Management of pregnancy and obstetric complications in prehospital trauma care: faculty of prehospital care consensus guidelines

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ABSTRACT

This consensus statement seeks to provide clear guidance for the management of pregnant trauma patients in the prehospital setting. Pregnant patients sustaining trauma injuries have certain clinical management priorities beyond that of the non-pregnant trauma patients and that if overlooked may be detrimental to maternal and fetal outcomes.

INTRODUCTION

Trauma in pregnancy is a leading coincidental cause of maternal death worldwide and remains a common cause of fetal demise.[1] Anatomical and physiological changes in pregnancy need to be understood in order to adapt medical management and overcome the numerous challenges that exist for such patients. Great care must be taken when managing such patients, especially in high-energy trauma injuries.

Epidemiology of trauma occurring during pregnancy has been described within mostly North American literature. In total, 6–8% of all pregnant women will sustain traumatic injury,[2] 0.4% require hospital admission[3] and 0.1% will be victims of major trauma (Injury Severity Score >15).[4] Also, 50% of non-obstetric maternal mortalities are due to trauma.[5] Fetal mortality is also a considerable issue, with 3–7 fetal deaths per 100 000 live births as a result of trauma.[6]

In the UK, 1% of female patients of childbearing age sustaining major trauma injuries are pregnant and pregnant trauma patients have a higher mortality rate as a result of their injuries.[7]

The most common cause of isolated fetal death, following maternal trauma, is due to placental abruption. Placental abruption is thought to occur either as a result of shearing forces or a 'contrecoup' mechanism, leading to separation of the rigid placenta from the elastic uterus. Reported series demonstrate up to 50% of pregnant patients with major traumatic injuries and as many as 5% with minor injuries will suffer a placental abruption.[8]

Fetal mortality following maternal major trauma injury is seen to be just under 50%.[7] Should the fetus survive, the results of trauma during pregnancy on the long-term health of the fetus, even from minor injury, include significantly increased risks of preterm delivery and low birth weight.

Blunt trauma predominates over penetrating injury, and road traffic accidents account for the majority of blunt injuries in the UK.[7] However, penetrating abdominal injury carries major risk. Studies have demonstrated rates of fetal mortality of 73% and maternal mortality 63% from penetrating trauma.[1] Domestic violence is widely considered to be under-reported and is likely to be the second leading mechanism of traumatic injury in pregnancy after road traffic accidents.

This document was developed to provide guidance to prehospital practitioners regarding the clinical management considerations required when caring for a pregnant trauma patient, particularly emphasising aspects of care that differ or need special attention in order to optimise treatment. Many aspects of clinical practice for this uncommon, yet vulnerable patient cohort remain controversial and limited evidential support; the consensus opinion of the expert panel has been compiled to aid practical decision-making for prehospital personnel.

Applicability of recommendations in prehospital trauma care

Due to the varying levels of healthcare personnel delivering prehospital care services,[9] this set of recommendations should not serve to contravene practitioners' qualifications or scope of practice. A number of recommendations pertain to invasive or advanced procedures and may only be applicable to higher-level practitioners. Yet, all practitioners should be aware of these recommendations and understand the implications for management, particularly when senior support is required or when care should be expedited. Practitioners, irrespective of level, should endeavour to achieve best practice within their scope of practice and should be able to justify actions if they should be contrary to the agreed recommendations.

METHODS

A review of the literature was undertaken prior to the consensus meeting and information was distributed to panel members. Literature was compiled from searches of the Medline Database, using PubMed and Google Scholar, along with reference to international guideline documents. Search terms included *pregnancy, obstetrics, trauma, injury, fracture, haemorrhage, peri-mortem caeserean section,* and *resuscitative hysterotomy.*

The relevant literature was presented at a consensus meeting held at the Queen Elizabeth Hospital Birmingham on 27 November 2014. Invited panel members and organisational representatives, along with a multidisciplinary audience, discussed the topics in the format outlined in the recommendations section below, the conclusions of which were used to form the preliminary recommendations and

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were subsequently ratified by the expert panel and listed organisations.

Hierarchy of evidence[10] is applied to the level of recommendations and the underlying literature justifying each statement in accordance with the information displayed in tables 1 and 2.

