The Leeds Teaching Hospitals NHS Trust

Centre for Reviews and Dissemination

Management of sudden onset severe headache presenting to the Emergency Department: A systematic review

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INTRODUCTION

Sudden onset severe headache is usually caused by a primary headache disorder but it may be secondary to a more serious problem, such as subarachnoid haemorrhage. Subarachnoid haemorrhage occurs when a weakened blood vessel supplying the brain suddenly bursts. Very few patients who present to an Emergency Department with headache have suffered a subarachnoid haemorrhage, but early identification is important to reduce the risk of death or severe disability. Diagnosis can be difficult in alert, neurologically intact patients; clinical features separating these patients from higher volume complaints with a similar presentation (e.g. migraine) are often unreliable indicators of who requires further investigation. UK guidelines recommend non-contrast computed tomography (CT) of the head followed by lumbar puncture to exclude subarachnoid haemorrhage, but guidelines pre-date the introduction of more sensitive modern CT scanners.

A systematic review was undertaken to assess the accuracy of diagnostic strategies for excluding subarachnoid haemorrhage in neurologically intact adult patients presenting to hospital with a sudden onset severe headache.

METHODS

Eighteen databases were searched in February 2020 to identify studies that assessed any clinical decision rule or diagnostic test for evaluating neurologically intact adults presenting to hospital with non-traumatic sudden onset severe headache (reaching maximum intensity within one hour). Study quality was assessed using criteria relevant to the study design; the majority of studies were assessed using the QUADAS-2 tool for diagnostic accuracy studies.

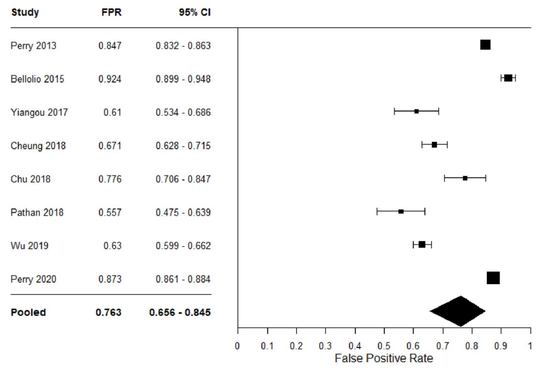
Where sufficient information was reported, diagnostic accuracy data were extracted into 2x2 tables to calculate sensitivity, specificity, false-positive and false-negative rates. Where equivalent diagnostic strategies or tools were used in three or more studies, hierarchical bivariate meta-analysis was used to synthesise results, otherwise studies were synthesised narratively.

RESULTS

Thirty-seven cohort/before and after studies were included. Twelve studies had a low risk of bias for all domains. Few studies had a high risk of bias for any of the domains; the risk of bias was unclear for several studies for each of the domains.

Eight studies that assessed the Ottawa subarachnoid haemorrhage clinical decision rule were pooled (total 8114 patients); sensitivity was 99.5% (95% confidence interval 90.8 to 100), specificity was 23.7% (95% confidence interval 15.5 to 34.4). The high false positive rate suggests that use of the tool would potentially result in 76.3% (95% confidence interval 65.6 to 84.5) of patients undergoing further investigation with no additional benefit.

Forest plot of false positive rates across studies assessing the Ottawa Rule



Four studies (conducted in centres with neuroradiology expertise) that assessed CT within six hours of headache onset were pooled (total 2377 patients); sensitivity was 98.7% (95% confidence interval 96.5 to 100), specificity was 100% (95% confidence interval 99.7 to 100). The sensitivity of CT beyond six hours from headache onset was considerably lower (≤90%; 2 studies).

Three studies that assessed lumbar puncture (cerebrospinal fluid assessed using spectrophotometry) following negative CT were pooled (total 1235 patients); sensitivity was 100% (95% confidence interval 100 to 100), specificity was 95.2% (95% confidence interval 86.0 to 98.5). Two studies reported that 5.3-9.5% patients returned to hospital after lumbar puncture with adverse events, such as headache and back pain. The pathway of CT followed by lumbar puncture also identified other significant pathologies, such as intracerebral haemorrhage, brain tumour and meningitis, meaning that the value of this pathway could extend beyond the identification of subarachnoid haemorrhage.

CONCLUSIONS

The evidence suggests that the Ottawa Rule is not sufficiently specific for ruling out subarachnoid haemorrhage and could result in additional unnecessary testing. There were no studies of other clinical decision rules for subarachnoid haemorrhage. CT within six hours of headache onset (with images assessed by a neuroradiologist or radiologist who routinely interprets head CT images) is highly accurate and likely to be sufficient to rule out subarachnoid haemorrhage. However, sensitivity reduces considerably over time, therefore, additional testing is more likely to be beneficial for ruling out subarachnoid haemorrhage and other significant pathologies. The pathway of CT followed by lumbar puncture is highly sensitive for detecting subarachnoid haemorrhage, although lumbar puncture resulted in some false-positive results and adverse events. Clinical and patient advisors emphasised the importance of shared decision making when considering subsequent tests after negative head CT, involving a clear discussion of the risks and benefits of further tests and taking into consideration the accuracy of CT.

Systematic review registration: The protocol was registered on PROSPERO (CRD42020173265).

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A full detailed report is available on the Centre for Reviews and Dissemination website: *https://www.york.ac.uk/media/crd/Sudden-onset-severe-headache-final-report.pdf*