropriate chaperone present). Intimate examinations should not be performed on children – if they are absolutely essential, the child should be referred for a senior surgical opinion.

### *Limbs*

Carry out a detailed limb examination, starting at the shoulder and ending at the toes. Examine each joint in detail and arrange X-rays as thought necessary. A detailed description of joint examinations is given in Chapter 6. If you find that the patient has an unstable ankle injury or a fractured femur, you may need to intervene and either reduce the fracture or splint the fractured femur following a femoral nerve block.

Depending on your progress in this OSCE, you may be shown a CT scan that reveals a right extradural haemorrhage. On diagnosing this, you must suggest contacting the neurosurgeons and getting the patient to theatre. Meanwhile, you should stabilize the patient and suggest that they have invasive monitoring and a urinary catheter (management of a patient with a major head injury is discussed in Scenario 2.4).

## Management/debriefing

You should also suggest that a debriefing be held after the trauma call for all of the team. Some of the management issues – such as why the F2 was left alone with the trauma patient – can be discussed openly without assigning any blame. The management slant to this OSCE is more important in the FCEM examination, where the candidate has to play the role of an acting consultant.

## Scoring Scenario 5.2: Secondary survey

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Establishes the need to put out a trauma call, assembles the team and states that he/she will be team leader | 0 | 1 | — |
| Asks for airway trolley and states intention to check equipment | 0 | 1 | 2 |
| Assesses 'A' adequately, with C-spine immobilization | 0 | 1 | — |
| Asks for monitoring and high-flow oxygen | 0 | 1 | — |
| Assesses 'B' adequately | 0 | 1 | 2 |
| Assesses 'C' and the need for IV access and bloods | 0 | 1 | 2 |
| Assesses 'D' adequately; ascertains that the patient has a GCS of 6 and unequal pupils | 0 | 1 | 2 |
| Checks blood sugar | 0 | 1 | — |
| Indicates the need for a definitive airway and a CT | 0 | 1 | — |
| Assesses 'E' adequately | 0 | 1 | — |
| Takes an 'AMPLE' history and performs a secondary survey<br>Ascertains that the patient is on antidepressants<br>Must ask for bloods to be sent for paracetamol/salicylate level | 0 | 1 | 2 |
| Diagnoses right extradural bleed and contacts the neurosurgeons | 0 | 1 | 2 |
| Suggests management in emergency department: central line/arterial lines/urinary catheter/head-up position | 0 | 1 | 2 |
| Suggests debrief session and counsels/supports F2 | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /32 | |

## SCENARIO 5.3: PAEDIATRIC TRAUMA

You are the emergency department registrar covering the paediatric emergency department. You are called to the resuscitation area because they have just heard that a 6-year-old boy has been hit by a bus and has sustained left-sided truncal injuries. He has a pulse rate of 140 bpm, a systolic blood pressure of 70 mmHg and a GCS of 11. The estimated time of arrival is 2 minutes.

Outline how you would prepare yourself and manage this child. You have an F2 and an advanced paediatric life support (APLS)-trained nurse to help you.

## SUGGESTED APPROACH

You should be prepared for a paediatric scenario; in essence, this is very similar to an adult scenario, except that you have to know a few formulas in addition to your primary survey protocol.

This child has sustained major trauma and from the observations given is clearly haemodynamically unstable. As you start your OSCE, make sure that you introduce yourself to the parent/guardian accompanying the child and ascertain their relationship to the child. It is likely that they will be extremely anxious and may even interfere with your assessment. It is important that you remain calm and do not exclude them from the scenario. Explain what is going to happen and if possible ask the nurse to stay with them. This will boost your global score, and you would be unwise to ignore them.

You will need the first 2 minutes to make your calculations. A good way of remembering these is the mnemonic 'WET FLAG':

**W**eight = (age in years + 4) × 2 kg

**E**nergy = 4 J $kg^{-1}$

**T**: endotracheal Tube diameter = (age in years/4) + 4 mm

**F**luids = 10 mL $kg^{-1}$ of crystalloid in trauma (10 mL $kg^{-1}$ of packed red blood cells where needed)

**L**orazepam 0.1 mg $kg^{-1}$

**A**drenaline = 0.1 mL $kg^{-1}$ of 1 in 10 000 adrenaline

**G**lucose = 5 mL $kg^{-1}$ of 10% glucose

You can also state that you would use the Broselow tape to estimate the child's weight, and you can use this to calculate the doses of fluids, drugs and equipment that you need. Once you have completed your calculation, you will need to check that you have the appropriate equipment to manage this child; this will be displayed on a table or resuscitation trolley.

The next part of this OSCE involves managing the child. The first thing that you will need to do is to put out a paediatric trauma call and allocate roles to your team, stating that you will be the team leader.

The initial assessment is the same as that described in Scenarios 5.1 and 5.2, but this child has a 'C' problem and on this assessment is also noted to have a capillary refill time of 5 s, left upper quadrant tenderness and pain on palpating the pelvis. In this scenario, it is important to note that:

- After the second fluid bolus, blood will be needed.
- A surgeon must attend, since if there is no response to the third bolus, the child will need to go to theatre with a high suspicion of a splenic injury.

When asked about the blood, the most rapidly available is O-negative, which should be kept in the fridge in the resuscitation area. Type-specific blood takes 10–15 minutes to prepare, whereas a full cross-match would take 45–60 minutes. You will get bonus points for mentioning doing a FAST scan, but none for requesting a CT, since this child is unstable and may arrest in the scanner. In fact, the parents may push you to order a CT scan, and you should explain to them that this is potentially dangerous for the child.

Another important measure is to apply pelvic support, be it a Velcro belt or just wrapping a sheet around the pelvis to reduce pelvic volume and blood loss. You may not get the chance to assess 'D' or 'E' in this child, since 'C' is the main problem and must be addressed, with the definitive care being that the child ultimately needs to go to theatre for the surgeons to deal with the splenic injury and the orthopaedic surgeons to deal with the pelvic fracture.

You should also deal with the child's pain appropriately by giving morphine 100–200 μg $kg^{-1}$ in a child over the age of 1 year. It is possible that the examiner will inform you that you are unable to get intravenous access; you should reply by telling the examiner that you will go for the intraosseous route.

## Intraosseous (IO) access

This is a core skill, and is commonly tested in the OSCE. The marks can be divided into three areas for this skill:

- explaining the need for the procedure and getting consent from the parent(s)
- performing the skill after identifying the anatomical landmarks:
  - tibial approach (anterior surface of the tibia 2 cm below the tibial tuberosity)
  - femoral approach (anterolateral surface 3 cm above the lateral condyle)
- technique (outlined in Chapter 31)

## Scoring Scenario 5.3: Paediatric trauma

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction. Confirms identity of parents/guardians and engages them | 0 | 1 | — |
| Correct calculations and preparation: weight/energy/endotracheal tube/fluids/lorazepam/adrenaline/glucose ('WET FLAG') | 0 | 1 | 2 |
| Establishes the need to put out a trauma call, assembles the team and states that he/she will be team leader | 0 | 1 | — |
| Assesses 'A' adequately, with C-spine immobilization | 0 | 1 | — |
| Assesses 'B' adequately | 0 | 1 | — |
| Assesses 'C' and the need for IV access and bloods | 0 | 1 | 2 |
| Indicates two failed attempts at IV access and states intention to place IO needle<br>Discusses with parents and informs verbal consent<br>Describes landmarks and inserts IO needle | 0 | 1 | 2 |
| Makes rapid assessment of abdomen and pelvis and indicates that the child has possible splenic/pelvic injuries | 0 | 1 | 2 |
| Suggests a FAST scan to the examiner | 0 | 1 | — |
| Does not recommend a CT scan when asked by parent | 0 | 1 | — |
| States the need for blood after second bolus and calls for a surgeon | 0 | 1 | 2 |
| Stabilizes the pelvis by wrapping a sheet around it | 0 | 1 | — |
| Indicates that the child needs to go to theatre, since he is haemodynamically unstable | 0 | 1 | — |
| **Score from parents** | /5 | | |
| **Global score from examiner** | /5 | | |
| **Total score** | /28 | | |

## SCENARIO 5.4: C-SPINE INJURY

Your F2 calls you to resuscitation to help with her patient. The patient is a 62-year-old female cyclist hit by a car going downhill and complaining of neck pain.

Indicate how you will assess this patient, and teach your F2 how to examine and clear a C-spine and how to perform a log roll. The primary survey has already been performed and the patient is otherwise stable. You should focus your assessment on the cervical spine.

## SUGGESTED APPROACH

From the outset, you should appreciate that this is a teaching OSCE, and so there will be a fixed number of marks for your ability to teach this student on how to examine and clear the C-spine clinically.

You should start by introducing yourself to the patient as well as the student, and explain to the patient that you are going to be teaching the student but that you will in charge and will perform the examination yourself. Ask if the patient is comfortable, and offer analgesia if required. Proceed to find out how much the student knows about C-spine injuries – you should not be surprised to learn that they know very little!

Lay out your objectives clearly, which could be to:

- demonstrate how to clinically examine the C-spine and perform a log roll
- discuss the NEXUS and Canadian C-spine rules

These objectives realistically form two separate OSCE scenarios in themselves, and you are unlikely to be asked to do both in one OSCE. However, as they are related, they will be discussed here as a single OSCE scenario.

### The clinical examination

Clinical examination of the C-spine is a core skill and is a good candidate for assessment in the OSCE. Start your examination by explaining to the patient what is going to happen and what you would like them to do. This is very important, and you should ensure that your patient understands not to move their neck until you ask them to. You should also explain the log roll to them before you do it, since it may be quite disconcerting for a patient in collar and blocks to be tilted to 90° while someone presses down their back and performs a rectal examination. A little explanation will go a long way towards your global marks. Inform the student about the concept of the log roll and that ideally you would need five people in total for an adult, with a dedicated person controlling the neck while three more support the patient in the tilted position and the fifth feels down the length of the spine. The person at the head end of the patient should be happy to take control of immobilizing the C-spine, and is therefore in charge of calling when to move the patient. You must ensure that this person is capable of managing the C-spine; you may have to do this in the examination to demonstrate to the examiner that you can lead the team.

The accepted call for moving is 'ready ... steady ... roll', although other, more confusing, calls are occasionally also encountered. Once the patient has been turned on their side, the person examining the spine should look for bruising and obvious step deformities, before palpating down the length of the spine for tenderness and completing their examination with a digital rectal examination for the presence of saddle anaesthesia and/or loss of anal tone.

The C-spine should be examined next, after removing the blocks and undoing the collar. While one of the assistants maintains the in-line immobilization of the neck, you should palpate down the back of the neck, looking for midline tenderness. If this is present, you should replace the collar and blocks and arrange for imaging of the C-spine.

The decision to clinically clear the neck is made with assistance from imaging and with the use of decision rules such as the Canadian C-spine rules and the NEXUS C-spine rules. You should teach the medical student whichever method you use regularly and mention the other so that the student can look it up after the session. In practice, the NEXUS rules are easier to remember, since there are only five criteria that need to be absent to clear the neck. You

should also tell the student that there may be occasions where the C-spine cannot be cleared with plain imaging, in which case additional imaging such as a CT/MRI of the neck may have to be arranged. You should conclude this part of the OSCE by summarizing the important steps of the process and asking the student if they have any questions. The student should be encouraged to ask questions, and you should suggest that they read the Canadian C-spine and NEXUS guidelines, which you can discuss the next time that you meet. These rules are summarized in Table 5.2.

**Table 5.2** Comparison of the Canadian and NEXUS C-spine rules

| Canadian C-spine rules | | NEXUS C-spine rules | |
|---|---|---|---|
| **Risk factors** | **Decision to X-ray** | **If all of the following criteria are met, there is low risk of cervical C-spine injury and an X-ray is not required** | **Decision to X-ray** |
| Age ≥ 65 | Yes | Absence of posterior midline tenderness | No |
| Dangerous mechanism | Yes | Absence of focal neurology | No |
| Fall from >3 ft (1 m) or >5 stairs | Yes | | |
| Motor vehicle collision at >100 km $h^{-1}$ | Yes | | |
| Rollover ejection | Yes | | |
| Bicycle collision | Yes | | |
| Simple rear-end collisions | No | Normal level of consciousness | No |
| *Unless:* | | | |
| Pushed into oncoming traffic | Yes | | |
| Hit by bus or truck | Yes | | |
| Rollover | Yes | | |
| Hit at high speed | Yes | | |
| Low risk factor that allows safe assessment of neck: | | No evidence of a distracting injury | No |
| Simple rear-ended motor vehicle collision | No | | |
| Sitting position in emergency department | No | | |
| Delayed onset of neck pain | No | | |
| Absence of midline tenderness | No | | |
| Ambulatory at any time | No | | |
| If safe to move neck to 45° to left and right: | | Not intoxicated | No |
| Able to move neck | No | | |
| Unable to move neck | Yes | | |
| Patient not alert | Yes | | |
| Paraesthesia in extremities | Yes | | |

You should conclude the scenario by reviewing the important aspects of your objectives. Encourage questions and arrange for the next teaching session. Do not forget to thank your patient and answer any questions that they may have.

## Scoring Scenario 5.4: C-spine injury

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction to patient and student/F2 | 0 | 1 | — |
| Gains patient's consent to examine C-spine and teach student/F2 | 0 | 1 | — |
| Ensures that patient is comfortable and provides analgesia if required | 0 | 1 | — |
| Outlines objectives to student/F2<br>Clinical examination and log roll<br>Discusses C-spine rules: either Canadian or NEXUS | 0 | 1 | 2 |
| Talks the student through assessing the C-spine and ascertains mechanism | 0 | 1 | 2 |
| Asks for assistance with log roll:<br>• Requests 5 people in total<br>• Assigns roles to team<br>• Takes control of C-spine safely<br>• Gives clear instructions and explanation to patient<br>• Gives clear instructions to team about hand positioning and when to roll patient<br>• Performs a safe and coordinated log roll<br>• Examines C-spine after removing collar<br>• Indicates that will perform digital rectal examination | 0 | 1 | 2 |
| Indicates that, after examination of the C-spine, imaging is indicated: lateral/AP/odontoid peg | 0 | 1 | — |
| Explains findings to patient and encourages questions | 0 | 1 | — |
| Summarizes objectives to student and sets out further learning objectives | 0 | 1 | 2 |
| Maintains patient's dignity | 0 | 1 | — |
| **Score from patient** | **/5** | | |
| **Score from student/F2** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/29** | | |

## REFERENCES AND USEFUL RESOURCES

American College of Surgeons Committee on Trauma. *ATLS Student Course Manual*, 8th edn. Chicago: American College of Surgeons, 2008.

Hoffman JR, Mower WR, Wolfson AB et al. Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. *N Engl J Med* 2000; **343**: 94–9.

Stiell IG, Clement CM, McKnight RD et al. The Canadian C-spine rule versus the NEXUS low risk criteria in patients with trauma. *N Engl J Med* 2003; **349**: 2510–18.

Trauma Audit & Research Network website: www.tarn.ac.uk.

Trauma.org website: www.trauma.org.

# 6 Musculoskeletal Emergencies

EVAN COUGHLAN

## CORE TOPICS

- Shoulder
- Elbow
- Wrist and hand
- Back
- Hip
- Knee
- Ankle

The diagnosis and management of musculoskeletal injuries in the emergency department is a core skill, and this is reflected in the CEM curriculum. All trainees should be competent in the examination of the joints listed above, as well as having a structured approach to the differential diagnosis and management of common musculoskeletal injuries.

It is also important to refresh yourself with the key anatomical landmarks of each joint.

The key to the musculoskeletal OSCE stations is to have a well-practised examination routine. All examinations begin with an appropriate introduction, confirmation of the patient's problem and a request to examine the site of injury. Consider other areas that may have been injured; it is appropriate to advise the examiner that you would like to exclude other associated possible injuries (e.g. head injury and cervical spine injury) if the mechanism is suggestive of these injuries, before moving on the appropriate area. Ask the patient if they require analgesia prior to examination.

Although the focus of the OSCE with respect to musculoskeletal injuries is on examination, it is appropriate to ask some focused questions, since these will often have an impact on your management. These include, as appropriate:

- mechanism of injury
- hand dominance
- occupation/hobbies
- smoking history
- tetanus prophylaxis
- history of previous problems in the specific area to be examined

If the area to be examined is a sensitive one, ask for a chaperone. Explain that you would wash your hands. Expose the area to be examined fully, while maintaining the patient's dignity.

We will now discuss the specific OSCEs.

# Examination of the Shoulder

## SCENARIO 6.1: EXAMINATION OF THE SHOULDER

You are asked to see a 40-year-old man who was thrown off his bicycle and landed on his left shoulder 2 days ago. He is now complaining of pain in that shoulder.

Examine his shoulder and present your findings, including a differential diagnosis and management plan.

## SUGGESTED APPROACH

### Inspection

Look at the shoulder from the front, sides and behind. Assess for:

- asymmetry
- abnormal posturing of the upper limb
- scars
- bruising/haematoma
- sinus tracts
- loss of contour
- muscle wasting (deltoid, supraspinatus, infraspinatus)
- step deformities in the clavicle
- subluxation of the acromioclavicular joint

### Palpation

Feel the skin overlying the shoulder joint for an increased temperature or crepitus. Proceed to palpate the following components of the shoulder joint for any tenderness:

- sternoclavicular joint (SCJ)
- clavicle
- acromioclavicular joint (ACJ)
- coracoid
- humeral head
- spine of the scapula

You should also palpate over the muscles that make up the rotator cuff for any tenderness:

- supraspinatus
- infraspinatus
- teres minor
- subscapularis

Specifically palpate the biceps tendon in the bicipital groove. Tenderness may be suggestive of tendonitis. A mass in the upper arm may represent rupture of the biceps tendon; this is associated with reduced flexion and supination of the forearm.

### Movement

You should ask the patient to move the joint both passively and actively against resistance through a range of movements. Table 6.1 summarizes the main actions of the shoulder joint.

**Table 6.1** Main actions of the shoulder joint

| Action | Range of movement | Comments |
|---|---|---|
| Forward flexion | 180° | 50% of this action is due to movement at the glenohumeral joint |
| Extension | 65° | |
| Abduction | 180° | • A restriction in initiating abduction may signify a rotator cuff (supraspinatus) injury<br>• A painful arc between 60° and 120° may suggest an impingement syndrome or a rotator cuff tear<br>• A painful arc at 140–180° may be indicative of pathology involving the ACJ |
| Adduction | 50° | Adduction places the ACJ under stress, and may be accompanied by pain over the ACJ when the ACJ is separated |
| External rotation | 60° | A weakness in external rotation may represent damage to the infraspinatus and teres minor components of the rotator cuff muscles |
| Internal rotation | 90° | See Gerber's test |

## Special tests

You should be familiar with the muscles of the rotator cuff and how to test them. Specific tests include the following.

### *Neer's test (for impingement)*

This is a test for impingement syndrome. After stabilization of the scapula, the arm is flexed forward at 90° while internally rotated so that the thumb is pointing downwards. This accentuates the impingement by reducing the space between the greater tubercle of the humeral head and the acromion. The arm is then gently raised; pain signifies impingement.

### *Gerber's lift-off test*

This tests the integrity of the subscapularis. It involves the subject attempting to lift their internally rotated arm off their back against resistance.

### *Drop test*

This is a test for a tear to the supraspinatus component of the rotator muscle group. The patient is asked to fully abduct their arms as far as possible so that they are above their head. They are then asked to gently lower the arms back down. If the supraspinatus is torn, the arm will suddenly drop at 90° towards the body.

## Neurological and vascular examination

Continue your examination by carrying out a focused neurological and vascular examination of the upper limb. Look specifically for any trauma to the branches of the brachial plexus, which may be due to falling on the shoulder.

## Completing the examination

Complete your examination by offering to assist the patient with getting dressed if appropriate and thanking them. You should present your findings in a systemic and logical fashion. You should offer a differential diagnosis, relevant investigations and management of common shoulder complaints (Table 6.2).