The level of evidence is detailed within the main body of the text in order to illustrate the relative merit underpinning the recommendation and define the grade of recommendation made by the consensus panel.

Also defined at the consensus meeting was the decision for these guidelines to be subject to review on a five-yearly basis (2019) in order to update recommendations with any new scientific evidence found within the literature.

Recommendations

Definition of pregnancy in prehospital trauma care

When encountering a female trauma patient between the ages of 10 and 55 years old, the potential of pregnancy must be considered. If pregnancy has been confirmed, the gestational age should be sought and relayed in further communications. The presence of a pregnancy >20 weeks gestation will considerably alter trauma care management. If the exact gestational age cannot be established, examination of the uterine fundal height may act as a guide for estimating gestational age (see figure 1).

The guidelines are presented in order of clinical priority as one were conducting a primary survey of a female trauma patient.

Airway

1. A recommendation is made for the use of a smaller-size endotracheal tube (ETT) during intubation of the pregnant trauma patient. [C]

Due to the presence of laryngeal/nasopharyngeal and oropharyngeal oedema in pregnancy, the use of a smaller-size ETT may improve rates of successful intubation[11] [III]. Optimising patient positioning, through the use of 'head up' or 'ramping', should be used when possible[12] [IV]. There is also increased risk of aspiration in the pregnant patient. Gastric aspiration following intubation in obstetric patients is reported to occur in 1% of patients undergoing general anaesthesia. This is significantly higher than the non-obstetric population that ranges up to 0.1% incidence rate. Gastric aspiration following failed intubation of obstetric patients is reported to occur in 8% of cases.[13] Therefore, early intubation should be considered, especially if there is potential airway compromise and/or an anticipated long transit time. However, proficiency at the skill of endotracheal intubation is mandatory and should not be undertaken by those without the requisite skills or support.

2. A strong recommendation is made for the use of a second-generation supraglottic airway device as the rescue device of choice following failed intubation or when intubation is unavailable. [D]

Recognition must be made of the increased risk of intubation failure in obstetric patients.[12] The incidence of failed intubation in obstetric patients undergoing general anaesthesia was shown to be 1 in 225.[13] Increasing age, higher body mass index (BMI) and higher Mallampati score are significant independent predictors of failed tracheal intubation.[13] For every 1 kg/m^2 increase in BMI, there was a 7% increase in the risk of failed intubation.[13] Intubation in the prehospital setting for obstetric patients may be more challenging, given unfavourable conditions, lighting, limited assistance, and so on. Second-generation supraglottic airway devices have been demonstrated to be superior to that of first-generation devices[14] [IV]. Highlighted features include improved pharyngeal and oesophageal seals, integral bite block and the presence of a drainage port. In a survey of anaesthetic practice, the classical laryngeal mask airway was the most commonly used rescue airway used in approximately two-thirds of cases and are advocated following failed intubation[12–15] [IV]. Due to the range of available devices, and associated effectiveness, without sufficient scientific evidential support, no specific device is recommended.

3. A strong recommendation is given for the use of longitudinal incision over the midline of the neck at the level of the cricothyroid membrane to enable access to the trachea. [C]

The use of a longitudinal incision over the midline has been studied in non-obstetric patients and has been demonstrated to increase accuracy of incision placement. Thus, reducing the likelihood of iatrogenic injury or incorrect tube placement when establishing a surgical airway[16 17] [II]. The increased soft-tissue oedema experienced in pregnancy, along with increased adiposity, can result in difficulty identifying key soft-tissue landmarks for the placement of the surgical airway. Therefore, if there is an indication for a surgical airway, use of this optimal longitudinal incision is recommended. The use of a 'Bougie' to aid tube passage during surgical airway placement is also recommended, especially in situations of anticipated difficulty. When available and following requisite training, the use of ultrasound may assist in identifying anatomical landmarks, as well as correct tube placement[18 19] [IIb].

Needle cricothyroidotomy is not recommended as a satisfactory method of oxygenation and should only be attempted if no other resources or options exist, and evaluated on an individual basis.

