

BET 2: DOES A NORMAL CT SCAN WITHIN 6 H RULE OUT SUBARACHNOID HAEMORRHAGE?

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ABSTRACT

A short cut review was carried out to establish whether a normal CT scan within 6 h of onset of a severe, sudden onset headache can be used to rule out a subarachnoid haemorrhage. Four studies were directly relevant to the question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of these papers are tabulated. The clinical bottom line is that a CT scan performed on a third generation scanner with thin slices, reported by a radiologist experienced in reporting CT brain scans, within 6 h of onset of the headache can be used to rule out a subarachnoid haemorrhage.

THREE PART QUESTION

In (patients presenting with a history of sudden onset headache) is a (CT scan within 6 h) sufficient to rule out (subarachnoid haemorrhage).

CLINICAL SCENARIO

A normally fit and well 26-year-old man presents to the emergency department with a sudden onset headache. It came on 2 h ago, and is the worst he has ever had. He has taken paracetamol without success. The headache made him feel very unwell, but he has no neurological symptoms. His Glasgow Coma Scale (GCS) is 15 and

Table 2 Relevant papers

Author, date, and country	Patient group	Study type	Outcomes	Key results	Study weaknesses
Perry <i>et al.</i> ¹ 2011, Canada	Patients over 15 years of age presenting with acute non-traumatic headache (maximum intensity within 1 h of onset), who had a CT scan as part of their evaluation. 953 patients, neurologically intact, GCS 15, had a CT scan within 6 h	Prospective multicentre cohort study of 3132 patients from 11 hospitals in Canada (2000–2009).	Confirmed SAH Overall sensitivity of CT scan for diagnosis of SAH. Overall specificity of CT scan for diagnosis of SAH. Sensitivity of CT within 6 hrs of onset. Negative predictive value of CT within 6 hrs.	240 (7.7%) 92.9% (95% CI 89.0% to 95.5%) 100% 100% (95% CI 97.0% to 100.0%) 100% (CI 99.5% to 100.0%)	Not all patients with a negative CT scan underwent lumbar puncture. 2% of patients were lost to follow-up, but 75% of these were known to be alive at 1 month after their initial presentation
Backes <i>et al.</i> ² 2012, the Netherlands	136 patients presenting with acute headache, no neurology, GCS 15, CT scan within 6 h and who underwent subsequent CSF analysis.	Single centre, retrospective database review	Sensitivity of CT Negative predictive value of CT	100% 100%	Retrospective study. All scans reviewed by neuroradiologist
Mark <i>et al.</i> ³ 2013, USA	55 patients with a diagnosis of subarachnoid haemorrhage on lumbar puncture after a negative CT scan within 6 h	Retrospective matched case-control study of patients presenting to 21 hospitals from 2000–2011	Negative predictive value of CT in confirmed SAH	80% (11 patients with a negative CT scan had blood in the CSF)	This study was performed to assess a clinical decision tool. It only assessed confirmed SAH rather than all patients presenting with symptoms (unknown number over this period). It included patients presenting with atypical symptoms including neurology, collapse, and neck pain alone. There was no subgroup analysis of those with headache only. The radiologists were not required to have advanced training in neuroradiology. Four of these patients had negative catheter angiography studies
Blok <i>et al.</i> ⁴ 2015, the Netherlands	760 patients presenting with acute headache, no neurology, GCS 15, CT scan within 6 h of onset of headache and was reported negative for SAH, and who underwent subsequent CSF analysis	Multicentre, retrospective case note and radiology review from 11 non-academic hospitals	Negative predictive value of CT	99.9% (CI 99.3% to 100%)	CSF results were considered positive for subarachnoid blood in 52 patients. Independent radiology review of the 52 CT scans confirmed no evidence of subarachnoid blood in all but 1 scan. Further investigation showed that this patient had suffered a nonaneurysmal perimesencephalic haemorrhage and had a 'benign clinical course'

CSF, cerebrospinal fluid; GCS, Glasgow Coma Scale; SAH, subarachnoid haemorrhage.

clinical examination is normal. You are concerned that he may have had a subarachnoid haemorrhage (SAH) and want to rule this out. He has a CT scan within 6 h of the onset of the headache. It is reported as normal. You wonder if this excludes a diagnosis of SAH.

SEARCH STRATEGY

(subarachnoid.mp. OR sub-arachnoid.mp.) AND (haemorrhage.mp. OR hemorrhage.mp. or exp Hemorrhage/) AND (6 hours.mp. OR six hours.mp.) AND (csf.mp. or exp Cerebrospinal Fluid/ OR lumbar puncture.mp. or exp Spinal Puncture/ OR xanthochromia.mp. OR bilirubin.mp. or exp Bilirubin/) AND (exp Tomography, X-Ray Computed/ or ct scan.mp.)

SEARCH OUTCOME

Ovid Medline (1946 to August week 2 2015): 13 papers, 4 of which were relevant to this question. These are presented in [table 2](#).

A search of the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews found no further papers relevant to the question.

COMMENTS

Headache is a common presentation to the emergency department, comprising approximately 2% of all attendances. Of these, 7% will have a SAH.⁵ Cerebrospinal fluid analysis has been regarded as essential to successfully exclude a SAH if the CT scan is normal.^{6 7} This dogma has not gone unchallenged, especially when the scan is performed within 12 h.⁸

Being able to rule out SAH in the emergency department using CT scan would be beneficial to patients. It would reduce inpatient admissions to carry out and await results from a lumbar puncture, which is an invasive procedure carrying risks of infection, pain, bleeding and dural puncture headache.

The evidence reviewed, with one exception, supports the use of a CT scan without lumbar puncture if patients present with an acute severe headache, no neurological deficit, and a normal level of consciousness. The exception was the study by Mark *et al*³ which found that 11 patients had missed SAHs despite an early negative CT brain scan. Vergouwen and Rinkel⁹ challenged the diagnostic criteria for these haemorrhages. For the scan to be diagnostic it must be done within 6 h of the onset of headache and must be reported by an experienced radiologist who regularly reports CT brain scans.¹⁰ In patients presenting with an absence of headache or with atypical features such as neck pain or stiffness, back pain or loss of consciousness, lumbar puncture is still indicated in the event of a negative CT scan.¹¹ All patients with a negative scan more than 6 h after the onset of their headache should have a lumbar puncture after 12 h.

Major international guidelines continue to recommend a lumbar puncture after negative CT brain scans irrespective of their timing.^{12 13} Clinical decision rules, which may give physicians the confidence to discharge more patients with a negative CT brain scan, are currently undergoing validation.

Clinical bottom line

CT scan alone is sensitive enough to rule out subarachnoid haemorrhage in patients presenting with lone acute severe headache, normal level of consciousness, and no neurological features, if performed within 6 h of onset with a third generation CT scanner with thin slices, and reported by a radiologist experienced in reporting CT brain scans.

Provenance and peer review Commissioned; internally peer reviewed.

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