**Table 6.2** Common shoulder complaints

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Rotator cuff injury** | • Pain and restriction on:<br>○ abduction<br>○ external rotation<br>○ internal rotation | • X-ray is not essential if you do not suspect a bony injury | • Conservative management<br>• Rest<br>• Physiotherapy<br>• Analgesia<br>• Follow-up and need for interventional measures (e.g. arthroscopy, steroid injection and surgery) |
| **ACJ dislocation** | • Deformity over the ACJ<br>• Pain over the ACJ on adduction | • Plain X-ray will demonstrate a step or separation of the ACJ | • Conservative management<br>• Rest<br>• Analgesia<br>• Follow-up in fracture clinic<br>• May require steroid injection |
| **Frozen shoulder** | • Global restriction in shoulder movement<br>• Pain on external rotation<br>• Worse at night<br>• History of diabetes<br>• Lung disease | • Urine dipstick for glycosuria<br>• Shoulder X-ray is not usually necessary | • Conservative management<br>• Steroid injection<br>• Non-steroidal anti-inflammatory drugs (NSAIDs)<br>• Treatment of underlying diabetes |
| **Dislocated shoulder** | • Obvious deformity<br>• Immobilized and painful arm<br>• Neurovascular deficit | • Shoulder X-ray to confirm type of dislocation<br>• Remember to conduct a full neurological assessment before and after the reduction | • Shoulder reduction with appropriate analgesia/sedation as necessary<br>• Check X-ray and splinting<br>• Follow-up in fracture clinic<br>• Recurrent dislocations may require surgical intervention |
| **Rupture of long head of biceps** | • Ball-like mass in upper arm<br>• Weakness in flexion and supination | • None | • Conservative management |
| **Fracture of clavicle** | • Pain on palpation of clavicle<br>• Step deformity seen clinically<br>• Majority of fractures involve middle third | • Chest X-ray to exclude pneumothorax | • Conservative management with collar and cuff and analgesia<br>• Follow-up in fracture clinic<br>• May result in malunion<br>• Aesthetic deformity |
| **Osteoarthritis** | • Pain and restriction following minor trauma<br>• History of osteoarthritis | • Shoulder X-ray may show classical changes | • NSAIDs<br>• Steroid injection<br>• Follow-up |

## Scoring Scenario 6.1: Examination of the shoulder

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction/explanation | 0 | 1 | — |
| Asks about occupation, hobbies, previous injuries, past medical history | 0 | 1 | 2 |
| Asks about nature of the pain | 0 | 1 | — |
| Exposes patient; asks for chaperone if necessary | 0 | 1 | — |
| Carries out an inspection of the shoulder for:<br>• scars<br>• posture of arm<br>• asymmetry<br>• deformity<br>• muscle wasting<br>• step deformity<br>• swelling<br>• erythema | 0 | 1 | 2 |
| Systematically palpates the shoulder joint over the:<br>• sternoclavicular joint (SCJ)<br>• clavicle<br>• acromioclavicular joint (acj)<br>• acromium<br>• bicipital tendon<br>• coracoid<br>• humeral head<br>• scapula<br>Feels for warmth on both sides | 0 | 1 | 2 |
| Active movement:<br>• forward flexion<br>• extension<br>• abduction<br>• adduction<br>• external rotation<br>• internal rotation<br>• drop test (supraspinatus tear)<br>• Apley's scratch test<br>• Gerber's lift-off test | 0 | 1 | 2 |
| Carries out passive movement to elicit painful arc | 0 | 1 | — |
| States intention to carry out a neurovascular examination of the upper limb to exclude brachial plexus injury | 0 | 1 | — |
| Offers a differential diagnosis and investigations | 0 | 1 | 2 |
| Outlines management and follow-up | 0 | 1 | 2 |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/27** | | |

## Examination of the Wrist and Hand

There are two types of scenarios that you may be faced with in relation to the wrist and hand. The first involves a primarily bony injury and the second a laceration to the hand or wrist and an assessment of primarily the nerves and tendons of the hand.

### SCENARIO 6.2: EXAMINATION OF THE WRIST AND HAND – BONY INJURY

You are asked to see a 30-year-old man who tripped over a curb and injured his hand last night. He is complaining of pain in his wrist.

Examine his wrist and hand and present your findings and a management plan.

### SCENARIO 6.3: EXAMINATION OF THE WRIST AND HAND – SOFT TISSUE INJURY

You are asked to see a 22-year-old woman who cut her hand with glass while cleaning an outhouse. She has a laceration to the palm of her hand.

Examine her hand and present your findings and a management plan.

### SUGGESTED APPROACH

Mark sheets for each of these questions will appear at the end of this section; however, we will not look at them separately, but will discuss the examination of the wrist and hand generally.

#### Inspection

It is important to expose both arms from above the elbows distally. This allows you to compare both sides for abnormalities. Look for the following:

- deformity
- swelling
- bruising
- redness/other colour change
- scarring
- muscle wasting
- rashes
- contractures
- trophic changes to skin and nails

## Palpation

Palpate for localized tenderness over the following areas:

- distal radius
- distal radioulnar joint
- anatomical snuffbox–scaphoid
- adductor pollicis longus and extensor pollicis longus
- lunate
- hook of hamate
- pisiform
- Guyon's canal
- median nerve
- phalanges
- midpalmar and thenar tendon sheaths

It is important to note any increased temperature, swelling or crepitus over joints and tendon sheaths.

## Movement

Passive and active assessment of range of movement is important. Loss of active but not passive movement is suggestive of nerve or tendon problems, whereas loss of passive movement is more likely to be due to joint problems or tendon adhesions. Assess the range of movement at each joint individually (Table 6.3).

**Table 6.3** Ranges of movement for wrist and hand joints

| Movement | Expected range |
|---|---|
| **Wrist** | |
| Dorsiflexion | 75° |
| Palmarflexion | 75° |
| Radial deviation | 20° |
| Ulnar deviation | 35° |
| Pronation | 75° |
| Supination | 80° |
| **Fingers** | |
| Metacarpophalangeal (MCP) joint | 90° |
| Proximal interphalangeal (PIP) joint | 100° |
| Distal interphalangeal (DIP) joint | 80° |
| **Thumb** | |
| Carpometacarpal (CMC) joint | Flexion 15°<br>Extension 20°<br>Abduction 60° |
| MCP joint | 55° |
| Interphalangeal (IP) joint | 100° |

## Assessment of flexor and extensor tendons

The important flexor and extensor tendons of the fingers are shown in Figure 6.1; the former should be assessed as shown in Figures 6.2 and 6.3.

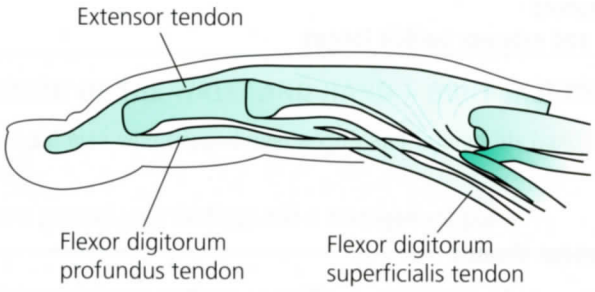


**Figure 6.1** Anatomy of the tendons in the fingers.

**Figure 6.2** Assessing the flexor digitorum profundus.

**Figure 6.3** Assessing the flexor digitorum superficialis.

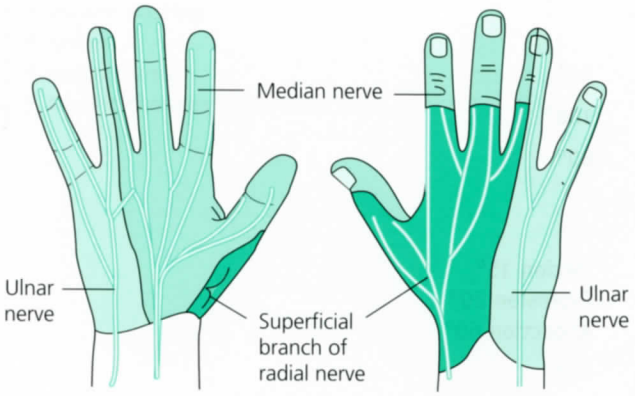


**Figure 6.4** Sensory nerve supply to the hand.

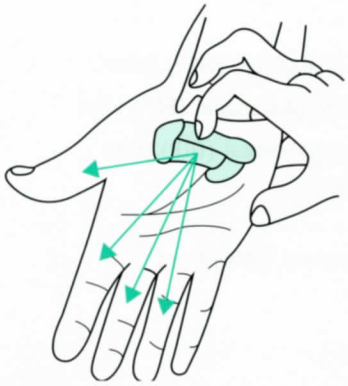

**Figure 6.5** Tinel's test.

## Assessment of neurological function of the hand

It is now important to check the function of the median, ulnar and radial nerves.

### *Sensory and motor function*

The sensory nerve supply to the hand (Figure 6.4) should be examined by two-point discrimination testing. The motor functions of the median, ulnar and radial nerves are assessed using the tests listed in Table 6.4.

**Table 6.4** Assessment of motor function of median, ulnar and radial nerves

| Nerve | Motor function | Test |
|---|---|---|
| **Median** | Abductor pollicis brevis | Palm flat, lifting thumb towards ceiling or pen |
| | Flexor digitorum profundus (index) | Support middle phalanx of index finger and ask patient to flex distal joint[a] |
| | Pronator teres | With arm in extension, ask patient to pronate against resistance[b] |
| | Flexor carpi radialis (FCR) | With palm upwards on a flat surface, ask patient to flex wrist against resistance. Look for tendons of FCR and palmaris longus |
| **Ulnar** | Interossei | Place sheet of paper between ring and little fingers with fingers extended. Withdraw and compare |
| | Abductor digiti minimi | Ask patient to resist as you adduct extended little finger |
| | Adductor pollicis | Place sheet of paper between thumbs. When you withdraw, flexion of a thumb produces a positive test (Froment's test) |
| Lesion pre-wrist | Flexor carpi ulnaris | Test resistance while you extend patient's flexed wrist |
| Lesion above or around elbow | Flexor digitorum profundus (little) | Support middle phalanx of little finger and ask patient to flex distal joint[a] |
| **Radial** | Finger extension | Elbow flexed and hand in pronation |
| Proximal to supinator tunnel | Supinator function | Supination against resistance with elbow extended |
| Proximal to supinator tunnel | Brachioradialis function | Flexion against resistance with arm in midprone position and feel for contraction |
| Brachial plexus | Triceps function | With shoulder in extension, test for elbow extension against gravity and resistance |

[a]Provided that the tendon is intact.
[b]Pain and tenderness over the pronator teres suggests entrapment.

### *Special tests*

#### *Tinel's test*

This tests for carpal tunnel syndrome. It involves tapping over the median nerve (between the tendons of the palmaris longus and flexor carpi radialis or medial to the flexor carpi radialis) (Figure 6.5). The test is positive if the patient gets sensory symptoms in the median nerve distribution.

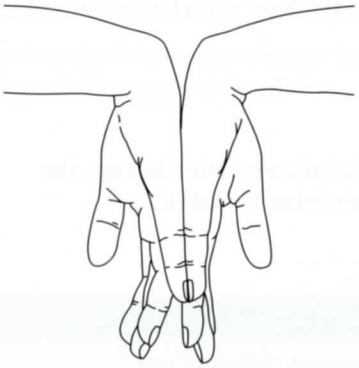

**Figure 6.6** Phalen's test.

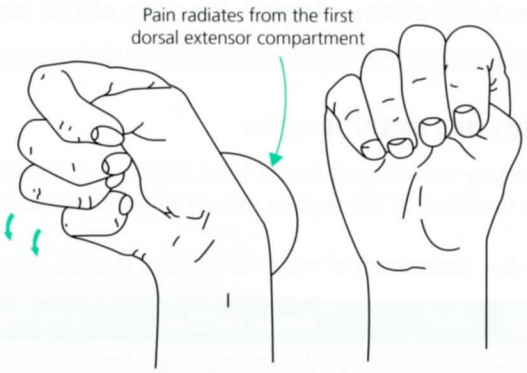


**Figure 6.7** Finkelstein's test.

### *Phalen's test*

This also tests for carpal tunnel syndrome. It involves placing both hands dorsum-to-dorsum for 30 seconds (Figure 6.6). The test is positive if the patient develops sensory symptoms in a median nerve distribution.

### *Finkelstein's test*

This test is for de Quervain's tenosynovitis. The patient's thumb is placed into the palm of their hand and the fingers are closed over it (Figure 6.7). The wrist is deviated in an ulnar direction. Pain in the wrist is the positive finding.

## Completing the examination

Complete your examination by offering to assist the patient with getting dressed if appropriate and thanking them. You should present your findings in a systemic and logical fashion, with comments about differential diagnosis and management. Common abnormalities of the wrist and hand are listed in Table 6.5.

**Table 6.5** Common abnormalities of the wrist and hand

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Scaphoid fracture** | • Fall onto outstretched hand<br>• Pain in anatomical snuffbox | • X-ray | *X-ray normal*<br>• Analgesia<br>• Futura splint<br>• Sling<br>• Repeat assessment ± X-ray in 7 days<br>X-ray abnormal<br>• Scaphoid cast/backslab<br>• Sling<br>• Orthopaedic follow-up |
| **Distal radial fracture** Colles', Smith's, Barton's, Chauffeur's | • Pain over distal radius after a fall<br>• Dinnerfork deformity may be present | • X-ray<br>• Assess median nerve | • Early reduction under appropriate anaesthesia if >10° dorsal tilt or >5 mm loss of radial length<br>• Backslab<br>• Fracture clinic follow-up<br>• May need open reduction and internal fixation |

*Continued*

**Table 6.5** *Continued*

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Metacarpal fractures** Bennett's, Rolando's, Boxer's | • Pain and swelling over one of the metacarpals<br>• Laceration over head of metacarpal | • X-ray<br>• Assess extensor tendon injury in fight bite | • Early reduction and splint fixation<br>• Fracture clinic follow-up<br>• Majority are managed with splinting for 3–6 weeks, but, depending on deformity, may need operative management<br>• Bennett's and Rolando's fractures always need operative pinning[a] |
| **Phalangeal fractures** Mallet finger | • Pain and swelling over phalanx | • X-ray | • Buddy splinting, closed reduction and fixation<br>• Fracture clinic follow-up<br>• Failure to maintain reduction, multiple and open fractures, and fractures involving >30% of articular surface require operative management. Mallet finger requires a mallet splint[a] |
| **Flexor tendon avulsion or laceration** | • Flexor digitorum profundus: inability to flex distal phalanx<br>• Flexor digitorum superficialis: inability to flex at proximal interphalangeal joint | • X-ray may reveal an avulsion fracture | • Operative repair mandatory |
| **Extensor tendon avulsion or laceration** | • Inability to extend distal phalanx (mallet finger) | • X-ray may reveal an avulsion fracture | • Closed avulsions and reduced dislocations may be treated with splinting, but require specialist follow-up<br>• Large fragments >30% of articular surface require open reduction internal fixation (ORIF)[a] |
| **Peripheral nerve damage** | • Laceration<br>• Reduced sensation to two-point discrimination<br>• Loss of motor power to muscles | | • Operative repair mandatory |

[a]If open then tetanus toxoid, antibiotics, washout ± fixation in operating theatre.

## Scoring Scenario 6.2: Examination of the wrist and hand – bony injury

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Takes focused history (hand dominance/occupation)<br>Relevant medical history<br>Medications/allergies | 0 | 1 | 2 |
| Inspection:<br>• deformity<br>• swelling<br>• bruising<br>• redness/other colour change<br>• scarring<br>• muscle wasting<br>• rashes<br>• contractures<br>• trophic changes<br>• nail pitting | 0 | 1 | 2 |
| Asks patient if they are in pain and offers analgesia | 0 | 1 | — |
| Systematically palpates wrist and hand over:<br>• distal radius<br>• distal radioulnar joint<br>• anatomical snuffbox<br>• lunate<br>• hook of hamate<br>• pisiform<br>• Guyon's canal<br>• metacarpal bones<br>• phalanges<br>• midpalmar and thenar tendon sheaths | 0 | 1 | 2 |
| Movement:<br>• dorsiflexion<br>• palmarflexion<br>• radial deviation<br>• ulnar deviation<br>• pronation<br>• supination<br>• opposition<br>• finger flexion (flexor digitorum profundus and superficialis)<br>• finger extension<br>• finger abduction<br>• finger adduction<br>• thumb flexion/extension/abduction | 0 | 1 | 2 |
| States intention to carry out a neurovascular examination | 0 | 1 | — |

*Continued*

**Scoring Scenario 6.2** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Offers a differential diagnosis and investigations | 0 | 1 | 2 |
| Outlines management and follow-up | 0 | 1 | 2 |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/25** | | |

## Scoring Scenario 6.3: Examination of the wrist and hand – soft tissue injury

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Takes focused history (hand dominance/occupation)<br>Relevant medical history<br>Medications/allergies | 0 | 1 | 2 |
| Inspection:<br>• laceration (presence of tendon/bone at base)<br>• deformity<br>• muscle wasting<br>• trophic changes<br>• erythema<br>• asks patient to turn hand over<br>• laceration<br>• radial nerve palsy | 0 | 1 | 2 |
| Asks patient if they are in pain and offers analgesia | 0 | 1 | — |
| Palpation:<br>• Assesses temperature and tenderness if redness<br>• Assesses peripheral circulation (capillary refill time)<br>• Checks pulse<br>• Palpates over tendon to assess movement, tenderness and crepitus<br>• Presence of foreign body | 0 | 1 | 2 |
| Movement:<br>• finger flexion (flexor digitorum profundus and superficialis)<br>• finger extension<br>• finger abduction<br>• finger adduction<br>• thumb flexion/extension/abduction | 0 | 1 | 2 |
| Performs median nerve tests:<br>• thumb abduction<br>• index finger distal phalanx flexion<br>• assesses pronator teres<br>• assesses flexor carpi radialis | 0 | 1 | 2 |

*Continued*

**Scoring Scenario 6.3** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Assesses ulnar nerve:<br>• interossei<br>• abductor digiti minimi<br>• adductor pollicis | 0 | 1 | 2 |
| Assesses radial nerve:<br>• finger extension<br>• supinator<br>• brachioradialis<br>• triceps | 0 | 1 | 2 |
| Assesses sensation: uses two-point discrimination; checks all three areas and digital nerves | 0 | 1 | — |
| Makes diagnosis | 0 | 1 | — |
| Outlines management and follow-up | 0 | 1 | — |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/29** | | |

## Examination of the Spine

The spine consists of three distinct parts: cervical, thoracic and lumbosacral. In the OSCE, examination of the spine is often divided into examination of the cervical spine and examination of the rest of the spine, and it is in this format that we will discuss the examination.

Historical information may be given to you before entering the OSCE, or you may have to elicit this during the OSCE. Important information to ascertain includes the following:

- age of patient
- mechanism of injury
- protective mechanisms in place (e.g. seatbelt if in car)
- sites of pain, including onset of neck pain
- ambulation post accident
- neurological abnormalities (pins and needles, pains shooting down the body, weakness)
- bladder or bowel disturbance
- systemic symptoms (fevers, chills, weight loss, night sweats)
- past history of osteoporosis, carcinoma, back pain, neck pain, rheumatological conditions, HIV
- drug and alcohol use
- steroid intake

## SCENARIO 6.4: CERVICAL SPINE INJURY

A 36-year-old man presents after a road traffic accident. He is complaining of neck pain and was collared at triage.

Examine his cervical spine and present your findings. There is an ATLS-trained F2 to assist you.

## SCENARIO 6.5: EXAMINATION OF THE BACK

A 65-year-old woman presents with back pain and progressively decreased mobility.

Examine her spine in relation to her presentation and present your findings.

## SUGGESTED APPROACH: CERVICAL SPINE

### Inspection

Look out for the following:

- swelling
- deformity: kyphosis
- scars
- sinuses
- webbing of the neck: Klippel–Feil syndrome
- muscle spasms/shortening: torticollis
- thyroid enlargement
- lymphadenopathy
- erythema
- eye problems: uveitis, episcleritis, scleritis
- rheumatological abnormalities: evidence of arthropathies

### Palpation

Palpate the neck for tenderness and swellings. Feel for uneven spacing between the spinous processes. Palpate the facet joints (one fingerbreadth lateral to the midline on either side). Palpate the paraspinal muscles.

Tenderness at the base of the neck is often associated with cervical spondylosis.

Feel for crepitus during flexion and extension, which is suggestive of cervical spondylosis.

Palpate any masses present, and examine for tenderness and temperature.

Palpate the supraclavicular fossa for a cervical rib and for lymphadenopathy. Asymmetry in the supraclavicular fossae may be caused by a Pancoast tumour.

## Movement

Ranges of movement of the cervical spine are shown in Table 6.6. Always ask the patient if they develop any symptoms during their range of movement. Ask them to hold positions for a few seconds in extremes of range of movement and question whether they develop symptoms.

**Table 6.6** Ranges of movement of the cervical spine

| Movement | Normal range |
|---|---|
| Flexion | 45° |
| Extension | 45° |
| Lateral flexion | 45° |
| Rotation | 70–90° |

### *Lhermitte's sign*

On flexing the neck, the patient gets electric-shock-like sensations that run down the centre of the spine. There are multiple causes, among which multiple sclerosis is the most recognized.

### *Spurling's manoeuvre*

Ask the patient to actively extend the neck and then laterally flex it and rotate the spine to both sides. Apply axial compression and ask about ipsilateral-side symptoms. This tests for foramina stenosis or nerve root irritation.