Table 1 Levels of evidence

Level of evidence	Type of evidence
Ia	Evidence from systematic reviews or meta-analysis of randomised controlled trials
Ib	Evidence from at least one randomised controlled trial
IIa	Evidence from at least one controlled study without randomisation
IIb	Evidence from at least one other type of quasi-experimental study
III	Evidence from non-experimental descriptive studies such as comparative studies, correlation studies and case–control studies
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Table 2 Grades of evidence

Grade of recommendation	Type of evidence
A	Based on hierarchy I evidence
B	Based on hierarchy II evidence or extrapolated from hierarchy I evidence
C	Based on hierarchy III evidence or extrapolated from hierarchy I or II evidence
D	Directly based on hierarchy IV evidence or extrapolated from hierarchy I, II or III evidence

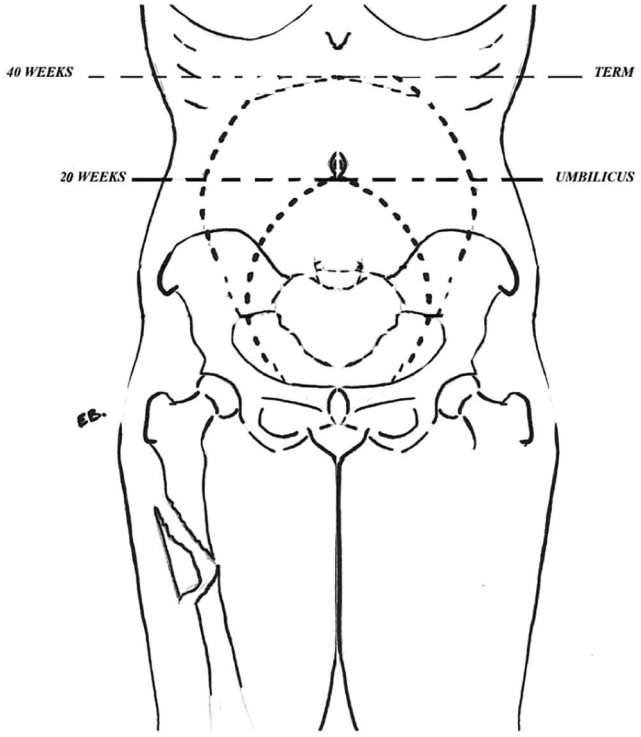

Figure 1 Uterine size and fundal height in relation to anatomical landmarks. Adapted from Battaloglu *et al*.[60]

Breathing

1. A strong recommendation is given for the provision of supplemental high-flow oxygen, via a non-breathing mask with reservoir bag, in the immediate management of the pregnant trauma patient. Following stabilisation or after minor injury, supplemental oxygen should only be given in the presence of hypoxaemia to maintain oxygen saturation 94–98%. [D]

Physiological changes in pregnancy result in significantly increased oxygen consumption compared with the non-pregnant state. These changes impact on the ability of the pregnant trauma patient to tolerate hypoxic conditions, particularly due to hypovolaemia or thoracic injury. Current British Thoracic Society 'Guidelines for emergency oxygen use in adult patients' advocate the use of oxygen for all patients with major trauma or obstetric emergencies. Treatment should be initiated through the use of a non-rebreathing reservoir mask at 10–15 L/min and aim for oxygen saturations within the range of 94–98%[20] [IV].

Evidence for the effect of high concentrations of inspired oxygen for patients with hypoxaemia is unquestioned; however, an increasing strength of evidence is emerging for the potentially detrimental effects of hyperoxaemia. Maternal oxygen supplementation during elective caesarean section has been shown to increase the requirement for neonatal resuscitation, and neonatal resuscitation with 100% oxygen is no longer recommended.[21 22] Primary focus following maternal trauma must be placed upon the optimal management of maternal health. Within prehospital environments, where comprehensive patient evaluation can be difficult, initial supplemental oxygen should not be withheld. Titration of therapy may be considered to avoid hyperoxaemia and can be delivered by simple facemask, Venturi mask or nasal cannulae. This decision should be taken on an individual basis in stabilised patients without critical or suspected critical conditions.