## Neurological examination

Your examination should include a full peripheral neurological examination, with particular reference to the upper limb. Any abnormality may point to the level of cervical disturbance. Cervical myelopathy usually causes upper motor neuron signs, including a positive Hoffmann's sign (an inverted radial reflex and clonus). The sensory abnormalities tend to be tract-related and non-dermatomal.

## Clearing the cervical spine

This involves deciding whether a trauma patient needs to have cervical spine imaging. Two large multicentre trials have looked at this question. From these studies have come two sets of decision rules: the NEXUS C-spine rules and the Canadian C-spine rules (see Table 5.2). Those who fulfil these criteria require no X-ray and the cervical spine can be cleared clinically. Clearance of the cervical spine following trauma is discussed in Scenario 5.4.

# SUGGESTED APPROACH: LUMBOSACRAL SPINE

## Inspection

Look for the following:

- swelling
- muscle spasm
- deformity: scoliosis, lordosis, kyphosis (mobile/fixed; regular/angular)
- scars
- sinuses
- erythema
- hair tuft, discolouration or dimpling at base of spine: spina bifida
- eye problems: uveitis, episcleritis, scleritis
- rheumatological abnormalities: evidence of arthropathies

## Palpation

Palpate the spinous processes and the interspinous ligaments, looking for tenderness, prominences and widened interspinous distances. Feel the paraspinal muscles for tenderness and spasm. Check for increased temperature and tenderness in areas of swelling.

Examine the sacroiliac joints, looking for tenderness, erythema and swelling.

## Movement

Ranges of movement of the thoracic and lumbar spine are shown in Table 6.7.

**Table 6.7** Ranges of movement of the thoracic and lumbar spine

| Movement | Expected range of movement | |
|---|---|---|
| | **Thoracic** | **Lumbar** |
| Flexion (Schober's test) | 45° | 60° |
| Extension | 25° | 35° |
| Lateral flexion | 30° | |
| Rotation | 40° | |

### *Schober's test (modified)*

This involves identifying the lumbosacral junction (at the level of the dimples of Venus). Horizontal lines are marked at this level and 10 cm above and 5 cm below. The end of a tape measure is held against the upper mark. The patient is asked to bend fully forward. The distance between the two lines is remeasured and 15 cm is subtracted from this new distance. The normal value obtained is 6–7 cm. A value less than 5 cm is indicative of spinal pathology.

### *Special tests*

#### *Straight leg raising (SLR)*

Ask the patient to lift their leg off the bed and to stop when they develop pain. The normal angle of elevation at this point is approximately 60°. Check the site of the pain, it is not abnormal to have hamstring pain, but pain in the back (central disc protrusion), leg (lateral disc protrusion), or paraesthesia and pain down the back of the leg (root irritation) are highly suggestive of disc protrusion. While the patient is in this position, passive dorsiflexion of the foot often worsens pain and paraesthesia.

#### *Bowstring test*

While at SLR level, slightly flex the knee and apply firm pressure to the popiteal fossa. The test is positive if this causes paraesthesia and radiating pain; this is indicative of sciatic nerve root impingement.

#### *Reverse Laségue test*

With the patient in a prone position, flex the patient's knee. If this results in pain in a femoral distribution, it is suggestive of an upper lumbar disc lesion. Pain in the ipsilateral buttock or thigh is suggestive of a more distal disc problem.

*Patrick's test*

With the hip and knee flexed, the lateral malleolus is placed on the patella of the other leg. Pressing down on the knee causes pain in sacroiliac disease and osteoarthritis of the hip.

## Completing the examination

It is important to follow up this examination by a lower limb neurological examination. Pay particular attention to flexion of the big toe, which will be reduced in cauda equina cord compression. Tell the examiner that you would like to perform an abdominal examination to assess for abdominal causes of back pain and to examine perianal sensation (S3–5) and rectal tone (both of which are abnormal in cauda equina lesions). You should also offer to examine the hip (see Scenario 6.6) and perform a vascular examination of the leg.

## Spinal conditions

Common spinal conditions are listed in Table 6.8.

**Table 6.8** Common spinal conditions

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Cervical spine fracture and dislocation** | • Neck pain dependent on site of fracture<br>• Neck may feel unstable and patient may be actively supporting head | • Cervical spine X-ray (3 views)<br>• CT spine to elucidate fracture<br>• MRI spine to image cord and ligaments | • Collar immobilization until diagnosis made<br>• Analgesia and collar with review in 2–3 weeks if stable fracture<br>• Halo fixation if unstable |
| **Whiplash injury** | • Neck pain<br>• Headache<br>• Jaw pain | • Cervical spine X-ray (3 views) may be needed to rule out other pathology | • Analgesia<br>• Return to activity<br>• Physiotherapy |
| **Cervical spondylosis** | • Intermittent neck or shoulder pain, which may be associated with neurological symptoms | • Cervical spine X-ray is usually unhelpful<br>• MRI is imaging modality of choice | • Analgesia and physiotherapy at onset<br>• Surgery may be required for decompression |
| **Spinal infections** Osteomyelitis, subdural and epidural | • Back pain, which may or may not be associated with fever<br>• Intravenous drug use or immunosuppression<br>• Neurological abnormality may be present | • Full blood count, C-reactive protein, erythrocyte sedimentation rate, cultures<br>• Plain films are usually normal for the initial 2–4 weeks in osteomyelitis<br>• CT is better for osteomyelitis and MRI for spinal canal infections | • Antibiotics (6–8 weeks of therapy in osteomyelitis)<br>• CT-guided biopsy in osteomyelitis<br>• Surgical intervention may be required |

*Continued*

**Table 6.8** *Continued*

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Spinal tumours**<br>Usually metastatic from breast (24%), gastrointestinal tract (9%), kidney (1%), lung (31%), prostate (8%), lymphoma (6%) and melanoma (4%) | • Back pain with neurology is usually associated with vertebral collapse<br>• Pain at night with a history of carcinoma is an ominous sign<br>• This may be followed by radicular pain and bladder and bowel dysfunction | • Plain films may show an abnormality, particularly loss of owl's eye on AP view (90%)<br>• Osteosclerotic changes with prostate cancer and Hodgkin's lymphoma and occasionally with breast cancer and other lymphomas<br>• MRI is modality of choice | • Steroids<br>• Management of hypercalcaemia if present with bisphosphonates<br>• Radiotherapy<br>• Surgery if stabilization is required |
| **Prolapsed intervertebral disc**<br>L5/S1 most common, followed by L4/L5 then L3/L4 | • Back pain ± sciatic symptoms dependent on root involvement<br>• Sensory abnormalities are dependent on level of lesion<br>• Positive straight leg raising test | • MRI will show level of lesion and whether there is compression | *If no neurology:*<br>• analgesia<br>• physiotherapy<br>• physical therapy<br>*If neurological abnormalities:*<br>• MRI spine<br>• orthopaedic opinion |
| **Cauda equina syndrome** | • Urinary retention<br>• Faecal incontinence<br>• Decreased rectal tone<br>• Sexual dysfunction<br>• Saddle anaesthesia<br>• Bilateral leg pain and weakness | • MRI spine | • Urgent surgical decompression |
| **Lumbar compression fracture** | • Back pain in the elderly<br>• History of osteoporosis<br>• Corticosteroid use | • Lumbar spine X-ray | • Compression fractures with <50% loss of height are usually stable injuries |
| **Ankylosing spondylitis** | • Back pain in 30s/40s that is worse in the morning and improves on exercise<br>• May have alternating buttocks pain and iritis | • Pelvis X-ray will show fusion of sacroiliac joints | • Analgesia and referral for rheumatology opinion would be appropriate |

## Scoring Scenario 6.4: Cervical spine injury

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| History:<br>• mechanism of injury (flexion, extension, rotation, compression)<br>• protective forces (seatbelt, airbag)<br>• ambulation<br>• sites of pain<br>• onset of pain<br>• bladder or bowel symptoms<br>• neurological abnormalities (weakness, pins and needles) | 0 | 1 | 2 |
| Uses assistant and appropriate places for in-line immobilization | 0 | 1 | 2 |
| Asks patient if they are in pain and offers analgesia | 0 | 1 | — |
| Palpation:<br>• Checks for central midline tenderness<br>• Comments on swelling, tenderness, widening of spinous processes<br>• Palpates paraspinal muscles | 0 | 1 | 2 |
| Neurological:<br>• Checks tone, power, coordination, reflexes and sensation in arms | 0 | 1 | 2 |
| Neurological:<br>• Checks tone, power, coordination, reflexes and sensation in legs | 0 | 1 | 2 |
| Asks patient to rotate neck laterally | 0 | 1 | — |
| Appropriate use of Canadian or NEXUS C-spine rules | 0 | 1 | 2 |
| Clears C-spine without X-ray and explains why | 0 | 1 | — |
| Outlines management and follow-up | 0 | 1 | 2 |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/28** | | |

## Scoring Scenario 6.5: Examination of the back

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Asks about bladder and bowel symptoms | 0 | 1 | — |
| History (red flags):<br>• age > 55<br>• progressive disability<br>• history of malignancy<br>• corticosteroid use<br>• systemic symptoms<br>• unexplained weight loss<br>• intravenous drug abuse<br>• immunosuppression<br>• HIV<br>• fevers | 0 | 1 | 2 |
| Inspection:<br>• swelling<br>• muscle spasm<br>• deformity<br>• scars<br>• sinuses<br>• erythema<br>• hair tuft, discolouration or dimpling at base of spine<br>• eye problems<br>• rheumatological abnormalities | 0 | 1 | 2 |
| Asks patient if they are in pain and offers analgesia | 0 | 1 | — |
| Palpation:<br>• Checks for central midline tenderness<br>• Comments on swelling, tenderness, widening of spinous processes<br>• Palpates paraspinal muscles | 0 | 1 | 2 |
| Movement:<br>• Assesses movement of spine for flexion, extension, lateral flexion and rotation | 0 | 1 | 2 |
| Neurological:<br>• Checks tone, power, coordination, reflexes and sensation in legs | 0 | 1 | 2 |
| Neurological:<br>• straight leg raising<br>• bowstring test<br>• reverse Laségue test | 0 | 1 | 2 |
| Asks to perform abdominal and vascular examination | 0 | 1 | — |
| Asks to assess for saddle anaesthesia and rectal examination | 0 | 1 | — |
| Outlines management and follow-up | 0 | 1 | 2 |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /29 | |

# Examination of the Hip

## SCENARIO 6.6: EXAMINATION OF THE HIP

You are asked to see a 65-year-old man who has been having pain in his right hip for the last month. He has taken analgesia for this, but is having problems with his mobility.

Examine his hip and present your findings, including a differential diagnosis and management plan.

## SUGGESTED APPROACH

To perform the hip examination properly, you will need a tape measure. The examination begins with the patient standing. Ask him to walk and take note of his gait:

- A **Trendelenburg gait** is one where weakened adductors allow the pelvis to tilt to the other side during walking.
- An **antalgic gait** occurs when the patient shortens the stance phase of movement on the painful side.

Other gait abnormalities include stiff leg gait and short leg gait.

### Trendelenburg sign

Ask the patient to stand on one leg. Normally, the pelvis tilts upwards on the side with the leg lifted; if it tilts downwards this test is said to be positive. This is a sign of abductor weakness on the stance side (Figure 6.8). Causes include an L5 root lesion, proximal myopathy or congenital hip problems.

### Inspection

Inspection of the hip is performed best while the patient is standing. Look for the following:

- muscle wasting
- rotational deformities
- plantarflexion of the foot
- spine: scoliosis, lordosis
- scars
- sinuses
- erythema
- ecchymoses
- swelling
- deformity

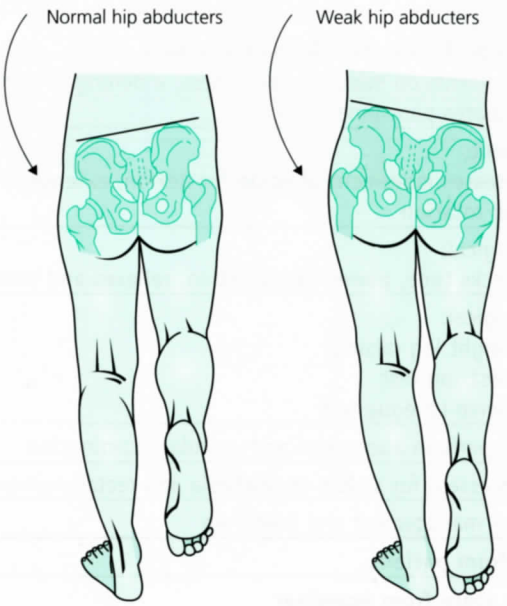


**Figure 6.8** Trendelenburg sign.

## Leg length

Assessment of leg length comes next, with the patient lying on the bed.

### *Apparent leg length*

This should be measured first, as you do not need to reposition the patient before doing so. Measure the length from the xiphisternum to the medial malleolus on both sides.

### *True leg length*

This should be measured from the anterior superior iliac spine (ASIS) of the pelvis to the medial malleolus and the sole of the foot on both sides. It is important that you position the patient properly to do this by straightening up the pelvis and placing the legs parallel to each other. If there is an abnormality then you must decide whether the problem is above or below the trochanter. Place your thumb on the ASIS and your index finger on the greater trochanter. If there is a shorter distance between thumb and finger on the affected side then the cause is above the trochanter. If not then ask the patient to flex their knees with their feet together and compare sides.

Be wary, since there may also be a discrepancy in the width of the foot – but you should have an idea of this if you also measure true length to the soles on each side.

## Palpation

Palpate over the head of the femur and feel for crepitus during motion of the leg. Feel for tenderness over the lesser trochanter (iliopsoas strain), adductor longus tendon (adductor strain), ischial tuberosity (hamstring strain) and greater trochanter. Feel for increased temperature.

## Movement

Ranges of movement of the hip are shown in Table 6.9.

**Table 6.9** Ranges of movement of the hip

| Movement | Expected range | Comment |
|---|---|---|
| Flexion | 120° | The good hip is first flexed and held in position by the patient while the bad hip is flexed |
| Abduction | 40° | Steady pelvis by holding the opposite ASIS and steadying the other with your forearm |
| Adduction | 25° | Again steady the pelvis with your forearm |
| Internal rotation | 45° | With knee flexed to 90° |
| External rotation | 45° | With knee flexed to 90° |
| Extension | 5–20° | With patient on their front and your hand on the pelvis. Loss is the first sign of a hip effusion |
| Internal rotation in extension | 35° | Knees flexed to 90° |
| External rotation in extension | 45° | With knees flexed to 90° |

### *Special tests*

#### *Thomas's test*

This test checks to see if the patient has a fixed flexion deformity. Ask the patient to lie flat, with your hand under the lower part of their back to remove any lumbar lordosis. With your hand in position, flex each leg fully in turn and see if the other leg remains lying flat on the bed. If it does not then this may indicate a fixed flexion deformity involving the iliopsoas muscle.

#### *FABER (flexion, abduction, external rotation of the hip) test*

The patient is asked to lie in the supine position. You should then flex the leg being tested and put the foot on the opposite knee. Proceed by pushing down on the superior aspect of the tested knee joint, lowering the leg into further abduction (Figure 6.9). The test is positive if there is pain at the hip or sacral joint, or if you cannot lower the leg to the same plane as the other leg.

**Figure 6.9** FABER test.

## Completing the examination

You should inform the examiner that you would like to examine the patient's back, knee, and hernial orifices and the vascular supply to the leg. Do not forget to thank the patient and cover them up. Offer help in dressing if necessary.

## Hip conditions

Common hip conditions are listed in Table 6.10.

**Table 6.10** Common hip conditions

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Hip fracture** | • Pain in hip post trauma<br>• Unable to weight-bear | • Pelvis and lateral hip views may show a fracture | • Analgesia<br>• Femoral nerve block<br>• Orthopaedic fixation |
| **Perthes' disease** | • Painful limp in 3- to 12-year-old child<br>• M > F<br>• Decreased range of movement | • Pelvis and lateral hip views | • Analgesia<br>• Orthopaedic opinion |
| **Slipped upper femoral epiphysis** | • Children aged 10–16 years<br>• There is often a history of minor trauma<br>• Decreased abduction and internal rotation | • Pelvis, lateral hip and frog-leg views | • Analgesia<br>• Orthopaedic opinion for reduction and fixation |
| **Transient synovitis** | • Hip pain and limp<br>• May follow a viral illness | • X-rays are normal. White cell count (WCC), erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are often mildly elevated<br>• Ultrasound will show an effusion, which can be aspirated if clinically indicated | • Rest and analgesia<br>• Reassessment in a few days if clinically well and bloods normal<br>• Aspiration to exclude septic arthritis |
| **Osteoarthritis of hip** | • Pain, stiffness and loss of mobility<br>• Loss of internal rotation is often the earliest sign | • X-ray will show changes suggestive of osteoarthritis | • Analgesia and physiotherapy<br>• Total hip replacement may be required if symptoms are severe |
| **Trochanteric bursitis** | • Lateral hip pain radiating down lateral thigh<br>• May be associated with snapping or clicking sensation<br>• Tenderness and crepitus over greater trochanter | • X-rays may rule out other conditions | • Analgesia<br>• Rest<br>• Local anaesthetic injection |
| **Septic arthritis** | • Pain and severely reduced movement<br>• More common in patients with rheumatoid arthritis, on immunosuppressants or steroids, and at extremes of ages | • X-ray may rule out other pathology<br>• WCC, ESR and CRP are elevated<br>• Joint aspiration for urgent microscopy and culture | • IV antibiotics<br>• Analgesia<br>• Joint washout |

## Scoring Scenario 6.6: Examination of the hip

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Assessment of gait | 0 | 1 | — |
| Inspection:<br>• muscle wasting<br>• rotational deformities<br>• plantarflexion of the foot<br>• spine: scoliosis, lordosis<br>• scars<br>• sinuses<br>• erythema<br>• ecchymoses<br>• swelling<br>• deformity | 0 | 1 | 2 |
| Trendelenburg sign | 0 | 1 | — |
| Asks the patient if they are in pain and offers analgesia | 0 | 1 | — |
| Assesses apparent and true leg length | 0 | 1 | — |
| Palpation: checks for tenderness and temperature over hip joint and tenderness over:<br>• adductor longus tendon<br>• lesser trochanter<br>• greater trochanter<br>• ischial tuberosity | 0 | 1 | 2 |
| Movement:<br>• flexion<br>• extension<br>• abduction<br>• adduction<br>• internal rotation (flexion and extension)<br>• external rotation (flexion and extension) | 0 | 1 | 2 |
| Thomas's test | 0 | 1 | — |
| FABER test | 0 | 1 | — |
| Asks to perform back, knee and vascular examination | 0 | 1 | — |
| Outlines management and follow-up | 0 | 1 | 2 |
| **Score from patient** | /5 | | |
| **Global score from examiner** | /5 | | |
| **Total score** | /26 | | |

# Examination of the Knee

## SCENARIO 6.7: EXAMINATION OF THE KNEE

You are asked to see a 28-year-old man who sustained an injury to his right knee earlier today while out jogging. He is complaining of knee pain and swelling. He is finding it difficult to weight-bear.

Examine his knee and present your findings, including a differential diagnosis and management plan.

## SUGGESTED APPROACH

Knee problems are common and can be quite complex. It is very important to have a good idea of the structure of the joint when performing this examination.

### Inspection

Look for:

- swelling
- erythema
- ecchymosis
- scars
- sinuses
- rashes
- eye signs
- muscle wasting
- deformity
- evidence of rheumatoid arthritis

### Palpation

Feel for tenderness and temperature over the joint. Palpate the joint line and feel for localized tenderness over the line suggestive of a meniscal tear. Palpate over the medial and lateral collateral ligaments, the patella, and the fibular head. Feel over the tibial tubercle to assess for tenderness. Feel for crepitus in the joint on movement.

The first evidence of an effusion may be loss of the knee dimple.

#### *Patellar tap*

Squeeze any excess fluid out of the suprapatellar pouch with one hand. Press quickly downwards with the fingers of the other hand. A click indicates a positive test.

#### *Fluid displacement test*

Squeeze any excess fluid out of the suprapatellar pouch with one hand. Stroke the lateral side of the joint and look for distension on the medial side suggestive of an effusion.

## X-rays

The decision to X-ray or not can be made using the Ottawa knee rules: X-ray if any of the following apply:

- age 55 or over
- isolated tenderness of the patella
- tenderness over the head of the fibula
- inability to flex to 90°
- inability to weight-bear (at least 4 steps) both immediately and in the emergency department

## Movement

Ranges of movement of the knee are shown in Table 6.11.

**Table 6.11** Ranges of movement of the knee

| Movement | Expected range |
|---|---|
| Flexion | 135° |
| Extension | 0° |

Test the extensor apparatus by sitting the patient with their leg over the side of the bed. Ask the patient to straighten their leg while you support it with one hand. Feel for contraction of the quadriceps and look for active limb movement. This may be abnormal if there is a quadriceps rupture, a patellar fracture, rupture of the patellar ligament or avulsion of the tibial tubercle.

### *Special tests*

#### *Medial collateral stretch*

With one hand on the thigh and the other on the lower leg, hold the upper hand stable and push the lower leg laterally. The test is positive if you feel the ligament give way.

#### *Lateral collateral stretch*

With one hand on the thigh and the other on the lower leg, hold the upper hand stable and push the lower leg medially. The test is positive if you feel the ligament give way.

#### *Anterior drawer test*

Flex the knee to 90° with the foot pointing straight forward. Grab the leg firmly with both hands while keeping the foot stable. Pull the leg towards you. The test is positive if the anterior cruciate ligament gives way.

#### *Posterior drawer test*

The same position is taken as described in the anterior drawer test. Pull the leg away from you. Again the test is positive if there is give.

#### *McMurray's test*

First flex the knee fully with your hand over the joint line to detect a click should one occur. Externally rotate the foot and abduct the lower leg; then extend the joint smoothly while maintaining abduction. A palpable click and associated pain suggests a medial meniscal tear. Reverse to test for a lateral meniscal tear.

## Completing the examination

Finish the examination by telling the examiner that you would also like to examine the patient's hip and back. Present your findings in a logical fashion and give a differential diagnosis and management plan. Common knee conditions are listed in Table 6.12.

**Table 6.12** Common knee conditions

| Condition | Features | Investigation in emergency department | Management |
|---|---|---|---|
| **Quadriceps rupture** | • Inability to straight-leg raise<br>• Tenderness and swelling along the course of the tendon | • Ultrasound of the quadriceps will confirm diagnosis | • Analgesia<br>• Orthopaedic opinion in relation to surgical repair |
| **Medial and lateral collateral ligaments** | • Pain with medial or lateral ligament stretch<br>• Peroneal nerve injuries can occur with lateral collateral ligament injuries | • Nil | • Analgesia<br>• Physiotherapy<br>• Orthopaedic follow-up if give is present<br>• Follow-up and reassessment by GP in 2 weeks |
| **Anterior and posterior cruciate injury**<br>O'Donoghue's triad: anterior cruciate injury, medial meniscal injury and/or medial collateral injury | • Sudden-onset haemarthrosis associated with injury<br>• Positive drawer test | • X-ray may show Segond's fracture in some cases | • Analgesia<br>• Physiotherapy<br>• Orthopaedic follow-up or reassessment by GP after analgesia and elevation for 2 weeks |
| **Septic arthritis** | • Swelling and inability to move joint<br>• Multiple sexual partners or recent infection | • Elevated white cell count, erythrocyte sedimentation rate and C-reactive protein<br>• Blood cultures<br>• Aspiration | • Analgesia<br>• Aspiration<br>• Antibiotics<br>• Orthopaedic referral for joint washout |
| **Meniscal tear** | • General sports-related, associated with synovitis<br>• May be associated with locking | • Nil | • Analgesia<br>• Orthopaedic outpatients follow-up |
| **Tibial plateau fracture** | • Severe trauma<br>• Haemarthrosis | • X-ray diagnosis | • Analgesia<br>• Orthopaedic assessment for fixation |

*Continued*

**Table 6.12** *Continued*

| | | | |
|---|---|---|---|
| **Osteochondritis dissecans** | • Male in 20s<br>• Usually presents with knee pain | • X-ray diagnosis | • Rest<br>• Analgesia<br>• Orthopaedic outpatients follow-up, since may need foreign body removed |
| **Bursitis** | • Swelling and redness over a bursa:<br>○ anterior patella for prepatellar bursitis<br>○ over patellar ligament for infrapatellar bursitis<br>○ in popliteal region for semimembranosus bursitis | • Aspiration of the bursa may help to distinguish between septic and aseptic bursitis | • Conservative management with analgesia and rest<br>• Steroid injections may help if aseptic<br>• Oral antibiotics if felt to be septic bursitis |
| **Osgood–Schlatter disease** | • Generally 10–14 years old with pain over the tibial tuberosity that is worse on movement | • X-ray confirms diagnosis | • Analgesia<br>• Rest until pain subsides, then physiotherapy<br>• Rarely surgery is required |

## Scoring Scenario 6.7: Examination of the knee

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Inspection:<br>• swelling<br>• erythema<br>• ecchymosis<br>• scars<br>• sinuses<br>• rashes<br>• eye signs<br>• muscle wasting<br>• deformity<br>• evidence of rheumatoid arthritis | 0 | 1 | 2 |
| Asks the patient if they are in pain and offers analgesia | 0 | 1 | — |
| Palpation:<br>• Checks for tenderness and temperature over knee joint<br>Examines:<br>• medial and lateral collateral ligaments<br>• quadriceps<br>• patellar tendon<br>• patella<br>• tibial tuberosity<br>• fibular head | 0 | 1 | 2 |
| Movement:<br>• Assesses flexion, extension | 0 | 1 | 2 |
| Assesses for joint effusion | 0 | 1 | — |
| Medial and lateral collateral ligament strain | 0 | 1 | 2 |
| Examines anterior and posterior cruciate ligaments | 0 | 1 | 2 |
| Examines for meniscal injury | 0 | 1 | 2 |
| Examines quadriceps function for strain or rupture | 0 | 1 | 2 |
| Outlines management and follow-up | 0 | 1 | 2 |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/29** | | |

# 7 Vascular Emergencies

SHUMONTHA DEV

## CORE TOPICS

- History and examination focused on the vascular system
- Identification of vascular conditions that threaten life or limb
- Differential diagnosis of the painful/swollen calf
- Investigation and management of deep vein thrombosis (DVT)
- Symptoms, signs, presentation and causes of peripheral ischaemia, mesenteric ischaemia, abdominal and thoracic aortic aneurysms, and aortic dissection
- Intra-arterial drug injection
- Traumatic vascular injury

### SCENARIO 7.1: ABDOMINAL AORTIC ANEURYSM ASSESSMENT

You are asked to see a 60-year-old man who presents to the emergency department with central constant abdominal pain radiating down his right side towards the groin.

His initial observations at triage are as follows:

Temperature 36.5 °C
Pulse 95 bpm, regular
BP 105/98 mmHg
Blood glucose 6.7 mmol $L^{-1}$
Oxygen saturation 95% on air

Take a focused history and carry out a vascular examination. Suggest your management of this patient.

## SUGGESTED APPROACH

### History

Introduce yourself and explain what you are about to do. Confirm the patient's name and obtain their consent to continue.

Your history should elicit the nature of the abdominal pain, its site, severity and character, its radiation, and exacerbating and relieving factors. In this patient, because of his age and the distribution of pain from the history at triage, there is a high index of suspicion of an abdominal aortic aneurysm (AAA).

Ask about any change in bowel habit. Mesenteric ischaemia may cause mucous production or bleeding.

Ask about the nature of any pain on walking. Characteristic claudication pain occurs in the distribution of muscles supplied by the artery affected by atherosclerosis. It increases during exercise and usually eases after resting. Your history should differentiate between joint pain and muscular pain.

Enquire specifically about a past medical history of high blood pressure, ischaemic heart disease, diabetes, high cholesterol, previous surgery and smoking.

Drug history is important: clues may be gained about previous diagnoses that have not yet become clear – for example, the patient may already be on a statin or antihypertensives. Additionally, medications may mask clinical signs. This patient was on a beta-blocker, which masked his tachycardia.

Is there any relevant family history of atherosclerotic disease, early myocardial infarction or other vascular disease?

### Examination

If a life-threatening cause of abdominal pain is suspected, inform the examiner that you would apply regular monitoring and insert two wide-bore cannulae as well as sending blood for group-and-save or cross-match.

Start with a general inspection of the patient. Are they obese or cachectic? Are they pale or flushed?

Briefly examine the patient's hands for capillary refill time and temperature, and reassess the patient's pulse and blood pressure, since these could easily have changed since triage. Check for anaemia and jaundice.

Proceed with an examination of the abdomen. With the patient in a supine position, inspect the abdomen for any obvious masses or distension. Palpate for a pulsatile and expansile mass in the epigastrium; remember that the aorta bifurcates at L4, which is at the level of the umbilicus. An AAA is most likely to be palpated over the lumbar lordosis, as the aorta is most anterior at this point. Also, note any tenderness and guarding on general palpation.

Listen for bowel sounds.

Move onto examination of the peripheral pulses. This should begin with exposure of both lower limbs. Look at the limbs for any discoloration or erythematous skin, and then feel for warmth. Also look for other stigmata of peripheral vascular disease:

- ulceration
- hair loss
- amputated digits

Palpate the pulses from proximal to distal, comparing both sides as you proceed: carotid, brachial, radial, femoral, popliteal, posterior tibial and dorsalis pedis. Note any absent pulses and listen to the carotids/femoral vessels for any bruits using a handheld Doppler ultrasound probe.

### *Buerger's test*

You should state that you would perform Buerger's test, which is a sign to demonstrate arterial insufficiency. To perform this test, lay the patient in the supine position and examine the soles of the feet. If they are perfused, they will be pink in colour. Raise both legs to 45° and after a minute look at the colour of the soles again. The presence of marked pallor suggests arterial insufficiency. From this position, sit the patient up and ask them to hang their legs over the edge of the couch. Examine the soles again: they should turn pink in a few seconds if there is delayed perfusion; if they become mottled, this is further evidence of ischaemia.

### *Ankle–brachial pressure index*

You should ask to perform an ankle–brachial pressure index (ABPI). This measures the highest blood pressure at the ankle divided by the blood pressure at the brachial artery (highest of two readings). A ratio of 0.9–1.3 can be considered to be in the normal range. A value above 1.3 is suggestive of peripheral vascular disease and a value less than 0.5 indicates severe arterial insufficiency.

### *Completing the examination*

You should complete your examination by telling the examiner that you would like to examine the cardiovascular system, request an ECG and ask for a urine dipstick to be performed.

## Differential diagnoses

### *Embolus*

An embolus is an abnormal mass of undissolved material carried in the bloodstream from one place to another. Vascular emboli are from cardiac sources in over 80% of cases (secondary to atrial fibrillation, prosthetic valves, atrial myxoma, vegetations or rheumatic heart disease).

### *Thrombus*

A thrombus is solid material formed at a specific site from the constituents of blood flowing past the site. Thrombosis may develop acutely at the site of atheromatous disease, and a previous history of intermittent claudication/vascular impairment is likely. Risk factors include hypertension, smoking, diabetes and hypercholesterolaemia.

### *Abdominal aortic aneurysm*

Middle-aged and elderly people frequently develop AAAs. Rupture is relatively common and is responsible for a large number of deaths, many occurring suddenly and out of hospital. The best chance lies with early diagnosis, prompt resuscitation and rapid transfer to theatre.

### *Renal colic*

Beware of the elderly patient who presents with renal colic. In this age group, an AAA can mimic the presentation of renal colic. This is a potential vascular OSCE scenario.

### *Ischaemic bowel*

Ischaemic bowel may arise either secondary to causes of intestinal obstruction or as a primary condition from interruption of the arterial or venous blood supply. The interruption may be due to emboli from the heart or great vessels or to thrombosis. The consequent mesenteric ischaemia commonly occurs in the elderly patient, who may have other signs of cardiac or vascular disease and may have a history of recent myocardial infarction or arrhythmia.

The abdominal pain is of sudden onset, rapidly becoming very severe, and the patient may be very distressed and shocked. Clinical signs may be minimal, but a high index of suspicion should exist in the elderly patient with severe abdominal pain. The mainstay of management is resuscitation with oxygen and intravenous fluids. Urgent referral to the surgical team is necessary.

### *Aortic dissection*

Aortic dissection is a surgical/medical emergency and has a 1-year mortality rate of over 90% if untreated. Dissection begins with formation of a tear in the intima, and the force of the blood cleaves the media longitudinally to various lengths. The history reveals an abrupt onset of very severe, commonly 'tearing', 'ripping', 'sharp' or 'stabbing', chest pain radiating to the intrascapular region. Sudden death or shock can occur owing to aortic rupture or cardiac tamponade.

## Investigations

These include ECG, bloods (full blood count, urea and electrolytes, and cross-match), chest X-ray and a CT scan. A chest X-ray may demonstrate:

- a widened upper mediastinum
- haziness or enlargement of the aortic knuckle
- irregular aortic contour
- separation (>5 mm) of intimal calcification from the outer aortic contour
- displacement of the trachea to the right
- enlarged cardiac silhouette (pericardial effusion)
- pleural effusion (usually on the left)

With the increasing use of ultrasound imaging in the emergency department, you could suggest that a bedside ultrasound scan may be appropriate to make the diagnosis of an AAA. This may be of great benefit in an otherwise unstable patient for whom transfer to the CT scanner may not be indicated.

## Management

If you strongly suspect that the patient has an AAA, you should begin by very carefully resuscitating them with fluids and or blood, as well as tightly controlling their blood pressure and providing adequate analgesia. You should make a rapid referral to the vascular surgeons for further management. You should suggest that aggressive fluid resuscitation should be avoided and the patient kept hypotensive.

## Scoring Scenario 7.1: AAA assessment

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Takes a focused vascular history:<br>• Characterizes nature of pain (site/severity/radiation/exacerbating and relieving factors)<br>• Is there any evidence of claudicating pain?<br>• Is there a history of peripheral vascular disease?<br>• Previous vascular surgery<br>• Enquires about vascular risk factors (high blood pressure/high cholesterol/diabetes/ischaemic heart disease)<br>• Enquires about smoking<br>• Regular medications/allergies<br>• Enquires about any lower limb neurology | 0 | 1 | 2 |
| Enquires about pain relief | 0 | 1 | — |
| Obtains patient's consent for vascular examination and exposes the patient appropriately, preserving their dignity and with a chaperone if appropriate | 0 | 1 | — |
| Performs visual inspection of abdomen (scars/abdominal distension/ expansile mass) | 0 | 1 | 2 |
| Palpates abdomen for abdominal mass (expansile/estimates size) | 0 | 1 | — |
| Listens for bowel sounds | 0 | 1 | — |
| Examines peripheries for stigmata of peripheral vascular disease (ulcers/ discoloration/hair loss/cold/erythema/amputations of digits) | 0 | 1 | 2 |
| Feels pulses bilaterally:<br>• carotid<br>• brachial<br>• radial<br>• femoral<br>• popliteal<br>• dorsalis pedis<br>• posterior tibial | 0 | 1 | 2 |
| Listens for carotid/femoral bruits | 0 | 1 | — |
| States intention to perform a cardiovascular examination | 0 | 1 | — |
| Performs Buerger's test, looking for arterial insufficiency | 0 | 1 | 2 |
| Suggests performing ABPI; knows normal range (0.9–1.3) | 0 | 1 | — |
| Arranges appropriate investigations: bloods(cross-match)/chest X-ray/ ultrasound/CT abdomen/ECG/urine dipstick | 0 | 1 | 2 |
| Secures bilateral IV access and monitoring/fluids | 0 | 1 | — |
| Makes a diagnosis of AAA and arranges referral to the vascular surgeons | 0 | 1 | — |
| **Score from patient** | | **/5** | |
| **Global score from examiner** | | **/5** | |
| **Total score** | | **/32** | |

## SCENARIO 7.2: DEEP VEIN THROMBOSIS – HISTORY AND EXAMINATION

A 30-year-old woman attends the emergency department with a 2-day history of right leg swelling and pain. As the emergency department registrar, you are asked to see this patient.

Take a focused history and carry out an examination. You will be asked to formulate a management plan for this patient.

## SUGGESTED APPROACH

Introduce yourself and explain what you are about to do. Confirm the patient's name and obtain their consent to continue. The diagnosis of most concern is the presence of a deep vein thrombosis (DVT). Ask the patient if they are comfortable and whether they require any analgesia.

### History

History should elicit both the site of the swelling and pain, before moving on to specific risk factors for DVT (Box 7.1). Ask about any recent history of trauma to the leg, insect bites, diabetes and previous similar episodes.

**Box 7.1** Risk factors for deep vein thrombosis (DVT)

**Procoagulant states**

*Congenital*
- Factor V Leiden
- Antithrombin III deficiency
- Protein C deficiency
- Protein S deficiency

*Acquired*
- Malignant disease
- Antiphospholipid syndrome
- Myeloproliferative disorders
- Oral contraceptive pill
- Nephrotic syndrome
- Homocystinuria
- Paroxysmal nocturnal haemoglobinuria

**Venous stasis**
- Immobility
- Recent surgery
- Pregnancy or recent childbirth
- Pelvic mass
- Severe obesity

**Miscellaneous**
- Hyperviscosity syndromes
- Previous DVT or pulmonary embolism (PE)
- Family history of DVT or PE

If the history is suggestive of a DVT, ask further about:

- pregnancy
- recent episode of immobility, including recent long-haul air travel
- previous DVT
- malignancy
- recent major surgery (especially pelvic or orthopaedic)
- thrombophilia
- smoking history
- drug history (oestrogen contraceptive pill)
- family history of DVT

A reasonable differential diagnosis at this stage includes DVT, cellulitis or trauma.

## Examination

State to the examiner that you would like to go on to examine the patient. You would also like to have her baseline vital signs (if not given) and a blood glucose level.

Mild fever may be present.

The leg may be erythematous and swollen, with dilated superficial veins and calf discomfort on dorsiflexion of the foot (Homans' sign). Mention the test – but do not perform it, since there is a risk of dislodging thrombus to produce emboli. The thrombus may also be palpable as a fibrous cord in the popliteal fossa.

Confirm swelling by measuring the limb circumference in both legs 15 cm above and 10 cm below the tibial tuberosity. In all cases, abdominal and rectal examinations must be performed to exclude an abdominal cause or venous obstruction, such as an ovarian mass.

You should perform a formal examination of the venous system and examine for venous ulcers, varicose veins and venous eczema.

### *Trendelenburg test (tourniquet test)*

This can be performed to test the competency of the venous system:

- The patient is asked to lie flat and the leg is elevated to empty the venous system.
- A tourniquet or two fingers is placed to occlude the saphenous opening, which lies 5 cm below and medial to the femoral pulse.
- While the saphenous opening is occluded, the patient is asked to stand up. If the valve is competent, you will observe a slow filling of the veins from below the tourniquet. If the valve is incompetent, you will see a sudden filling of the veins from above the tourniquet when you remove it.
- This procedure should be repeated at different levels.

### *Completing the examination*

Examine the abdominal system, looking particularly for masses that may impair venous drainage, causing venous stasis, or that may indicate an underlying abdominal malignancy.

## Management of DVT in the emergency department

### *Investigations*

D-dimers have a high predictive value for DVT and can be useful in combination with a clinical assessment scoring system such as the Wells score (Table 7.1). If there is a low clinical probability of DVT and a negative D-dimer result, no further investigation is required. A positive D-dimer result should be followed by ultrasonography.

**Table 7.1** Wells score for a pre-test clinical probability scoring for a DVT

| Clinical features | Points |
|---|---|
| Active cancer (treatment within last 6 months or palliative) | 1 |
| Paralysis, paresis or recent plaster immobilization of leg | 1 |
| Major surgery or recently bedridden for >3 days in last 4 weeks | 1 |
| Local tenderness along distribution of deep venous system | 1 |
| Entire leg swollen | 1 |
| Calf swelling >3 cm compared with asymptomatic leg | 1 |
| Pitting oedema | 1 |
| Collateral superficial veins (non-varicose) | 1 |
| Alternative diagnosis as likely or more likely than that of DVT | −2 |

Venous compression ultrasonography of the leg veins is quick and non-invasive, with sensitivity and specificity of over 90%. It can simultaneously assess the extent of proximal progression of the thrombus, in particular extension into pelvic vessels.

Consider baseline full blood count, urea and electrolytes, ECG, chest X-ray, urinalysis, and pulse oximetry on all patients.

Look for an underlying cause if appropriate, with a coagulation screen and a procoagulant screen, and screen for specific malignancies.

### *Wells score and guidelines for DVT management*

- **≥3 points: high pre-test probability.** Treat as suspected DVT and perform compression ultrasound scan.
- **1–2 points: intermediate pre-test probability.** Treat as suspected DVT and perform compression ultrasound scan.
- **0 points: low pre-test probability.** Perform D-dimer test. If the test is positive then treat as suspected DVT and perform compression ultrasound scan. If it is negative then DVT is reliably excluded.