2. A strong recommendation is given for thoracostomy sites or the insertion of intercostal drains, when clinically indicated, to be made in either the third or the fourth intercostal space and anterior to the mid-axillary line. [D]

Due to the position of the uterus within the abdomen, careful anatomical consideration must be given to the level of the diaphragm when performing thoracic procedures in the pregnant trauma patient. The uterus may displace the diaphragm up to 4 cm cephalad.[23] Therefore, in order to reduce the risk of iatrogenic injury to vital organs or the elevated diaphragm, the site of thoracostomy should be higher than the classical fifth intercostal space[24 25] [IV].

Circulation

1. A recommendation is given for limited reliance to be placed on BP as a marker of hypovolaemia following trauma. [D]

There is very limited information about the physiological burden of trauma in pregnancy. Yet, the physiological response to obstetric haemorrhage is well described. HR is the primary physiological marker to change during pregnancy, rising by 8–16 beats/min.[26 27] The effect may be less evident in supine or lateral positions and more evident during sitting.[28] Notable expansion of blood volume also occurs during pregnancy, increasing approximately 1500 mL,[29] of which 1000 mL is plasma volume and 500 mL is erythrocytes.[30 31]With plasma volume amplified more than red blood cell volume, up to 45% over pre-gravid levels, the resultant hypervolaemic state is often referred to as 'physiological anaemia of pregnancy'.[32] Blood volume expansion may be even greater in multiple pregnancy.[31]

The effect of this dilution means that the circulating volume in pregnancy increases to 100 mL/kg. This serves to act as a protective factor for mother and fetus during periods of haemorrhage, traumatic or obstetric.

BP is not increased in normal pregnancy due to decreased peripheral vascular resistance.[32] Both the systolic and diastolic BPs decrease until 24 weeks gestation, with gradual recovery to prepregnancy levels by the latter stages of gestation.[33] Systolic pressure may remain stable, whereas diastolic pressure decreases up to 15 mm Hg in mid-pregnancy.[34] Pregnancy maximally dilates the uterine vasculature, so that autoregulation is compromised. Uterine blood flow is directly dependent upon maternal mean arterial pressure.[35]

Measurement of the brachial arterial pressure may not give a true indication of uterine arterial pressure and the uterine arterial pressure can be extremely low, even when the brachial arterial pressure is normal. The uterine blood flow increases from approximately 50 mL/min prepregnancy to 500 mL/min at 40 weeks gestation. The corresponding change in systemic cardiac output, directed to the uterus, rises from 2% to 18% during the third trimester.[36 37]

The combination of the increased HR, circulating volume and the lower vascular resistance of the uterus and placenta leads to an increase in resting cardiac output, approximately 25% greater than pre-gravid levels.[38] There is, therefore, a greater compensatory ability to maintain BP following haemorrhage. As a result of these physiological changes during pregnancy, the pregnant trauma patient may lose up to 35% circulating blood volume prior to exhibiting signs or symptoms of hypovolaemic shock.

2. Examination of the uterus and external genitalia is recommended to complete abdominal evaluation for haemorrhage. [D]

The principal obstetric complication of concern to the prehospital practitioner when encountering a pregnant trauma patient is antepartum haemorrhage (APH). Although defined as

bleeding in pregnancy after 24 weeks gestation, significant haemorrhage can occur at any gestation. APH has an overall incidence of 3–5% in pregnancy. Classification is based upon blood loss; minor (>50 mL), major (50–1000 mL), massive (>1000 mL) and torrential (uncontrollable or life-threatening). Visual estimation of blood loss however is often inaccurate and should not be relied upon for diagnosis. In a hospital setting, additional factors that can be considered in diagnosis of major APH include a fall in haemoglobin >4 g/dL or the requirement for a red blood cell transfusion of greater than four units. However, the ability to judge the severity of APH in the prehospital setting is extremely limited. Thus, any bleeding in the presence of traumatic injury should be regarded as being clinically significant and should influence clinical decision-making regarding acute management and transfer destination.

Complications of APH include intrauterine death/fetal demise, disseminated intravascular coagulopathy and maternal mortality. The most common causes of traumatic APH are placental abruption and uterine rupture. Placental abruption is the separation of the placenta from the uterine wall. Uterine rupture is the term for any breach in the myometrial wall of the uterus and can be potentially catastrophic. APH can be either concealed or revealed. Concealed haemorrhage can occur in up to 20–35% of APH cases overall[39] [III]. There is potential for a concealed haemorrhage to be massive and thus abdominal examination is vital. Principal clinical features suggestive of uterine injury include abdominal pain, tenderness on abdominal palpation, rigidity of the uterus, absence of fetal HR on auscultation and evidence of injury to the external genitalia. Failure to examine the uterus can lead to potentially missing a source of significant injury and is recommended as part of thorough evaluation.

3. Manual uterine displacement or left tilt positioning is recommended at all times for the pregnant trauma patient. [D]

The positioning of the pregnant trauma patient has significant implications for the anatomy, physiology and treatment. A clarification of positioning, including definition of terminology, is provided below.

A. Supine: In the supine position, lying flat on her back, the pregnant woman's uterus will apply extrinsic compression of the inferior vena cava (IVC)[40] and laterally displaces the subrenal aorta.[41] Compression of the IVC reduces maternal cardiac output[42–45] and can result in patients developing supine hypotension syndrome (SHS), compromising circulation. Caval compression is often concealed, with only 10% of pregnant women exhibiting SHS.[46 47] SHS is most often encountered in late pregnancy; however, it may be seen from the 20th week of gestation and in the postpartum period.[48] Moreover, placental blood flow is compromised despite the absence of maternal symptoms or signs.

B. Tilt: In order to avoid or reduce the uterine compression of the IVC and resulting propensity for SHS, while maintaining an inline spinal immobilisation position, the patient can be tilted to the left or right side. The angle and direction of tilt has an important effect on compression of the IVC. The IVC, along with the abdominal aorta, runs in the midline of the retroperitoneal space. The IVC is right of the midline and the aorta is to the left. Therefore, a benefit is achieved from left tilt (or right side up) to offload the IVC. The angle of tilt required to achieve uterine displacement is demonstrated only by a minimum of 15° tilt.[49] Tilt <15° is not associated with a reduction in aortocaval compression.[50 51] Right tilt (or left side up) <15° is associated with decreased cardiac output as a result of caval compression.[50] However, even left tilt to 15° may not sufficiently alleviate caval compression and there may be ongoing haemodynamic compromise. Therefore, the pregnant patient should be tilted to the patient's tolerance as well as to be clinically practical and safe.

C. Lateral: The lateral position is the rotation of the patient by 90°, either right or left, dependent upon clinical findings or needs. Lateral positioning in either direction avoids uterine compression of the IVC. Inline spinal immobilisation can be preserved in the lateral position, but requires sufficient personnel/equipment to maintain in a safe fashion.

D. Recovery: The standard recovery position is also sufficient to avoid uterine compression of the IVC. Yet, this slumped position proves difficult to maintain spinal immobilisation and should be used when maintaining the airway takes clinical priority or spinal injury is not suspected.

Manual uterine displacement is the term given for the act of physical shifting of the uterus from the midline position as an alternative method of alleviating uterine compression of the IVC. It requires a technique of 'up, off and over' in order to displace the uterus. Proper instruction in performing this technique is required to ensure sufficient uterine displacement is achieved.

The consensus group makes recognition of the fact that in the majority of ambulances across the UK, positioning of pregnant trauma patient in left tilt would result in the patient facing the sidewall of the vehicle. Manual uterine displacement should be used if the patient does not tolerate tilting or require intervention. Yet, the maintenance of manual uterine displacement during transportation may be challenging and potentially hazardous to prehospital personnel. Therefore, the optimal positioning of the pregnant trauma patient should be selected on an individual basis and make consideration of the relative risks and benefits dependent upon situational factors.

4. A recommendation is given to aim for the establishment of circulatory access above diaphragm in the pregnant trauma patient. [D]

The standard protocol for trauma patients should be to establish dual site intravenous access with large bore cannulas (Advanced Trauma Life Support). The consensus group recognises the potential for sub-diaphragmatic circulatory access to be compromised by uterine compression of the IVC; therefore, the primary site of circulatory access should be placed in the upper limbs or neck. Intraosseous access is a useful alternative to gain circulatory access and is recommended as a rescue measure when intravenous access cannot be established easily or promptly[52] [III].