### *Treatment for positive DVT*

Low-molecular-weight heparin (LMWH) (e.g. enoxaparin 1.5 mg $kg^{-1}$/24 h) is superior to unfractionated heparin. Start warfarin at the same time, and stop heparin once the INR is 2–3. Consider the use of local anticoagulation services or the patient's GP for ongoing care.

## Scoring Scenario 7.2: DVT – history and examination

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction and asks about analgesia | 0 | 1 | — |
| Enquires about the risk factors for a DVT:<br>• procoagulant states (acquired and congenital) (gives 3 examples)<br>• venous stasis (gives 3 examples)<br>• previous history of DVT/PE<br>• family history of DVT/PE | 0 | 1 | 2 |
| Takes focused medical, drug and social history | 0 | 1 | 2 |
| Obtains patient's consent for vascular examination and exposes the patient appropriately, preserving their dignity and with chaperone if appropriate | 0 | 1 | — |
| Examines leg, looking for:<br>• erythema/cellulitis<br>• swelling<br>• pitting oedema<br>• scars indicating previous surgery<br>• stigmata of peripheral vascular disease<br>Looks for varicose veins (venous eczema)<br>Palpates peripheral pulses<br>Assesses skin temperature<br>Palpates for tenderness along venous system | 0 | 1 | 2 |
| Mentions Homans' sign, but does not perform test | 0 | 1 | — |
| Mentions Trendelenburg test to assess venous competency (does not have to perform it) | 0 | 1 | — |
| Measures leg circumference appropriately at two sites | 0 | 1 | — |
| Suggests examination of the abdomen for masses | 0 | 1 | — |
| Calculates Wells pre-test probability (PPT) for DVT (examiner to provide criteria) and stratifies patient as high/intermediate/low-risk for a DVT | 0 | 1 | 2 |
| Outlines management according to Wells score (requests ultrasound scan and treats for DVT if intermediate- or high-risk; only asks for D-dimers if low-risk PPT) | 0 | 1 | 2 |
| Arranges appropriate follow-up | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /27 | |

# 8 Abdominal Emergencies

CHETAN R TRIVEDY AND ANDREW PARFITT

## CORE TOPICS

- Differential diagnosis of acute abdominal pain
- Examination of the abdominal system
- The management of upper and lower gastrointestinal bleeds
- Infective gastroenteritis

### SCENARIO 8.1: ABDOMINAL PAIN

A 44-year-old woman presents to the emergency department with an 8-hour history of acute epigastric pain and vomiting; she is in marked discomfort. She has a history of drinking 15 units of alcohol a day.

Her initial observations at triage are:

Temperature 38.2 °C
Pulse 118 bpm
BP 98/66 mmHg
Blood glucose 9.4 mmol $L^{-1}$
Oxygen saturation 94% on air
Urine dipstick negative; urine β-hCG negative

Take a focused history and at the end of your assessment offer a differential diagnosis and management plan.

## SUGGESTED APPROACH

Even after just reading the instructions for the scenario, you should be alerted that this patient is unwell, since she is pyrexial, tachycardic and hypotensive. You should be considering significant underlying pathology and ascertain the location of the patient in the department. You should suggest that the patient is unwell and should be transferred to the resuscitation area.

After introducing yourself appropriately, you should begin by characterizing the nature of the patient's pain:

- site
- severity (scale of 1–10)
- character (e.g. colicky, constant)

- time/rapidity of onset
- exacerbating and relieving factors
- sites of radiation
- previous episodes of abdominal pain

## History

Take a focused abdominal history:

- nausea/vomiting
- haematemesis/melaena
- dysphagia
- any change in bowel habit
- reduced appetite
- weight loss
- extra-abdominal features of inflammatory bowel disease (IBD), such as mouth ulcers, glossitis and anaemia, may be suggestive of malabsorption

Enquire about past medical history, such as previous surgery, urinary tract infections and gallstones.

Gynaecological history is important: *the diagnosis of an ectopic pregnancy should be excluded, and you should never forget to perform a urine pregnancy test on all women of childbearing age with abdominal pain*. The presence of vaginal bleeding, irregular periods or a vaginal discharge may point to a gynaecological cause of the abdominal pain, such as a ruptured ovarian cyst, fibroids, endometritis, ovarian torsion or acute exacerbation of pelvic inflammatory disease.

Enquire about drug history; for example, steroids and non-steroidal anti-inflammatory drugs (NSAIDs) may be associated with gastritis and peptic ulcers.

Taking an accurate history about alcohol use is very important, You should be aware that patients who have an alcohol dependency may also present with acute withdrawal symptoms because they have been too unwell to consume their usual quantities of alcohol, and this may need addressing in the emergency department.

Enquire about non-prescription drug use and smoking habits.

Ask about foreign travel, occupation and recent dietary history if there is diarrhoea and you suspect infective gastroenteritis.

Enquire about any family history of inflammatory bowel disease (IBD).

Mention that you would routinely take a brief general medical history, and ask about previous illnesses, operations, current medications and allergies.

## Differential diagnosis

A reasonable differential diagnosis of epigastric pain in this patient includes:

- pancreatitis
- peptic ulcer disease
- cholecystitis
- small bowel obstruction

The fact that urinary β-hCG (β human chorionic gonadotropin) is negative virtually excludes an ectopic pregnancy.

The likely diagnosis is pancreatitis, given that the patient has a significant alcohol history and raised blood sugar, although you should also consider diabetic ketoacidosis in an insulin-dependent diabetic patient presenting with acute abdominal pain.

## Investigations of the acute abdomen in the emergency department

These include:

- full blood count (FBC)
- urea and electrolytes (U&E)
- coagulation screen
- bone profile
- group and save/cross-match
- serum glucose
- serum amylase
- lactate (this is often available from the arterial blood gas)
- liver function tests (LFT)
- arterial blood gas (ABG)
- blood and stool cultures where appropriate

The bloods listed above constitute a standard abdominal profile; these should only be requested if you suspect a major cause. They should not routinely be requested for every patient who presents with abdominal pain. Any patient who is likely to go to theatre for surgery should be cross-matched appropriately. The usefulness of C-reactive protein (CRP) is controversial, although it is frequently requested. It is a non-specific inflammatory marker and is not particularly discriminatory.

## Imaging the acute abdomen in the emergency department

An erect chest X-ray should be taken, looking for air under the diaphragm to exclude a perforation. Remember that the patient will have to be sat upright for at least 10 minutes prior to the X-ray.

A plain abdominal X-ray should be requested only if you suspect bowel obstruction.

Ultrasound imaging may also be considered when specific pathologies are sought (e.g. abdominal aortic aneurysm or gallstones).

Contrast CT should be performed where appropriate and available.

## Management of the acute abdomen in the emergency department

This should include:

- high-flow oxygen
- fluid resuscitation
- correction of electrolyte and pH disturbances
- control of blood sugar with an insulin sliding scale
- analgesia
- antiemetics
- intravenous proton pump inhibitors if gastritis or peptic ulceration is suspected
- HDU/ITU involvement should be considered if the patient is acutely unwell
- central venous access and arterial line placement
- urinary catheter to monitor fluid balance
- broad-spectrum antibiotics where appropriate
- nil by mouth; consider nasogastric tube if there is profuse vomiting
- surgical/gastroenterology referral

You should be aware of the Glasgow Prognostic Score and Ranson's criteria for scoring the severity of acute pancreatitis (Boxes 8.1 and 8.2). However, for the purposes of the emergency department, Ranson's criteria are less useful, since they require the patient to be reassessed after 48 hours.

**Box 8.1** Glasgow Prognostic Score for acute pancreatitis

- Age > 55 years
- WBC > 15 × $10^9$ $L^{-1}$
- Urea > 16 mmol $L^{-1}$
- Glucose > 10 mmol $L^{-1}$
- $Po_2$ < 60 mmHg
- Albumin < 32 g $L^{-1}$
- Calcium < 2 mmol $L^{-1}$
- LDH > 600 units $L^{-1}$
- AST/ALT > 100 units $L^{-1}$

WBC, white blood cell count; LDH, lactate dehydrogenase; AST, aspartate aminotransferase; ALT, alanine aminotransferase

**Box 8.2** Ranson's criteria for acute pancreatitis

**Present on admission**

- Age > 55 years
- WBC > 15 × $10^9$ $L^{-1}$
- Glucose > 11 mmol $L^{-1}$
- LDH >350 units $L^{-1}$
- AST > 250 units $L^{-1}$

**Developing during first 48 hours**

- Haematocrit fall 10%
- Urea rise 1.8 mmol $L^{-1}$
- Serum calcium < 2 mmol $L^{-1}$
- Arterial $Po_2$ < 60 mmHg
- Base deficit > 4 mmol $L^{-1}$
- Fluid sequestration > 6 L

The Glasgow Prognostic Score provides a useful immediate guide of severity. A score of 3 or more indicates severe pancreatitis. The *UK Guidelines for the Management of Acute Pancreatitis*, produced by the British Society of Gastroenterology (BSG), recommend that these patients should be managed in HDU/ITU.

These guidelines, published in *Gut* 2005; **54** (Suppl III): iii1–9, are available at: www.bsg.org.uk/clinical/general/guidelines.html.

## Differential diagnosis

Although a discussion of each cause of the acute abdomen is outside the scope of this book, it is recommended that you be familiar with the common differential diagnosis of an acute abdomen specified in the syllabus and listed below. It is essential that you be knowledgeable in the discriminatory clinical features and investigations of each of these conditions in order to be able to make a working diagnosis and institute appropriate treatment in the emergency department.

### *Hepatobiliary disorders*

- Pancreatitis
- Biliary colic
- Cholecystitis

### *Upper gastrointestinal tract disorders*

- Small bowel obstruction
- Peptic ulcer

### *Vascular disorders*

- Mesenteric ischaemia
- Abdominal aortic aneurysm

### *Lower gastrointestinal disorders*

- Diverticulitis
- Appendicitis
- Infective gastroenteritis
- Incarcerated inguinal hernia

### *Renal disorders*

- Renal colic
- Pyelonephritis

### *Gynaecological disorders*

- Ectopic pregnancy
- Ovarian cyst/torsion
- Fibroids
- Endometriosis
- Pelvic inflammatory disease

## Scoring Scenario 8.1: Abdominal pain

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Addresses the fact that the patient is in pain and offers pain relief | 0 | 1 | — |
| Takes a focused abdominal history:<br>• site of pain<br>• radiation<br>• severity<br>• character<br>• relieving/exacerbating factors | 0 | 1 | 2 |
| Enquires about:<br>• vomiting<br>• diarrhoea<br>• melaena<br>• haematemesis | 0 | 1 | 2 |
| Enquires about changes in bowel habits/weight loss | 0 | 1 | — |
| Takes a focused medical history:<br>• serious illnesses<br>• medications<br>• allergies<br>• operations<br>• asks about alcohol intake | 0 | 1 | 2 |
| Takes a focused gynaecological history:<br>• vaginal bleed/discharge<br>• dysmenorrhoea<br>• dyspareunia<br>• menorrhagia | 0 | 1 | — |
| Makes a working differential diagnosis from the history | 0 | 1 | 2 |
| Asks for appropriate investigations | 0 | 1 | 2 |
| Constructs an appropriate treatment plan | 0 | 1 | — |
| Arranges appropriate follow-up | 0 | 1 | — |
| Conducts examination in a fluent and logical manner | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /27 | |

## SCENARIO 8.2: ABDOMINAL EXAMINATION

You have been asked to see a 34-year-old man who has a 2-day history of colicky abdominal pain. Carry out an examination of his abdominal system and present your findings. You are not required to take a history.

## SUGGESTED APPROACH

This is a very basic and common OSCE scenario, in which you can score highly if you have a well-rehearsed and slick routine for examining the abdominal system.

### General inspection

After introducing yourself, ensure that there is privacy and an appropriate chaperone. Explain to the patient that you are going to examine their abdomen. Ask briefly if they are comfortable, and offer analgesia if appropriate.

You should expose the patient (explain to the examiner that you would ideally expose the patient from nipple to knee, but for the purposes of dignity in the examination setting would keep the genitalia covered) so that you can see the entire abdomen clearly while maintaining the patient's dignity .

Examine the patient from the end of the bed. Make it clear that you are looking for:

- scars
- stoma sites
- abdominal distension
- masses (transplanted kidneys)
- skin colour (jaundice or bruising in the flanks)
- striae/spider naevi

### Examine the hands

You should examine the hands, paying particular attention to the following:

- warmth
- capillary refill (>2 s is prolonged)
- palmar erythema (liver disease)
- hyperpigmentation of the skin creases (Addison's disease)
- clubbing of the fingers (inflammatory bowel disease)
- Dupuytren's contracture (liver disease)
- arteriovenous fistula (suggesting an underlying renal disease)
- fingernails, for koilonychia (chronic anaemia)

You should observe the presence of a liver 'flapping' tremor (liver disease).

Feel the pulse: rate, character and volume.

Indicate that you would take the patient's blood pressure.

### Examine the face

Examine the eyes by gently retracting the lids, and look for jaundice and pallor.

Look at the oral mucosa for ulcers (inflammatory bowel disease or dehydration).

Look at the tongue: a smooth red tongue suggests anaemia; a white-coated tongue is more likely to be due to dehydration, but may indicate a candidal infection.

## Examine the neck

Look for any masses in the neck and feel for any lymph nodes. A palpable lymph node in the supraclavicular region (Virchow's node) is associated with gastrointestinal malignancy.

## Examine the abdomen

Ensure that the patient is adequately exposed and look at the abdomen closely for scars. Make sure that you can see the groins – an often-ignored area that can hide a multiple of signs. Ask the patient if it is OK to lay them flat with their hands by their side. Ensure that they are comfortable and ask them to point to where the pain is. You should ideally position yourself so that your face is at the same level as the patient's abdomen, such as by kneeling down.

## Palpate the abdomen

Gently palpate the abdomen in all four quadrants, starting in an area that is not painful. It is often helpful to make conversation with the patient while you do this and observe their reaction. Look for signs of peritonism (rigidity/guarding/rebound tenderness) as you palpate.

Feel for any masses. Repeat the process, palpating deeper.

Continue by examining the liver, palpating in the lower right iliac fossa and progressing towards the upper right quadrant and the spleen in the upper left quadrant.

Ballot the kidneys by placing a hand behind the loin and gently pressing downward with your other hand.

Palpate the aorta for an abdominal aortic aneurysm.

Examine the hernial orifices while the patient is lying down and also in the standing position if the history suggests an inguinal or femoral hernia.

Carry out a scrotal examination, feeling each testis in turn. Comment on the size and shape and whether you can feel any masses, and whether you can get above any such mass or separate it from the body of the testis. Transilluminate the scrotum to look for cysts and hydroceles.

## Percussion

The abdomen should be percussed for dullness; this can confirm the presence of an enlarged liver or spleen. The shifting dullness sign may also be elicited in the presence of ascites. Pain on percussion may also be a marker of peritonism. Large volumes of fluid can also elicit transmitted sound, which may be felt as a fluid thrill.

## Auscultation

Listen for the presence or absence of bowel sounds. To be able to state that bowel sounds are absent, you need to listen for over a minute. Define their character (normal, active, sparse, tinkling). It is also possible to listen for bruits in the liver and the major vessels if relevant to a vascular examination.

## Rectal examination

Ask to perform a digital rectal examination, specifically feeling for masses and bogginess in the rectal wall. Warn the patient that it will be uncomfortable, but that they should report any pain, since this may be significant.

## Urinalysis

Perform a urinalysis for ketonuria, nitrites, glycosuria, haematuria and proteinuria. If positive, the sample should be sent for microscopy, culture and sensitivity.

## Completing the examination

You should thank the patient and offer to assist them with getting dressed.

## Scoring Scenario 8.2: Abdominal examination

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Addresses the fact that the patient is in pain and offers pain relief | 0 | 1 | — |
| Adequately exposes and positions the patient | 0 | 1 | — |
| Carries out a general inspection from the end of the bed, looking for:<br>• scars<br>• abdominal distension<br>• jaundice<br>• masses (transplanted kidney) | 0 | 1 | 2 |
| Examines the hands | 0 | 1 | — |
| Examines the eyes | 0 | 1 | — |
| Examines the mouth | 0 | 1 | — |
| Palpates the neck for lymphadenopathy/masses | 0 | 1 | — |
| Conducts a superficial and deep palpation of all four quadrants :<br>• Palpates the liver<br>• Palpates the spleen<br>• Ballots the kidneys<br>• Feels for an abdominal aortic aneurysm | 0 | 1 | 2 |
| Percusses over liver and spleen | 0 | 1 | — |
| Auscultates for bowel sounds and bruits | 0 | 1 | — |
| States intention to conduct an examination of the hernial orifices and testes | 0 | 1 | — |
| States intention to conduct a digital rectal examination and urinalysis | 0 | 1 | — |
| Carries out examination in a fluent manner | 0 | 1 | — |
| Offers a differential diagnosis | 0 | 1 | 2 |
| Suggests appropriate investigations | 0 | 1 | 2 |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/30** | | |

## SCENARIO 8.3: UPPER GI BLEED

You are asked to review a 65-year-old man who has presented with a 2-hour history of vomiting blood. He has a history of atrial fibrillation and was recently started on oral amoxicillin and non-steroidal anti-inflammatory drugs (NSAIDs) for a dental infection.

His initial observations at triage were:

Temperature 36.9 °C
Pulse 110 bpm, irregular
BP 110/80 mmHg
Oxygen saturation 97% on air
GCS 15

Take a focused history and make a management plan. You are not expected to examine the patient.

## SUGGESTED APPROACH

Gastrointestinal (GI) bleeds are a common presentation to the emergency department. It is important that all emergency department trainees be familiar with the differential diagnosis and management of GI bleeding. This is summarized in the national clinical guideline *Management of Acute Upper and Lower Gastrointestinal Bleeding*, produced by the Scottish Intercollegiate Guidelines Network (SIGN) and adopted by the BSG.

This guideline is available at: www.sign.ac.uk/guidelines.

### History and immediate management

The initial observations suggest that this patient is haemodynamically stable. OSCE scenarios, which require you take a history, will invariably involve a stable patient. However, the tachycardia is worrying, despite his normal blood pressure. It would be prudent to tell the examiner from the outset that you would move the patient to an area where he can be monitored and that you would obtain a repeat set of observations, since those carried out at triage may have changed.

The immediate management would to secure two large-bore cannulae for intravenous access and obtain a venous gas to check haemoglobin and electrolytes. Send blood samples, including a coagulation screen and a group and save. The patient should be cross-matched if still actively bleeding or if there is low haemoglobin on the initial blood gas. Fluid resuscitation should be carried out as required.

The key to this scenario is to first ensure that you have stabilized the patient and then take a focused history so that you can make a definitive management plan. The important features in this patient's history are as follows:

- It is important to ascertain if the blood is fresh or whether it has been partially digested ('coffee grounds'), since this will localize the site of the upper GI bleed, which may differentiate between a variceal bleed and a duodenal ulcer.
- The passage of melaena, which usually presents as black, offensive tarry stools, also supports the diagnosis of an upper GI bleed. Although a patient may vomit small amounts of blood, they may suffer massive blood and fluid loss through melaena.

You should ask about the following:

- *Whether there is pain associated with the bleed*. A duodenal ulcer is more likely to present with severe epigastric pain and features of peritonism, whereas a variceal bleed may be asymptomatic.
- *Any bleeding disorders or the use of anticoagulants*. The clue in this OSCE is that the patient has an irregular pulse and was on warfarin for his atrial fibrillation. Other medications such as NSAIDs and corticosteroids may also cause erosive gastritis and contribute to an upper GI bleed. This patient was also on amoxicillin, which may have interacted with the warfarin, thereby potentiating its effect.
- *Shortness of breath, weakness, lethargy or fainting episodes*. These may indicate significant blood loss.
- *Risk factors that may predispose to a variceal bleed (portal hypertension)*. An alcohol history is essential, as is any history of pre-existing liver disease, gastritis or peptic ulcers.
- *Any retching or vomiting before the bleed*. This is necessary to exclude a Mallory–Weiss tear.
- *Symptoms such as anorexia, weight loss, dysphagia and abdominal pain*. These may suggest a neoplastic disease.

## Investigations and management

The patient should have cardiac monitoring, and should ideally be treated and observed in the resuscitation area. In addition, ask for a lying and standing blood pressure to look for a postural drop.

Two large-bore IV cannulae should be inserted and fluid resuscitation commenced in the event of shock.

Bloods should be sent at the earliest opportunity, to prevent any delay in obtaining cross-matched blood. In an emergency situation, it may be possible to obtain group O rhesus D-negative blood (crash blood). It is important that the cross-match sample be taken prior to the transfusion, to allow typing.

Assessment of liver function and a coagulation screen are also essential in formulating a definitive treatment. In this scenario, a high International Normalized Ratio (INR) arising as a result of the interaction of warfarin and amoxicillin was the precipitating cause. There is often a rise in serum urea owing to the degradation of red blood cells in the digestive tract.

An erect chest X-ray should be performed to exclude a perforated ulcer.

Calculate the Clinical Rockall Score for the patient (Table 8.1). This scoring system is useful to identify those patients who may require HDU/ITU input (those who have a score > 3). There is also a Total Rockall Score, which incorporates the endoscopic findings and has been used to predict mortality.

**Table 8.1** Clinical Rockall Score

| | Score | | | |
|---|---|---|---|---|
| **Risk** | **0** | **1** | **2** | **3** |
| **Age** | <60 years | 60–79 years | >80 years | — |
| **Shock** | No shock<br>Pulse < 100 bpm<br>Systolic BP >100 mmHg | Pulse > 100 bpm<br>Systolic BP > 100 mmHg | Systolic BP < 100 bpm | — |
| **Comorbidity** | None | — | Cardiac failure, ischaemic heart disease or any other major comorbidity | Renal/liver failure or disseminated malignancy |

If the patient is not actively bleeding and is otherwise stable, they should be referred to gastroenterology for a non-urgent inpatient endoscopy of their upper GI tract. If they are still actively bleeding or become unstable or you suspect a variceal bleed, they should have an urgent endoscopy by an experienced gastroenterologist with anaesthetic cover to protect the airway once they have been resuscitated. This may not only identify the source of the bleed but also treat the cause by banding or injecting the site.

If the patient is haemodynamically stable, they can be managed conservatively by either temporarily stopping warfarin or reversing its effects by administering a combination of vitamin K, fresh frozen plasma (FFP) or prothrombin complex concentrate (PCC).

Intravenous proton pump inhibitors should be given if you suspect erosive gastritis as the cause of the bleed.

Bleeds that cannot be stopped by endoscopic intervention may require open surgery or interventional angiography.

The majority of patients with a significant upper GI bleed will be admitted. Those who have presented with minor bleeds and are haemodynamically stable with a normal blood profile may be discharged home with appropriate follow-up.

## Scoring Scenario 8.3: Upper GI bleed

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Identifies that the patient is shocked and institutes immediate treatment if unstable:<br>• Asks for repeat observations and arranges appropriate monitoring (postural drop)<br>• Secures bilateral large-bore IV access<br>• Requests bloods, including a cross-match, coagulation screen, liver function tests, and urea and electrolytes<br>• Institutes fluid resuscitation and oxygen | 0 | 1 | 2 |
| Takes a focused past medical history:<br>• previous illnesses<br>• previous operations<br>• medications (anticoagulants/steroids)<br>• allergies<br>• family history of bowel disorders<br>• shortness of breath/faints/dizziness/lethargy | 0 | 1 | 2 |
| Enquires about :<br>• colour of blood: fresh/'coffee ground' vomiting<br>• presence of melaena<br>• abdominal pain<br>• use of NSAIDs/corticosteroids<br>• anticoagulants (patient on warfarin for atrial fibrillation)<br>• history of peptic ulcer disease<br>• use of alcohol<br>• other medications (interaction of warfarin with amoxicillin) | 0 | 1 | 2 |
| Suggests appropriate investigations:<br>• erect chest X-ray to exclude a perforation<br>• urgent endoscopy | 0 | 1 | — |
| Offers a differential diagnosis:<br>• bleed secondary to increase in INR<br>• variceal bleed<br>• peptic ulcer<br>• upper GI malignancy | 0 | 1 | 2 |
| Offers management plan:<br>• fluid/blood resuscitation<br>• intravenous proton pump inhibitors<br>• reversal of warfarin (vitamin K/FFP)<br>• urgent gastroenterology opinion<br>• upper GI endoscopy<br>• HDU/ITU involvement | 0 | 1 | 2 |
| Correctly calculates and interprets Clinical Rockall Score | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /23 | |

## SCENARIO 8.4: LOWER GI BLEED

You are asked to see a 70-year-old man who has presented with a 2-week history of passing blood per rectum. He appears pale and his initial observations are:

Temperature 36.8 °C
Pulse 110 bpm, regular
BP 90/60 mmHg
Oxygen saturation 96% on air
GCS 15

Take a focused history, and give a management plan, including the investigations that you would request.

## SUGGESTED APPROACH

This patient is tachycardic and also hypotensive, suggesting that he is unwell. The fact that he has been bleeding for at least 2 weeks and is pale suggests that he may require a transfusion.

As this OSCE asks you take a focused history and outline your management, your strategy should be to tell the examiner what immediate measures you would undertake to stabilize the patient. You should then proceed to take the history and follow up with your definitive management plan for this patient in the emergency department.

The immediate management of a lower GI bleed is the same as for an upper GI bleed (Scenario 8.3), and the patient should be resuscitated as necessary with fluids or crash O negative blood. Urgent bloods should be sent, and an arterial or venous gas should be used to assess the baseline haemoglobin. Often, direct examination of the anus and rectum will identify an obvious cause, such as bleeding haemorrhoids or an anal fissure. However, bleeding from the more proximal lower GI tract may be difficult to diagnose, and the patient may require endoscopic examination or imaging to find the source.

In addition to a standard medical history, enquiring about previous illnesses, operations, medications and allergies, you should ask focused questions to characterize the bleed with regard to when it started and any factors that make it better or worse. Ask about recent intake of foods such as beetroot that can give the impression of blood in the stool. Ask about symptoms such as shortness of breath and dizziness or evidence of postural hypotension, since these will indicate significant blood loss.

You should ask the following:

- What colour is the blood (bright red or dark red) and is the bleeding associated with bowel opening? Lower GI bleeds usually present with fresh red blood, and it is important to quantify the volume of blood passed and whether it was mixed in with stool or whether the stool was covered with blood.
- Is there any abdominal pain? Is there is any change in bowel habit? Diarrhoea is a more sinister sign than constipation.
- Has there been any weight loss?
- Is any mucus passed with the stool?
- Is the patient taking any medications such as anticoagulants that can potentiate a lower GI bleed?
- Is there a past history of inflammatory bowel disease (IBD): Crohn's disease, ulcerative colitis or diverticulitis? Features of IBD include mouth ulcers, glossitis, rashes (erythema nodosum) and perianal tags.
- Has there been local trauma or anal intercourse? In children, you may have to consider a non-accidental injury.
- Are there any associated features such as fever or vomiting that in the presence of bloody diarrhoea would support an infective cause?

Note that a painless lower GI bleed accompanied with weight loss and a change in bowel habit in an elderly patient is highly suggestive of an underlying malignancy.

## Investigation and management

Blood tests should be as for an upper GI bleed (see Scenario 8.3). In addition, blood and stool cultures should be requested if you suspect an infective cause.

In addition to the routine observations, ask for a lying and standing blood pressure and a urine specimen.

Plain abdominal X-rays should not be routinely requested for every lower GI bleed unless you suspect a toxic megacolon or a malignant stricture causing a bowel obstruction.

Colonoscopy or flexible sigmoidoscopy is the investigation of choice, but is rarely indicated in the emergency setting.

Other investigations include:

- mesenteric angiography
- double-contrast barium enema
- red blood cell labelling scintography
- helical CT

The main goal of management in the emergency department is to resuscitate and stabilize the patient. Patients who are haemodynamically stable and have a normal haemoglobin can be discharged home and be followed up for an outpatient colonoscopy. Where the cause is external (e.g. haemorrhoids or an anal fissure), the patient should be managed conservatively and have follow-up with their GP in the first instance. Patients with an acute flare-up of ulcerative colitis should be managed with a combination of anti-inflammatories and steroids and referred to the gastroenterology team.

## Scoring Scenario 8.4: Lower GI bleed

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Identifies that the patient is shocked and institutes immediate treatment:<br>• Asks for repeat observations and arranges appropriate monitoring (postural drop)<br>• Secures bilateral large-bore IV access<br>• Requests bloods, including a group and save and cross-match, coagulation screen, liver function tests, and urea and electrolytes<br>• Institutes fluid resuscitation and oxygen<br>• Requests blood transfusion | 0 | 1 | 2 |
| Takes a focused past medical history:<br>• previous illnesses<br>• previous operations<br>• medications (anticoagulants/steroids)<br>• allergies<br>• family history of bowel disorders<br>• shortness of breath/faints/dizziness/lethargy | 0 | 1 | 2 |

*Continued*

**Scoring Scenario 8.4** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Enquires about:<br>• colour of blood (fresh/melaena)<br>• change in bowel habit<br>• weight loss<br>• associated abdominal pain<br>• features to suggest an infective aetiology (fever/diarrhoea/travel)<br>• history of inflammatory bowel disease (diverticulitis/ulcerative colitis/Crohn's disease)<br>• use of anticoagulants<br>• local trauma | 0 | 1 | 2 |
| Suggests appropriate investigations:<br>• plain abdominal X-ray<br>• double-contrast barium enema<br>• flexible sigmoidocopy/colonoscopy | 0 | 1 | — |
| Offers a differential diagnosis:<br>• diverticulitis<br>• inflammatory bowel disease<br>• benign anorectal disease<br>• malignancy<br>• coagulopathy<br>• angiodysplasia | 0 | 1 | 2 |
| Offers management plan:<br>• fluid/blood resuscitation<br>• correction of any coagulopathy<br>• urgent colonoscopy<br>• use of anti-inflammatories/steroids in ulcerative colitis | 0 | 1 | 2 |
| Arranges appropriate referral and/or follow-up | 0 | 1 | — |
| **Score from patient** | | **/5** | |
| **Global score from examiner** | | **/5** | |
| **Total score** | | **/23** | |

## SCENARIO 8.5: GASTROENTERITIS

You are asked to see a 20-year-old female medical student who has had a 2-day history of diarrhoea.

Her initial observations are:

Temperature 37.8 °C
Pulse 100 bpm
BP 118/84 mmHg
Oxygen saturation 96% on air

Take a focused history and outline your investigations and management plan.

## SUGGESTED APPROACH

This scenario represents a common presentation to the emergency department, and you should have a sound knowledge of the differential diagnosis and management of acute gastroenteritis. A key feature in the scenario is that the patient is a medical student, which is likely to have a significant impact on the management. The bulk of the marks will be for taking a history, but there will also be marks for suggesting a differential diagnosis and suggesting a management plan. As this patient is infective, you should inform the examiner that you would like to put on gloves and an apron before you proceed.

The history should include the following:

- Determine the onset of symptoms and establish what the patient perceives as diarrhoea. How often is the patient opening their bowels? (By definition, diarrhoea is the passage of more than three watery stools a day.)
- Is there an association with abdominal pain (possibly indicating appendicitis or inflammatory bowel disease)?
- Are there any exacerbating or relieving factors?
- Is there associated nausea or vomiting?
- Is there associated fever or rash?
- Determine the dietary history in the preceding 24 hours.
- Is blood, mucus or pus present in the stool?
- Obtain a description of stool consistency and colour (black tarry stools suggests an upper GI bleed). Fatty offensive stools that do not flush easily (steatorrhoea) may suggest a small bowel or pancreatic disorder resulting in malabsorption.
- Are there any features of inflammatory bowel disease (IBD), such as mouth ulcers, weight loss, anaemia or perianal tags?
- Has there been any previous bowel surgery?
- Ask about any recent travel (student elective in this scenario).
- Are there any occupational factors? (In this scenario, ask if the student has been working on a ward where there been an outbreak of any diarrhoeal illnesses.)
- Ask about drug history and if there has been any recent use of antibiotics or any laxative use or abuse. Has the patient used antimotility drugs, which may prolong the symptoms?
- Is there a history of:
  - hepatitis/jaundice?
  - diabetes?
  - a thyroid disorder?
- Is there a history or features of irritable bowel syndrome (IBS)?
- Is there any history of constipation (overflow diarrhoea)?
- Is there a history or any features of immunosuppression (HIV or immunosuppressive drugs)?

### Differential diagnosis

Diarrhoea in a young otherwise healthy medical student presenting with a fever is likely to be infective in origin (Table 8.2). A detailed travel history is important here, especially if she has recently been on her elective. It is also important to find out if there has been an outbreak of diarrhoea on any of the wards she has been working on (*Clostridium difficile* or norovirus). Other causes in the differential diagnosis include:

- IBD
- IBS
- malabsorption sydrome or coeliac disease
- laxative abuse

**Table 8.2** Incubation times for common infective causes of diarrhoea

| Organism | Incubation time | Comments[a] |
|---|---|---|
| *Vibrio cholerae* | 2 h–5 days | P |
| *Staphylococcus aureus* | 1–6 h | |
| *Bacillus cereus* | 1–6 h | |
| *Salmonella* | 6–48 h | Bloody diarrhoea, P |
| Norovirus | 12–48 h | H |
| *Escherichia coli* | 24–48 h | P |
| VTEC O157[b] | 24–48 h | P |
| *Campylobacter* | 24–72 h | Most common bacterial cause, P |
| *Cryptosporidium* | 2–5 days | P |
| *Shigella* | 24–72 h | P |
| Rotavirus | 1–7 days | Most common viral cause |
| *Giardia lamblia* | 1–25 days | P |
| *Clostridium difficile* | 1 day–6 weeks | H |
| Hepatitis A | 2–6 weeks | P |
| *Entamoeba histolytica* | Days–months | P |

[a]P, refer to public health laboratories; H, hospital-acquired infection.
[b]Verocytotoxin-producing *E. coli* O157.

## Investigations and management

No investigations are usually necessary in those who present with a short history of diarrhoea, are haemodynamically stable and are otherwise well. If the patient is acutely unwell or presents with bloody diarrhoea, marked dehydration or a high fever, the following tests can be ordered:

- full blood count
- urea and electrolytes (look for electrolyte disturbances)
- liver function tests (giardiasis and other parasitic infections)
- C-reactive protein (CRP) (if you suspect IBD)
- coagulation screen (if you suspect hepatic involvement)
- blood culture (if the patient is pyrexial or is systemically unwell)
- urine dipstick
- stool analysis for microscopy and culture (*C. difficile* antigen test)
- venous/arterial blood gas to look at lactate and the severity of the acid–base disturbance (if the patient is acutely unwell)

A plain abdominal X-ray is not indicated unless you suspect that the patient has a toxic megacolon.

Those working with food, in a school or with patients should have stool cultures sent to have the pathogen identified.

Management for the majority of cases is supportive with oral hydration therapy, where 200–400 mL can be taken after each loose bowel motion. It is important that you advise on strict hand hygiene instructions. Those working with food, in a school or in a clinical setting should refrain from attending work for 48 hours after the diarrhoea has

stopped. Furthermore, it is important that the medical student in this scenario be informed that if the stool culture is positive for the following pathogens, she may need clearance to work (in the form of negative stool specimens):

- *Entamoeba histolytica*
- VTEC O157
- *Shigella dysenteriae*

Severe dehydration should be managed with intravenous fluids, and antibiotic treatment should be reserved for serious bacterial infections with positive stool cultures after consultation with the infectious diseases team. Antidiarrhoeal medications are rarely necessary except when the patient may be travelling.

A useful resource for the management of gastroenteritis can be found at: http://cks.library.nhs.uk/gastroenteritis.

## Scoring Scenario 8.5: Gastroenteritis

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Puts on protective apron and washes hands before entering cubicle | 0 | 1 | — |
| Enquires about:<br>• onset of symptoms<br>• number of bowel motions a day<br>• associated vomiting/nausea<br>• profession (placement on a surgical ward)<br>• travel (student elective)<br>• presence of blood, mucus or pus in the diarrhoea<br>• recent use of antibiotics/other medications<br>• features/history of IBD<br>• features/history of IBS<br>• relevant medical history (diabetes, thyroid disorders) | 0 | 1 | 2 |
| Suggests appropriate investigations: stool culture, since patient is based on a surgical ward. Blood tests and imaging are not necessary | 0 | 1 | — |
| Offers a differential diagnosis:<br>• infective gastroenteritis<br>• IBD<br>• IBS<br>• antibiotic-related | 0 | 1 | 2 |
| Offers management plan:<br>• Oral rehydration therapy<br>• Stops antibiotics<br>• Advises patient to refrain from work for 48 hours after diarrhoea has stopped<br>• Stool cultures<br>• Reinforces hand hygiene<br>• Does not recommend antidiarrhoeal medications | 0 | 1 | 2 |
| Arranges appropriate follow-up with occupational health before patient returns to clinical work (may need negative stool cultures) | 0 | 1 | — |
| Washes hands and disposes of apron before leaving cubicle | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /21 | |

# 9 Genitourinary Emergencies

FRANCESCA GARNHAM

## CORE TOPICS

- Acute urinary retention
- Acute scrotal pain
- Priapism
- Ureteric colic/renal calculi
- Phimosis
- Paraphimosis
- Fracture of the penis
- Haematuria
- Fournier's gangrene
- Prostatitis
- Skills: urethral catheterization, suprapubic catheterization

### SCENARIO 9.1: TESTICULAR TORSION

A young man presents with a history of scrotal pain. Take a relevant history from the patient and demonstrate your examination on the model. Outline your investigations and management.

## SUGGESTED APPROACH

A history of acute testicular pain in an otherwise fit and healthy young adult is highly suspicious of testicular torsion, and this should be at the top of your differential diagnosis. You should start by ensuring that the patient is given appropriate analgesia.

### History

Ask when the pain started: a short history of sudden onset is more characteristic of testicular torsion.

Enquire about the following:

- nature of the pain (dull or sharp, continuous or colicky)
- exacerbating or relieving factors
- site of the pain (unilateral or bilateral)
- referred pain to abdomen, back or flank
- urinary symptoms (dysuria or haematuria)
- nausea or vomiting
- abdominal pain
- fever
- penile discharge
- previous history of sexually transmitted disease (STD)
- previous history of orchitis, epididymitis or mumps
- any risk factors for torsion:
  - congenital abnormality
  - undescended testicle
  - vigorous sexual activity
  - trauma
  - exercise
  - active cremasteric reflex in cold weather
- any other medical problems
- medications and allergies

## Examination

After ensuring the patient's privacy and the presence of a chaperone, the patient should be exposed so that the scrotum and hernial orifices are exposed.

Look for scrotal swelling and for any discoloration of the scrotum (erythema or dusky appearance).

Is the scrotum hot to touch?

Gently palpate each of the testes in turn. Comment on the size, shape, consistency and lie of the testes. In torsion, the testicle may be high-riding and have a horizontal lie.

Check for any masses and their size and consistency (soft or hard, smooth or irregular). Is there a mass separate from the body of the testicle, for example an inguinal hernia or hydrocele (which feels like a bag of worms)?

Palpate the epididymis. Is it thickened? Is it tender on palpation?

Check for any testicular tenderness. Lift the scrotum to see if this alleviates the tenderness (Prehn's sign). This test is positive in epididymo-orchitis, but negative (no pain relief on elevation of the scrotum) in testicular torsion.

Does the scrotum transilluminate (hydrocele)?

Examine the hernial orifices for any masses or lumps.

Examine the penis. Look for any discharge, ulcers, erythema or vesicles.

You should complete the examination by examining the abdomen.

## Investigations

Ultrasound is a helpful adjunct in the diagnosis of torsion, but if there is a high clinical suspicion it is not sufficiently sensitive to rule out torsion. Radionuclide scans and colour Doppler ultrasound can also be helpful in identifying arterial blood flow and other testicular disorders.

Note that a full blood count may be performed, but is not discriminatory, since up to 60% of patients with testicular torsion have an elevated white cell count. Other blood tests include urea and electrolytes, C-reactive protein, a coagulation screen, and a group and save.

Where you suspect epididymo-orchitis, you should perform a urine dip (for pyuria), urine microscopy (including Gram stain and presence of threads), culture and sensitivities, a urethral swab, and a urine nucleic acid amplification test (for *Neisseria gonorrhoeae* and *Chlamydia*).

If an STD is present then the patient should be screened for other STDs.

## Differential diagnosis

### *Testicular torsion*

Testicular torsion has two peaks, at 1 and 14 years of age. It is uncommon in men over 35. Patients often present with sudden-onset pain in the left iliac fossa. Fifty percent have had previous episodes of intermittent torsion. In addition, 20–30% have nausea and vomiting and/or abdominal pain, 16% are pyrexial, and 4% have urinary frequency.

It is essential that you convey that testicular torsion is a **SURGICAL EMERGENCY** and that the prognosis is time-critical. Most cases are salvageable with detorsion within 6 hours, 20% with detorsion within 12 hours and 0% after that. You should arrange an urgent referral to the surgical team on call for further management.

Manual detorsion is described as a temporary measure: the respective testis should be rotated outwards along its vertical axis in units of 90° as if opening a book (clockwise on the right side and anticlockwise on the left). Even if this procedure is successful, an urgent surgical referral is mandatory.