Sites for intraosseous access include humeral head, sternum or proximal tibia. The site of intraosseous access should avoid extremity injuries and attempt to avoid suspected fracture sites or be outside zones of injury where possible. If appropriate, intraosseous access should be placed in the right humeral head to facilitate left tilt/left lateral positioning of the patient.

5. A recommendation is given for the early administration of blood products in the aggressive volume resuscitation of the pregnant trauma patient. [C]

Administration of non-blood products for volume resuscitation further increases the physiological anaemia of pregnancy. Therefore, infusing large volumes of crystalloid or colloid fluids should be avoided. Only sufficient amounts to maintain life should be administered, titrated against a palpable radial pulse to determine the required volume.

The activation of a Massive Transfusion Protocol for the pregnant trauma patient with suspected haemorrhage is advisable[53] [II]. If prehospital blood transfusion is not available, this

requirement should be relayed to the receiving facility in order to expedite the availability of blood products for resuscitation. Recent advances in resuscitation principles in both trauma and obstetric haemorrhage indicate survival improvements from the use of early blood resuscitation[54] [III].

6. A strong recommendation is made for the use of tranexamic acid (TXA), as per local guidelines in trauma, for pregnant trauma patients. [B]

TXA has been demonstrated to confer improved survival benefits when administered to bleeding trauma patients[55] [I/II]. Early administration, within 3 hours of injury, is required in order to maximise benefits and avoid potential harm; therefore, prehospital services play a crucial role in its administration. Evidence has demonstrated that TXA is effective in obstetric haemorrhage; however, clinical safety is yet to be proven[56 57] [IV].

7. A strong recommendation is made for the use of pelvic binder devices, as per local guidelines in trauma, for pregnant trauma patients. [C]

Further guidance can be found on the prehospital management of pelvic injuries in 'The pre-hospital management of pelvic fractures: initial consensus statement'[58] [III]. Due to the range of available devices, and associated effectiveness, without sufficient scientific evidential support, no specific device is recommended.

Disability

1. Spinal immobilisation precautions are recommended, as per local guidelines in trauma, for pregnant trauma patients. [D]

Injury to the spine or spinal cord is comparable for pregnant and non-pregnant trauma patients alike. Although limited literature exists defining the relative risk of spinal injury for pregnant patients, an evaluation of the national trauma registry information has not demonstrated a difference in incidence[7] [IV]. The anatomical changes common in pregnancy may exacerbate risk of complication from cervical collars and should be given careful consideration. If a collar is not applied, pregnant trauma patients should have manual inline stabilisation maintained and minimal patient-handling measures used. Further guidance regarding prehospital minimal patient handling can be found in 'Minimal patient handling: a faculty of pre-hospital care consensus statement'[59] [III].

2. The placement of adjuncts to achieve sufficient patient tilt should be positioned below any spinal immobilisation devices and be supported along the length of any devices. [D]

In order to achieve a sufficient patient tilt to alleviate SHS, any wedge or alternative should be placed below any spinal immobilisation devices wherever possible (see figure 2).[60] Also, the wedge should support the length of the spinal immobilisation device in order to be a stable platform and prevent hinging under the weight of the patient. The consensus group undertook a practical demonstration of this method and unanimously agreed on its recommendation in the absence of evidence from the literature [IV].

Figure 2 Spinal immobilisation tilted. Adapted from Battaloglu *et al*.[60]

Resuscitation

1. A strong recommendation is given for cardiopulmonary resuscitation (CPR) to be performed in a supine position with manual uterine displacement. [B]

Patient positioning arises again when considering the clinical effectiveness of CPR. Closed chest cardiac compressions generate approximately 30% cardiac output when performed correctly; however, the levels of cardiac output decrease markedly if attempted in suboptimal positions.[61] Tilting, with a wedge/firm support acting as a splintage for the chest, results in only 80% compression force achieved compared with the supine position;[62] this is even further reduced if attempted in the lateral position[63] [II].

2. Resuscitative hysterotomy/perimortem caesarean section should be completed according to Faculty of Prehospital Care (FPHC) recommendations, following maternal cardiac arrest.