### *Torsion of the testicular appendix*

In torsion of the testicular appendix, on examination, at the upper pole of the testis, there may be focal discoloration ('blue dot' sign) and a palpable hard, pea-sized mass.

### *Epididymitis ± orchitis*

Epididymitis, with or without orchitis, is the most common cause of acute scrotal pain in adolescents worldwide. Organisms are usually spread from the prostatic urethra or the seminal vesicles or are blood-borne (less commonly).

Predisposing factors include:

- STDs (e.g. *Chlamydia trachomatis* and *N. gonorrhoeae*) – especially in those aged under 35
- urinary tract infections – especially in those aged over 35
- urinary tract anatomical abnormalities
- urethral instrumentation

Note that Gram-negative enteric organisms may also be transmitted through anal intercourse.

Non-infective epididymitis is also recognized with drugs (e.g. amiodarone) and Behçet's disease.

Onset may be more gradual than is seen with torsion and the patient may have associated systemic signs (fever, tachycardia, etc). There is tenderness in the epididymis and/or the testis. Prehn's sign is positive (pain is relieved on elevating the scrotum). There may be urethral discharge or erythema of the overlying scrotum.

Complications include chronic epididymitis, testicular atrophy, infarction, abscess formation, and reduced fertility or infertility (from fibrotic obstruction of the epididymal tubes).

Management involves analgesia (non-steroidal anti-inflammatory drugs may be particularly helpful), scrotal support and bed rest.

Contact partners for investigation and advise avoidance of sexual intercourse until treatment has been completed.

Antibiotics should be provided before results of investigations are available; they should be determined by the likely organism from the history using national and local guidelines.

### *Strangulated hernia*

With a strangulated hernia, there is a firm, tender irreducible swelling, possibly with a previous history of a lump. There may be signs of obstruction and/or sepsis. Precipitating factors include:

- raised intra-abdominal pressure due to straining while defecating, urinating or lifting heavy weights or when coughing (note any history of chronic obstructive pulmonary disease)
- ascites
- ventriculoperitoneal shunt and peritoneal dialysis
- family history of hernias
- obesity

### *Trauma*

It is usually obvious from the history that trauma has occurred, although the patient may require encouragement to reveal assault or trauma secondary to sexual activities.

### *Tumours*

Usually a tumour will appear as a painless lump or swelling, but approximately 10% of men present with acute pain and 20–30% experience an ache. Half of testicular tumours are seminomas (found in older patients), with the remainder comprising teratomas, mixed tumours and others (more commonly found in younger patients).

Testicular malignancies account for 1% of cancers in men in the UK, with a peak incidence in the age range 25–35 years.

Risk factors include developmental abnormality (e.g. dysgenesis or maldescent), previous cancer in the opposite side, HIV/AIDS, torsion, Klinefelter's syndrome and a family history of testicular cancer.

The prognosis is generally good: the 5-year survival rate for seminomas is nearly 90%.

More than half of solid swellings in the body of the testis are due to cancer.

## Scoring Scenario 9.1: Testicular torsion

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Ensures privacy and chaperone | 0 | 1 | — |
| Offers analgesia | 0 | 1 | — |
| Ascertains time of onset of pain | 0 | 1 | — |
| Characterizes pain:<br>• site<br>• radiation<br>• severity<br>• character | 0 | 1 | 2 |

*Continued*

**Scoring Scenario 9.1** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Asks about:<br>• dysuria<br>• haematuria<br>• nausea/vomiting<br>• abdominal pain<br>• penile discharge | 0 | 1 | 2 |
| Elicits risk factors for torsion:<br>• vigorous sexual activity<br>• undescended testis<br>• congenital abnormality<br>• trauma<br>• exercise | 0 | 1 | 2 |
| Suggests taking a sexual history | 0 | 1 | — |
| Washes hands | 0 | 1 | — |
| Exposes genitalia and inguinal region | 0 | 1 | — |
| Inspects for:<br>• swelling<br>• discoloration | 0 | 1 | — |
| Palpates the testes, commenting on:<br>• size and shape<br>• consistency<br>• lie of the testes<br>• pain<br>• palpates spermatic cord<br>• any masses | 0 | 1 | 2 |
| Transilluminates scrotum for a hydrocele | 0 | 1 | — |
| States intention to examine for hernias | 0 | 1 | — |
| Recognizes that testicular torsion is a surgical emergency and makes an urgent referral | 0 | 1 | — |
| Demonstrates manual detorsion with appropriate analgesia (nitrous oxide) | 0 | 1 | 2 |
| Arranges investigations:<br>• Doppler ultrasound<br>• bloods<br>• midstream urine | 0 | 1 | — |
| **Score from patient** | | **/5** | |
| **Global score from examiner** | | **/5** | |
| **Total score** | | **/32** | |

## SCENARIO 9.2: HAEMATURIA – HISTORY

A 78-year-old man presents complaining of a 2-day history of haematuria. Take a history and outline your investigations, differential diagnosis and management.

The aim of this OSCE is to test your ability to take a urological history relating to haematuria.

## SUGGESTED APPROACH

After introducing yourself, you should enquire about the patient's observations and ensure that they are haemodynamically stable before progressing to continue with the history. If the patient is not stable, you should state that you would resuscitate them before proceeding.

Offer any analgesia as required

Ask if the patient has frank haematuria (passing just blood) or if they are passing bloodstained urine.

Enquire about the following:

- passage of clots
- timing of haematuria in relation to micturition:
  - beginning or end – prostate, bladder neck or urethra
  - mixed with the urine – higher in the urinary tract
  - speed of onset
- associated pain:
  - loin to groin – suggestive of renal colic (less likely as a first in a 78-year-old)
  - abdominal and back pain in a 78-year-old – exclude an abdominal aortic aneurysm
  - pain at the end of micturition – suggestive of a bladder stone
- referred pain
- urinary symptoms: frequency, nocturia, dysuria, urgency and flow characteristics (initiation, dribbling, etc.)
- associated symptoms: e.g. fevers, rigors, vomiting, weight loss, night sweats or lethargy
- occupational history: dye industry or chemicals
- history of smoking and alcohol
- history of foreign travel
- bleeding or clotting disorders
- use of anticoagulants

### Investigations

These should include the following:

- full blood count (FBC)
- urea and electrolytes (U&E)
- coagulation screen
- group and save
- liver function tests (LFT)
- blood cultures if pyrexial
- urine dipstick and culture
- autoimmune screen and antistreptolysin O titre (ASOT)
- prostate-specific antigen (PSA) levels
- renal ultrasound
- CT-KUB (kidneys, ureter, bladder)
- cystoscopy

## Differential diagnosis

### *Renal colic*

Renal colic would be a consideration in a younger person and is discussed in detail in Chapter 19. You should be aware that symptoms of an abdominal aortic aneurysm (AAA) are often mistaken for renal colic in the elderly.

### *Malignancy*

#### *Renal cell carcinoma*

Risk factors for renal cell carcinoma include smoking, obesity, hypertension, exposure to industrial chemicals (e.g. cadmium, certain organic solvents and asbestos), dialysis, radiation, Von Hippel–Lindau disease and family history (hereditary papillary renal cell carcinoma).

#### *Transitional cell carcinoma of the bladder*

Risk factors for transitional cell carcinoma of the bladder include cigarette smoking, exposure to industrial chemicals (e.g. aniline dyes, arsenic and asbestos). The peak age is 60–70 years. Gross haematuria is the most common presenting complaint (75–95%), microscopic haematuria occurs in 3–11% and 14–37% complain of pain.

#### *Squamous cell carcinoma of the bladder*

Risk factors for squamous cell carcinoma of the bladder include cigarette smoking, chronic or repeated infections, and certain occupations (e.g. cooks and welders).

### *Trauma*

Trauma can be due to recent surgery, catheterization, or penetrating or blunt trauma.

### *Prostate conditions*

Prostate conditions causing haematuria include benign prostatic hyperplasia (BPH) and prostatitis.

### *Urethral stricture*

The aetiology of urethral stricture includes causes of inflammation (e.g. STDs and repeated episodes of urethritis), injury or instrumentation (including urethral catheterization), scar tissue from surgery, and external pressure from BPH or tumours.

Symptoms include dysuria, poor stream, urinary urgency and/or frequency, lower abdominal pain, haematospermia, haematuria, urethral discharge, incontinence, and urinary retention.

True strictures in women and congenital strictures are rare.

### *Urinary tract infections (UTI)*

The most common causative organisms of UTI are *Escherichia coli* (which accounts for >70%), *Proteus mirabilis*, *Klebsiella pneumoniae*, *Staphylococcus saprophyticus* (see the note below regarding nitrites), *S. aureus* (especially in sexually active women) and *Pseudomonas aeruginosa* (usually in complicated cases such as catheterized patients). In addition, tuberculosis and schistosomiasis should be considered if indicated by the history (especially with foreign travel).

Note that nitrites may not be present if the causative organism does not have the ability to reduce nitrates. This is the case, for example, for *Enterococcus*, *Acinetobacter* and *S. saprophyticus*.

### *Drugs*

A number of drugs can cause haematuria. These include anticoagulants such as warfarin, D-penicillamine and cyclophosphamide.

### *Clotting abnormalities*

Clotting abnormalities can result in haematuria.

### *Exercise-induced haemoglobinuria*

Exercise-induced haemoglobinuria is usually painless and resolves 1–2 days after injury. There are numerous possible mechanisms, including renal trauma and hypoxia, foot-strike haemolysis, dehydration, myoglobinuria, erythrocyte peroxidation, a substance released from the bladder that causes haemolysis, and increased circulation rate.

### *Glomerular disease*

Examples of glomerular disease include glomerulonephritis, bacterial endocarditis and immunoglobulin A (IgA) nephropathy. These are usually suggested by microscopic haematuria with proteinuria.

## Management in the emergency department

After taking the history, intravenous access should be secured and the appropriate investigations should be arranged. An urgent urology opinion should be obtained.

If you suspect that there is clot retention, you should pass a 22G triple-lumen urinary catheter for bladder irrigation.

Coagulopathies should be corrected and the patient resuscitated as necessary.

## Scoring Scenario 9.2: Haematuria – history

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction | 0 | 1 | — |
| Checks that patient is haemodynamically stable | 0 | 1 | — |
| Takes a history relating to haematuria:<br>• frank haematuria<br>• fresh/dark blood<br>• timing of bleed in relation to the stream (beginning/ middle/end)<br>• passage of clots<br>• painful/painless | 0 | 1 | 2 |
| History of trauma:<br>• recent surgery<br>• catheter in situ | 0 | 1 | — |
| Associated symptoms:<br>• weight loss<br>• fever<br>• rigors<br>• night sweats<br>• urinary symptoms | 0 | 1 | 2 |

*Continued*

**Scoring Scenario 9.2** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Smoking and alcohol history | 0 | 1 | — |
| Asks about bleeding/clotting disorders | 0 | 1 | — |
| Asks about use of anticoagulants | 0 | 1 | — |
| Asks about occupation (dye industry/chemicals) and foreign travel | 0 | 1 | — |
| Suggests:<br>• FBC/U&E/C-reactive protein<br>• LFT/coagulation screen<br>• group and save<br>• bladder scan to calculate residual volume<br>• CT-KUB<br>• urology referral | 0 | 1 | 2 |
| Suggests a differential diagnosis:<br>• malignancy<br>• UTI<br>• stricture<br>• trauma<br>• drugs (warfarin)<br>• prostate pathology | 0 | 1 | 2 |
| Suggests that renal colic is unlikely in this age group and excludes AAA | 0 | 1 | — |
| Refers to urology and suggests a three-way catheter to treat for clot retention | 0 | 1 | — |
| States intention to correct coagulation defects | 0 | 1 | — |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/28** | | |

## FURTHER READING AND USEFUL RESOURCES

Association for Continence Advice website: www.aca.uk.com.
British Association for Sexual Health and HIV website: www.bashh.org.
*Clinical Evidence* website: www.clinicalevidence.bmj.com.
eMedicine: www.emedicine.com.
National Guideline Clearing House: www.guideline.gov.
National Institute for Health and Clinical Excellence website: www.nice.org.uk. See especially their infection control guidelines.
Swash M, ed. *Hutchinson's Clinical Methods*, 21st edn. London: WB Saunders, 2001.

# 10 Ophthalmological Emergencies

SHUMONTHA DEV

## CORE TOPICS

- Red eye: conjunctivitis, corneal abrasions, corneal ulcers, keratitis, foreign bodies, ocular burns, scleritis, episcleritis
- Sudden visual loss: retinal haemorrhage, retinal vascular occlusions, vitreous haemorrhage, retinal detachment, optic neuritis, central causes of visual loss
- Painful red eye: glaucoma, uveitis, iritis
- Trauma to the eye: hyphaema, lens dislocation, orbital floor fractures and penetrating injuries of the eye, lacrimal duct injuries, retinal detachment, lid margin laceration
- Other conditions: cellulitis (orbital, preorbital and endophthalmitis), dacrocystitis, eyelid disorders (blepharitis), keratitis, cavernous sinus thrombosis
- Skills: use of slit lamp, rust-ring removal, ocular foreign body removal

### SCENARIO 10.1: ACUTE RED EYE

A 25-year-old man comes to the emergency department with a painful red right eye. You are asked to take a focused history, examine the eye and outline a management plan.

## SUGGESTED APPROACH

Introduce yourself appropriately and offer analgesia if appropriate.

### History

Elicit the following history:

- Which eye is affected?
- When did the red eye appear?
- Are there any associated symptoms such as discharge, pain, photophobia or blurred vision?

- Are there any floaters or other visual disturbances?
- Is the problem intermittent or continuous?
- How have the symptoms changed?
- Has there been any trauma to the eye, or the possibility of a foreign body?
- Were there any other precipitants?
- Does the patient use glasses or contact lenses?
- Does anything alleviate the symptoms?
- Is there a past history of red eye/ophthalmological problems?
- Are there any associated features such as joint pains or urethral discharge?
- Obtain a sexual history if relevant.
- Is there any other past medical history?

## Examination

Examination of the eye involves assessment of the retina and optic nerve, visual acuity, visual fields, and colour vision.

### *Visual acuity*

Visual acuity (VA) measures the function of the eye and gives some idea of the patient's disability. VA is tested with the Snellen chart and is usually expressed as a fraction: for example, if the last line on the chart that can be read accurately by a patient 6 m away is the line that a person with normal vision can read at 24 m then the patient has a VA of 6/24. Vision should be tested with the aid of the patient's usual glasses or contact lenses. To achieve optimal VA, the patient should be asked to look through a pinhole. This reduces the effect of any refractive error and is particularly useful if the patient cannot use contact lenses because of a red eye or has not brought their glasses. You should state that VA should be formally tested with the Snellen chart at 6 m distance. However, in the examination situation, a quick assessment can be made by simply asking the patient to read words from a book.

### *Visual field*

Visual field testing may give clues to the site of any lesion and the diagnosis. To perform the visual field test, the patient should be seated directly opposite you, approximately 1 m away. Ask them to cover their normal eye and look at your face. By covering your own eye with one hand, it is possible to test gross visual field problems by holding the finger of your other hand out to the side, and asking the patient to tell you when they see it moving. Check vision in several areas, such as the top, middle and bottom of the patient's peripheral fields.

### *Pupils*

Check the pupils with a bright torch. When testing the direct and consensual reactions of the pupil to light, the light in the room should be reduced and the patient should focus on a distant point. A more sensitive test is the relative difference in pupillary reaction. Here, the torchlight is moved to and fro between the eyes, not allowing time for the pupils to dilate fully. If one of the pupils continues to dilate when the light shines on it, there is a defect in the visual pathway on that side (a relative afferent pupillary defect).

### *Eye position and movements*

Check eye position and eye movements. Patients should be asked if they have any double vision. If so, then they should be asked whether diplopia occurs in any particular direction of gaze. Test eye movements in all directions and also convergence. Look for nystagmus.

### *Eyelids, conjunctiva, sclera and cornea*

The eyelids, conjunctiva, sclera and cornea should be examined in good light and with magnification. Look under both the upper and lower eyelids for foreign bodies or evidence of conjunctival infection.

### *Ophthalmoscopy*

Good ophthalmoscopy is essential to avoid missing serious ocular and general diseases. A direct ophthalmoscope can be used to allow intraocular structures to be seen. For a good view, the pupil should be dilated, for example with tropicamide 1%, which is short-acting and has little effect on accommodation. The direct ophthalmoscope should be set on the '0' lens. The patient is asked to fix their gaze on an object in the distance, since this reduces pupillary constriction and accommodation, and helps keep the eye still. To enable the patient to fix on a distant object with the other eye, you should use your right eye to examine the patient's right eye, and vice versa. Check the optic disc, vessels and retinal surface.

### *Colour vision*

Colour vision should be assessed using Ishihara colour plates.

### *Slit-lamp examination*

You should indicate that you would perform a slit-lamp examination using fluorescein dye to look for evidence of corneal abrasion, ulceration, or the presence of infiltrates, blood (hyphaema) or pus (hypopyon).

## Other tests

As systemic disease can commonly manifest with eye signs, you should routinely ask for the patient's blood pressure to be measured and a urine dipstick test to be performed, looking for glucose, blood and protein.

## Differential diagnosis of red eye

Red eye is a common ophthalmic problem. Conjunctivitis is one of the most common causes of an uncomfortable red eye. Conjunctivitis itself has many causes, including bacteria (including *Chlamydia*), viruses and allergies.

### *Bacterial conjunctivitis*

With bacterial conjunctivitis, there is usually discomfort and purulent discharge in one eye that spreads to the other. Management involves topical antibiotic drops (e.g. chloramphenicol), which should be instilled every 2 hours for the first 24 hours, decreasing to 4 times a day for 1 week.

### *Viral conjunctivitis*

Viral conjunctivitis is commonly associated with upper respiratory tract infections and is often caused by an adenovirus. The symptoms usually last longer than bacterial conjunctivitis, sometimes persisting for many weeks. It is a self-limiting condition, but antibiotic eye drops provide symptomatic relief and help prevent secondary bacterial infection. Viral conjunctivitis is extremely contagious and hygiene measures are important (e.g. washing hands).

### *Episcleritis and scleritis*

Episcleritis and scleritis both usually present as a localized area of inflammation. The episclera lies just beneath the conjunctiva and adjacent to the tough white scleral coat of the eye. Both the sclera and episclera may become inflamed. Management includes identifying any cause. Episcleritis is self-limiting, but steroid eye drops hasten recovery and provide symptomatic relief. Scleritis is much more serious and requires urgent referral to an ophthalmologist.

### *Corneal ulceration*

Ulceration of the cornea is usually caused by bacterial, viral or fungal infections. These may occur without an obvious precursor or may be secondary to an event that has compromised the eye, such as abrasion, wearing contact lenses or use of topical steroids. Patients with corneal ulceration need to be referred urgently to an ophthalmologist. You should ensure that appropriate swabs and cultures are arranged and treat any underlying cause.

## *Acute angle closure glaucoma*

Acute angle closure glaucoma should be considered in a patient over the age of 50 with a painful red eye. The attack comes on quite quickly, characteristically in the evening, when the pupil becomes semi-dilated. There is pain in one eye, which is severe and accompanied by vomiting. There is impaired vision, and haloes appear around light sources owing to oedema of the cornea. There may have been similar attacks in the past that were relieved by going to sleep (the pupil constricts during sleep, thereby relieving the attack). The patient may be systemically unwell, with severe headache, nausea and vomiting.

Acute angle closure glaucoma must not be missed, or the eye may be damaged permanently. The eye is inflamed and tender. The cornea is hazy and the pupil is semi-dilated and fixed. Vision is impaired according to the state of the cornea. On gentle palpation, the affected eye feels harder than the other eye. The anterior chamber appears shallower than usual, with the iris being close to the cornea.

Management includes urgent referral to ophthalmology. Intravenous acetazolamide 500 mg should be given and pilocarpine 4% instilled in the eye to constrict the pupil. Initially, the pressure must be decreased medically and a hole then made in the iris with a laser (iridotomy) or surgically (iridectomy) to restore normal aqueous flow. The other eye should be treated prophylactically. If treatment is delayed, adhesions may form between the iris and the cornea or the trabecular meshwork may be irreversibly damaged, necessitating a surgical drainage procedure.

## Scoring Scenario 10.1: Acute red eye

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction and offers analgesia | 0 | 1 | — |
| Conducts a focused ophthalmological history:<br>• onset/duration of symptoms<br>• associated visual impairment/loss<br>• floaters/haloes<br>• nausea/vomiting<br>• discharge/watery eye<br>• photophobia<br>• associated pain<br>• previous ophthalmological problems<br>• history of trauma/foreign bodies<br>• use of contact lenses/glasses<br>• focused medical history (diabetes, high blood pressure, rheumatological disorders, medications) | 0 | 1 | 2 |
| Makes external assessment of eyes:<br>• Looks for periorbital swelling<br>• Looks for proptosis/exophthalmos<br>• Looks for discharge/lacrimation<br>• Looks for redness/subconjunctival haemorrhage/corneal injection<br>• Examines pupil size/shape/response to light/afferent defect<br>• Inspects inner surfaces of eyelids carefully for foreign bodies<br>• Assesses eye movement (restriction/pain) | 0 | 1 | 2 |
| Checks visual acuity with a Snellen chart (suggests use of pinhole camera) | 0 | 1 | — |
| Checks for peripheral visual field defects | 0 | 1 | — |
| Suggests dilating pupils prior to fundoscopy | 0 | 1 | — |
| Performs fundoscopy appropriately and checks red reflex | 0 | 1 | — |
| Suggests a slit-lamp examination with fluorescein staining to look for ulcers/abrasions | 0 | 1 | — |
| States intention to test colour vision with an Ishihara chart | 0 | 1 | — |
| Ask for blood pressure and urine dipstick | 0 | 1 | — |
| Offers differential diagnosis:<br>• conjunctivitis (bacterial/viral)<br>• iritis<br>• episcleritis<br>• glaucoma (older patient) | 0 | 1 | 2 |
| Arranges follow-up and gives appropriate advice (viral conjunctivitis is highly contagious) | 0 | 1 | — |
| **Score from patient** | | /5 | |
| **Global score from examiner** | | /5 | |
| **Total score** | | /25 | |

## SCENARIO 10.2: ACUTE LOSS OF VISION

A 70-year-old woman attends the emergency department with a complaint of sudden visual loss in the left eye this morning. Take a focused history and perform an appropriate examination of the visual system. Give the possible causes and outline a management plan.

## SUGGESTED APPROACH

Sudden visual loss requires rapid assessment and treatment. It is important to determine the onset and duration of the visual loss and whether there has been any progression or recovery.

Introduce yourself appropriately. Confirm the patient's name. The patient may understandably be upset, and accurate diagnosis will often depend on your ability to reassure them in order to obtain an accurate and swift history and examination.

It is essential to establish that this is truly a sudden loss of vision and not simply a longstanding loss that has gone unnoticed.

Identification should be made of any associated features, such as visual symptoms or pain, that preceded visual loss. Obtain clarification of general medical history, such as diabetes or hypertension.

### Examination

Examine the eye as described in Scenario 10.1.

### Differential diagnosis and management

The causes of sudden onset of visual loss are numerous (Box 10.1). They can be classified anatomically from the anterior to the posterior axis of the eye.

**Box 10.1** Causes of sudden visual loss

**Painful**
- Angle closure glaucoma
- Retrobulbar optic neuritis
- Giant cell arteritis
- Orbital cellulitis
- Uveitis
- Endophthalmitis
- Corneal ulcer/keratitis

**Painless**

*Fleeting*
- Embolic arterial occlusion
- Migraine
- Raised intracranial pressure
- Prodromal in giant cell arteritis

*Prolonged*
- Ischaemic optic neuropathy
- Retinal artery occlusion
- Retinal vein occlusion
- Vitreous haemorrhage
- Retinal detachment
- Age-related macular degeneration
- Other macular disease
- Orbital disease affecting the optic nerve
- Intracranial disease affecting the visual pathway

### *Corneal ulcer/keratitis*

The development of a corneal ulcer or keratitis may lead to rapid visual loss – usually, but not always, with severe pain.

### *Anterior uveitis*

Anterior uveitis may cause some blurring of vision when inflammatory cells adherent to the back of the cornea (keratitic precipitates) lie on the visual axis.

### *Posterior uveitis*

With posterior uveitis, visual loss may be caused by vitritis (inflammation of the vitreous). This may be associated with local retinitis or choroiditis, with further visual loss due to retinal damage. The eye may be painful and photophobic.

### *Acute angle closure glaucoma*

Sudden onset of corneal oedema and clouding in acute angle closure glaucoma causes blurred vision, severe pain and redness of the eye. A history of attacks of blurred vision and eye pain or headache that then subsided is given by the patient. These prodromal attacks may be precipitated in the dark, by pupil dilatation.

### *Proliferative diabetic retinopathy*

A common cause of sudden, painless visual loss is a bleed into the vitreous, which may result from the rupture of abnormal capillary vessels growing from the surface of the retina in proliferative diabetic retinopathy.

### *Wet age-related macular degeneration*

Wet age-related macular degeneration can cause a sudden loss of vision. Central vision is lost, but peripheral vision is retained. Central serous retinopathy or a macular hole may cause a sudden central visual loss.

### *Retinal detachment*

Retinal detachment (Figure 10.1) may be preceded by floaters, due to a small vitreous bleed or to a vitreous detachment and condensation of the vitreous gel. Vitreous detachment also puts traction on the retina, giving symptoms of flashing lights. Patients may report premonitory flashing lights or a 'snowstorm', before developing cloudy vision. Retinal detachment occurs commonly in people with myopia or diabetes, in elderly people and following trauma. The affected retina is dark and opalescent, but may be difficult to visualize. Urgent referral to ophthalmology is needed for surgery and reattachment.

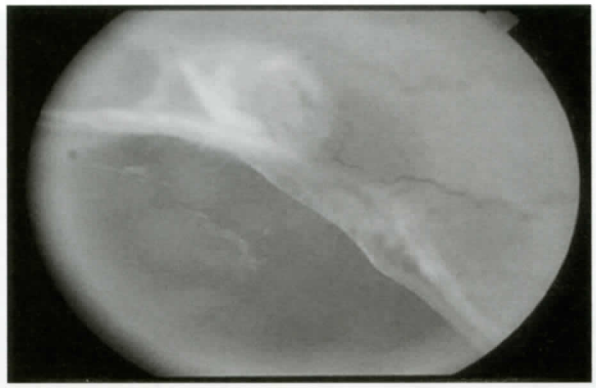

**Figure 10.1** Retinal detachment.

### *Venous or arterial occlusion*

Sudden painless loss of vision involving the whole visual field may result from total occlusion of the central retinal vein or retinal artery. A partial loss of vision is caused by a branch occlusion. Direct pupil reaction is sluggish or absent in the affected eye, but the pupil reacts to consensual stimulation (afferent pupillary defect). The retina is pale, with a swollen pale optic disc and 'cherry-red macula' (the retina is thinnest here and the underlying choroidal circulation is normal) (Figure 10.2). The retinal blood vessels are attenuated and irregular ('cattle-trucking' in arteries).

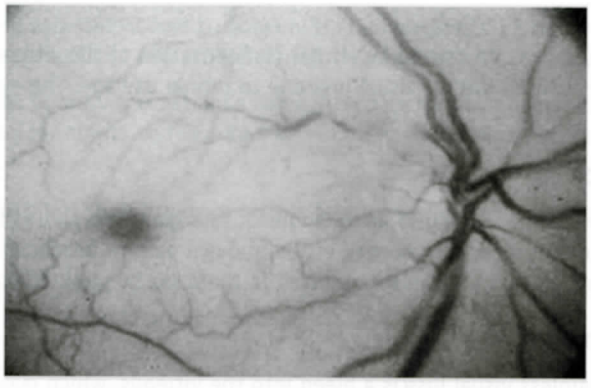

**Figure 10.2** Central retinal artery occlusion.

Put out an urgent call for the ophthalmologist. Meanwhile, start treatment by digitally massaging the globe for 5 seconds every 10 seconds to decrease intraocular pressure and dislodge the embolus. Sublingual glyceryl trinitrate (GTN) and intravenous acetazolamide 500 mg (which decrease intraocular pressure) can be started.

Central retinal vein occlusion is a more frequent cause of sudden painless visual loss than arterial occlusion. Old age, chronic glaucoma, arteriosclerosis, hypertension and polycythaemia are the main predisposing factors. There is markedly reduced visual acuity and often an afferent pupillary defect. Ophthalmoscopy shows a 'stormy sunset' appearance (hyperaemia with engorged veins and adjacent flame-shaped haemorrhages) (Figure 10.3). The disc is obscured by haemorrhages and oedema. Cotton-wool spots may be visible. There is no specific treatment, but underlying causes may be treatable and so provide protection for the other eye.

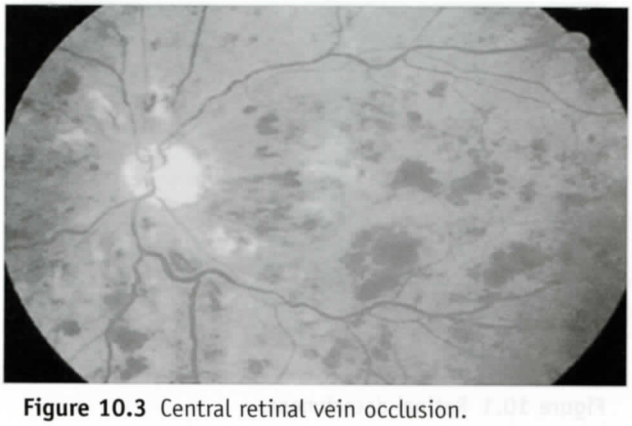

**Figure 10.3** Central retinal vein occlusion.

### *Amaurosis fugax*

A transient loss of vision, lasting minutes and said to be like 'a shutter coming quickly across the vision', is known as amaurosis fugax. This is caused by a platelet embolus passing through the retinal circulation. This is usually classified as a form of transient ischaemic attack (TIA) and should be investigated and managed accordingly.

### *Migraine*

Occasionally, visual loss is attributable to a migraine attack causing vasospasm of the retinal vessels.

### *Anterior ischaemic optic neuropathy*

Anterior ischaemic optic neuropathy (AION) results from a sudden decrease in blood supply to the optic nerve head. It presents with loss of vision. It may be caused by giant cell arteritis, with associated symptoms of pain in the temple, jaw claudication, shoulder pain and tiredness. There is profound loss of vision in the affected eye. AION is also seen in patients with vascular disease, and with ageing, diabetes or hypertension. The risk is increased in those with small, crowded optic discs. The loss of field is painless. Symptoms often occur in the morning, perhaps because of decreases in blood pressure and optic nerve head perfusion pressure during sleep. The visual loss affects the upper or lower visual field.

### *Giant cell (temporal) arteritis*

In giant cell arteritis, inflammation of the posterior ciliary arteries results in rapid and profound visual loss. Usually this presents in people over 50 years of age (with a female predominance) and is associated with polymyalgia rheumatica. Visual loss is preceded by headache, jaw claudication and muscular pains. The temporal arteries are tender to palpation. The ischaemic disc is pale, waxy and elevated and has splinter haemorrhages. On suspicion, give intravenous hydrocortisone 200 mg or oral prednisolone 60 mg and check the erythrocyte sedimentation rate (ESR) (typically this is much greater than 40 mm $h^{-1}$, but can be normal) before referral to the acute medical team.

## Pathology images

With this type of OSCE, you may be asked to take a history from a healthy patient/actor, perform your fundocopy on a model and describe your findings to the examiner. Alternatively, you may be shown an image of retinal pathology to comment on. You should be able to identify the following:

- hypertensive retinopathy
- diabetic retinopathy
- retinal detachment (Figure 10.1)
- retinal artery occlusion (Figure 10.2)
- retinal vein occlusion (Figure 10.3)

## Scoring Scenario 10.2: Acute loss of vision

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction and offers analgesia | 0 | 1 | — |
| Conducts a focused ophthalmological history:<br>• onset/duration of symptoms<br>• associated visual impairment/loss<br>• floaters/haloes<br>• characteristics of visual field loss (partial/total)<br>• discharge/watery eye<br>• photophobia<br>• whether marked pain is associated with visual loss and whether there is jaw claudication/scalp tenderness<br>• previous ophthalmological problems<br>• history of trauma<br>• use of contact lenses/glasses<br>• focused medical history (diabetes/high blood pressure/ rheumatological disorders/medications)<br>• history of migraines | 0 | 1 | 2 |
| Makes external assessment of eyes:<br>• Looks for periorbital swelling<br>• Looks for proptosis/exophthalmos<br>• Looks for discharge/lacrimation<br>• Looks for redness/subconjunctival haemorrhage/corneal injection<br>• Examines pupil size/shape/response to light/afferent defect<br>• Inspects inner surfaces of eyelids carefully for foreign bodies/ ulceration<br>• Assesses eye movement (restriction/pain) | 0 | 1 | 2 |
| Checks visual acuity with a Snellen chart (suggests use of pinhole camera) | 0 | 1 | — |
| Checks for peripheral visual field defects | 0 | 1 | — |
| Does not recommend dilating pupils, since this may exacerbate glaucoma | 0 | 1 | — |
| Performs fundoscopy appropriately and checks the red reflex | 0 | 1 | — |
| Suggests a slit-lamp examination with fluorescein staining to look for ulcers/abrasions | 0 | 1 | — |
| States intention to test colour vision with an Ishihara chart | 0 | 1 | — |
| Ask for blood pressure and urine dipstick | 0 | 1 | — |
| Offers differential diagnosis:<br>• temporal arteritis<br>• glaucoma<br>• optic neuritis<br>• uveitis | 0 | 1 | 2 |

*Continued*

**Scoring Scenario 10.2** *Continued*

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Orders blood tests, including ESR | 0 | 1 | — |
| Makes urgent referral to ophthalmology and suggests commencing patient on steroids | 0 | 1 | — |
| Addresses patient's concerns about coping with disabled husband | 0 | 1 | — |
| **Score from patient** | **/5** | | |
| **Global score from examiner** | **/5** | | |
| **Total score** | **/27** | | |

## SCENARIO 10.3: TRAUMATIC EYE INJURY

A 20-year-old man has been involved in a fight, during which he sustained injuries to the left eye. You are asked to assess the patient and manage as appropriate.

## SUGGESTED APPROACH

Introduce yourself appropriately. Early on in your assessment, you should double-check the mechanism of injury, and any other injuries that may have occurred. Note that if the patient is inebriated or has a reduced level of consciousness, it may be necessary to proceed with advanced trauma life support (ATLS) guidelines and carry out a primary survey to exclude life-threatening emergencies.

Assess exactly how the injury occurred. Blunt trauma from objects may result in severe damage to the globe, particularly when there is high-velocity impact (e.g. a squash ball injury). Penetrating trauma can also damage ocular structures, and it is important to examine the globe carefully for an entry point and also for foreign bodies.

In all cases, it is vital that visual acuity be recorded in both the injured and the uninjured eye. Where a penetrating injury is suspected, pressure to the globe should be avoided and it may only be possible to measure vision approximately in the injured eye. The skin around the orbit and eyelids should be examined carefully for a penetrating wound.

Damage to the orbit itself (a blow-out fracture) should be suspected if there is:

- paraesthesia below the orbital rim, suggesting infraorbital nerve damage
- air emphysema in the region of the maxillary sinus
- restriction of eye movement due to entrapment of the rectus muscles resulting in ophthalmoplegia

The eye may subsequently become recessed into the orbit (enophthalmos).

A laceration involving the medial canthus may result in damage to the lacrimal canaliculi, causing epiphora (excessive tear production) if untreated.

The eyelids should be everted to exclude a subtarsal foreign body. Proceed to examine the conjunctiva and sclera after administering local anaesthetic eye drops and performing a slit-lamp examination using fluorescein dye.

Examine the fundus with a direct ophthalmoscope, looking for damage to the optic disc as well as retinal haemorrhage. Absence of the red reflex may indicate a vitreous haemorrhage. The pupil may also show a fixed dilatation as a result of blunt trauma (traumatic mydriasis).

The optic disc may be pale from a traumatic optic neuropathy caused by avulsion of the blood vessels supplying the optic nerve.

Blunt trauma may cause haemorrhage into the anterior chamber, where blood collects, with a fluid level becoming visible (hyphaema). This is caused by rupture of blood vessels in the root of the iris; alternatively, the iris may be torn away from its insertion into the ciliary body (iris dialysis to produce a D-shaped pupil).

Dislocation of the lens may be suggested by a fluttering of the iris diaphragm on eye movement (iridodonesis). The lens clarity should be assessed with the slit lamp and against the red reflex after pupil dilatation. Cataracts can develop abruptly following direct penetrating trauma to the eye. Blunt trauma also causes a transient posterior subcapsular cataract within hours of injury.

## Management of traumatic eye injuries

If there is any doubt as to the diagnosis, referral should be made to the on-call ophthalmology team.

### *Lacerations to the skin and lids*

Lacerations to the skin and lids require careful suturing, especially if the lid margin is involved. This may necessitate referral to a plastic surgeon.

### *Corneal abrasions*

Abrasions of the cornea are very painful, but normally heal rapidly. Treatment is with antibiotic ointment, with or without an eye pad. Dilatation of the pupil with cyclopentolate 1% can help to relieve the pain caused by spasm of the ciliary muscle.

### *Corneal foreign bodies*

Foreign bodies in the cornea should be removed with a needle under topical anaesthesia. A rust ring may remain, but can be removed with a small rotating burr. Subtarsal objects can often be swept away from the everted lid with a cotton-wool bud. Treatment is then as for an abrasion. A CT scan may also be indicated if an intraocular foreign body is suspected, and imaging should be discussed with the ophthalmologist on call.

### *Hyphaema*

Hyphaema (Figure 10.4) usually settles with rest, but a re-bleed may occur in the first 5–6 days after injury. Children usually require admission to hospital for a period of observation, whereas adults can be treated at home, provided that they rest. Steroid eye drops are given for a short time, with dilatation of the pupil. Steroids reduce the risk of re-bleeds. The commonest complication is raised ocular pressure.

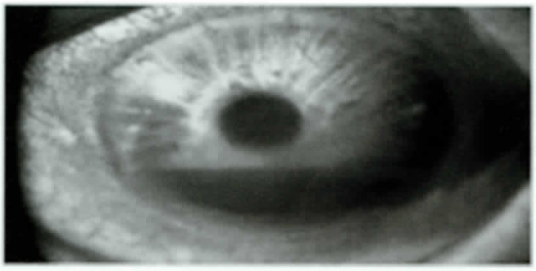

**Figure 10.4** Hyphaema.

### *Chemical injury*

In chemical injury, the most important aspect of treatment is immediate irrigation of the eye with copious quantities of clean water at the time of the accident. The nature of the chemical is ascertained by history and measuring tear pH with litmus paper.

### *Blow-out fracture*

If a blow-out fracture is suspected, a CT scan will delineate the bony and soft tissue injury. If this is not possible, plain facial X-rays are performed. Treatment may be delayed until the periorbital swelling has settled, and the patient should be referred for a maxillofacial opinion.

## Scoring Scenario 10.3: Traumatic eye injury

| | Inadequate/ not done | Adequate | Good |
|---|---|---|---|
| Appropriate introduction and offers analgesia | 0 | 1 | — |
| Ascertains mechanism of injury | 0 | 1 | — |
| Suggests performing a rapid primary survey to exclude life-threatening injuries | 0 | 1 | — |
| Provides adequate analgesia | 0 | 1 | — |
| Conducts a focused ophthalmological history:<br>• associated visual impairment/loss<br>• diplopia<br>• characteristics of visual field loss (partial/total)<br>• photophobia<br>• previous ophthalmological problems<br>• use of contact lenses/glasses (trauma may result in corneal abrasions)<br>• takes a focused medical history | 0 | 1 | 2 |
| Makes external assessment of eyes:<br>• Looks for periorbital swelling<br>• Looks for proptosis/exophthalmos<br>• Looks for bony tenderness/step deformity of orbital rim/zygoma<br>• Looks for subconjunctival haemorrhage<br>• Looks for hyphaema<br>• Examines pupil size/shape/response to light/afferent defect<br>• Inspects inner surfaces of eyelids carefully for foreign bodies/ ulceration<br>• Assesses eye movement (restriction/pain may suggest blow-out fracture) | 0 | 1 | 2 |
| Checks visual acuity with a Snellen chart (suggests use of pinhole camera) | 0 | 1 | — |
| Checks for peripheral visual field defects | 0 | 1 | — |
| Performs fundoscopy appropriately and checks the red reflex | 0 | 1 | — |
| Suggests a slit-lamp examination with fluorescein staining to look for ulcers/abrasions | 0 | 1 | — |
| States intention to test colour vision with an Ishihara chart | 0 | 1 | — |
| Checks tetanus status if there is a contaminated wound | 0 | 1 | — |
| Arranges appropriate imaging (facial views to exclude blow-out fracture)<br>Recognizes signs on a plain film | 0 | 1 | — |
| Makes referral to maxillofacial surgeon<br>Gives head injury advice prior to discharge | 0 | 1 | — |
| **Score from patient** | | **/5** | |
| **Global score from examiner** | | **/5** | |
| **Total score** | | **/26** | |