Further guidance regarding resuscitative hysterotomy/perimortem caesarean section may be found in the companion article.

Communication/voice procedure

1. A recommendation is given for the modification of the handover/interpersonal communication by healthcare professionals when managing pregnant trauma patients.[D]

(Example use: AT-MIST with modification in pregnancy)

A: age and *estimated gestational age*
T: time of injury
M: mechanism
I: injuries suspected and *potential obstetric complication*
S: signs and symptoms and *obstetric clinical findings*
T: treatment and *need for obstetrics or paediatrics/neonatology*
[D]

The use of a structured handover system, in order to aid the passage of relevant information in a timely fashion, which highlights aspects of patient characteristics, is recommended. Although evidential support is limited, the consensus group advocates the use of the structured handover, as shown above [IV].

Transportation and services

1. A strong recommendation is made that all pregnant trauma patients should be assessed primarily within the ED of the receiving facility and obstetric/paediatric/neonatal services should attend as clinically indicated. [D]

The consensus group unanimously agreed to the necessity for emergency care of pregnant trauma patients to take place within the ED of the receiving hospital. The ability to provide adequate trauma resuscitation and intervention may be compromised by delivering a pregnant trauma patient directly to a maternity unit.

Early notification of the receiving facility to alert the on-call obstetrician to attend the resuscitation of the pregnant trauma patient is advisable [IV].

2. A recommendation is given for 'D15 standard contract for Major Trauma Centres' to include and be mandatory for the provision of 'on-site or co-located' obstetric services. [D]

Currently, the commissioning requirements for the designation of a major trauma centre do not include the mandatory

provision of on-site, co-located or independent obstetric services. The consensus group advocates the care of pregnant trauma patients to be performed as part of a multispecialty combined care model for which obstetric services are mandatory [IV].

Obstetric services should therefore be available at all times to respond to trauma team activation, as clinically indicated.

3. A strong recommendation is given for the adoption of a sophisticated triage tool or review system to operate within all regional trauma networks. [C]

Recent literature has provided additional support for advocating the use of sophisticated triage tools by the prehospital services to guide destination of trauma patients to provide optimal treatment for their injuries. Higher levels of evidence are available from North American literature demonstrating the sensitivity and specificity of the national trauma triage tool[64 65] [III]. Limited evidence is available from the UK and currently no national standards exist.

4. A recommendation for the adaptation of UK Trauma Triage Tools when considering pregnant trauma patients is summarised below:

A. Pregnancy <20 weeks; follow normal triage tool pathway.
B. Pregnancy >20 weeks, otherwise trauma triage negative; attend nearest trauma unit with obstetric services.
C. Pregnancy >20 weeks, trauma triage positive; attend nearest Major Trauma Centre with available Obstetric Services. [B]

Evidence suggests that pregnancy is not shown to be an independent predictor for the need for major trauma activation[66 67] [IIb]. Although pregnancy alone should not be sole activation trigger for major trauma, all pregnant patients involved in trauma require competent assessment of the status of the pregnancy and adequate monitoring to exclude maternal and fetal injury.

SUMMARY OF RECOMMENDATIONS

Recommendations are summarised in table 3.

Table 3 Summary of recommendations

Recommendation	Grade of recommendation
Airway	
A recommendation is made for the use of a smaller size endotracheal tube during intubation of the pregnant trauma patient.	C
A strong recommendation is made for the use of a second-generation supraglottic airway device as the rescue device of choice following failed intubation or when intubation is unavailable.	D
A strong recommendation is given for use of vertical incision over the midline of the neck at the level of the cricothyroid membrane to enable access to the trachea.	C
Breathing	
A strong recommendation is given for the provision of supplemental high-flow oxygen, via a non-breathing reservoir mask, in the immediate management of the pregnant trauma patient. Following stabilisation or after minor injury, supplemental oxygen should only be given in the presence of hypoxaemia to maintain oxygen saturation 94–98%.	D
2. A strong recommendation is given for thoracostomy sites or the insertion of intercostal drains, when clinically indicated, to be made in either the third or the fourth intercostal space and anterior to the mid-axillary line.	D
Circulation	
A recommendation is given for limited reliance to be placed on BP as a marker of hypovolaemia following trauma.	D
Examination of the uterus and external genitalia is recommended to complete abdominal evaluation for haemorrhage.	D
Manual uterine displacement or left tilt positioning is recommended at all times for the pregnant trauma patient.	D
A recommendation is given to aim for the establishment of vascular access above diaphragm in the pregnant trauma patient.	D
A recommendation is given for the early administration of blood products in the aggressive volume resuscitation of the pregnant trauma patient.	C
A strong recommendation is made for the use of tranexamic acid, as per local guidelines in trauma, for pregnant trauma patients.	B
A strong recommendation is made for the use of pelvic binder devices, as per local guidelines in trauma, for pregnant trauma patients.	C
Disability	
Spinal immobilisation precautions are recommended, as per local guidelines in trauma, for pregnant trauma patients. [D]	D
The placement of adjuncts to achieve sufficient patient tilt should be positioned below any spinal immobilisation devices and be supported along the length of any devices. [D]	D
Resuscitation	
A strong recommendation is given for cardiopulmonary resuscitation to be performed in a supine position with manual uterine displacement.	B
Resuscitative hysterotomy/perimortem caesarean section should be completed according to FPHC recommendations, following maternal cardiac arrest.	D
Communication	
A recommendation is given for the modification of the handover/interpersonal communication by healthcare professionals when managing pregnant trauma patients.	
Transportation and services	
A strong recommendation is made that all pregnant trauma patients should be assessed primarily within the ED of the receiving facility and obstetric/paediatric/neonatal services should attend as clinically indicated. [D]	D
A recommendation is given for 'D15 standard contract for Major Trauma Centres" to include and be mandatory for the provision of "on site or co-located' obstetric services. [D]	D
A strong recommendation is given for the adoption of a sophisticated triage tool or review system to operate within all regional trauma networks. [C]	C
A recommendation for the adaptation of UK Trauma Triage Tools, when considering pregnant trauma patients is summarised below: A. Pregnancy <20 weeks; follow normal triage tool pathway. B. Pregnancy >20 weeks, otherwise trauma triage negative; attend nearest trauma unit with obstetric services. C. Pregnancy >20 weeks, trauma triage positive; attend nearest Major Trauma Centre with available obstetric services.	B

LIMITATIONS

This guideline is based on the best available evidence concerning prehospital obstetric and trauma care. However, a guideline can never be a substitute for clinical judgement and there may be cases where it is appropriate for clinicians to be guided according to the needs of individual patients. Furthermore, the responsibility for the care of individual patients rests with the clinician in charge of the patient's care and the advice offered in this guideline must, of necessity, be of a general nature and should not be relied upon as the only source of advice in the treatment of patients. Literature is limited, with very few high-level articles available, not requiring extrapolation or inference of conclusions/outcomes.

FURTHER RESEARCH

The recommendations provided in this consensus statement are based upon the available clinical literature, as well as the input from a wide range of experienced clinicians. Principal aspects requiring further investigation include robust epidemiological evaluation of the incidence of pregnancy in major trauma in the UK, the adequacy of tilt angle required to alleviate uterine compression of the IVC or to avoid SHS, comparison of tilt against manual uterine displacement in pregnancy. Further areas for research include the use of prehospital ultrasound for determining pregnancy status and the role of novel devices for front of neck access compared with standard surgical approach in pregnant patients requiring emergency airways. General aspects of prehospital trauma care, not limited to pregnancy, have been highlighted as part of this investigation, but are beyond the scope of this article at present.

SUMMARY

This consensus statement seeks to provide clear guidance for the management of pregnant trauma patients in the prehospital setting. Pregnant patients sustaining trauma injuries have certain clinical management priorities beyond that of the non-pregnant trauma patients and that if overlooked may be detrimental to maternal and fetal outcomes.

ENDORSEMENTS

Adult Life Support Group (MOET & POET)
Association of Ambulance Chief Executives; National Ambulance Service Medical Directors
British Association for Immediate Care (BASICS & BASICS Scotland)
Faculty of Pre-Hospital Care
Joint Royal Colleges Ambulance Liaison Committee
Obstetric Anaesthetists Association

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