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# An evaluation of the effect that the implementation of the NICE rules may have on a diagnostic imaging department for the early management of head injuries

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**Abstract** *Introduction:* Guidelines by the National Institute of Clinical Excellence (NICE) for the early management of minor head injuries initiate the use of computed tomography (CT) for patients who may be at risk of developing intracranial haematoma. This retrospective study was designed to evaluate the effect the implementation of the NICE guidelines would have on the diagnostic imaging department of a local district general hospital. The main objective was to establish if there would be an increase in the number of CT head referrals for patients with minor head injuries. Secondly to assess how the implementation of these guidelines would affect the workload to the diagnostic imaging department in terms of cost and time, and to discuss the issue of radiation dose to patients. *Method:* A sample of 100 patients who were referred from the Accident and Emergency department (A&E) for plain skull radiographs, over a 4-month period were selected. The clinical information on each of these patients' was then extracted and a data collection sheet was to assess each patient according to the NICE criteria. *Results and conclusion:* The study found an 18% ($n = 100$) increase in the referral rate for CT heads for patients presenting with minor head injuries. It was also found that the use of these guidelines would mean a decrease in cost to the diagnostic imaging department of £324. Furthermore a saving of 10 h of radiographers' time was established, although the effective radiation dose to patients would be increased by 29 mSv.

The NICE guidelines have proved efficient in identifying patients with intracranial damage although this coincides with an 18% ($n = 100$) increase in referral rates for CT and increased radiation dose to patients. However, the use of these guidelines would reduce workload to the diagnostic imaging department in terms of cost and time.


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## Introduction

Minor head injuries are common in the UK, with approximately 150,000 patients presenting to Accident and Emergency departments (A&E) in the UK each year.[1] ''Minor head injury is defined as a patient with a history of loss of consciousness, amnesia, or disorientation and a Glasgow Coma Score (GCS) score of 13–15.''[2]

Following on from this, data provided by the Department of Health; The Hospital Episode Statistics highlights that there are a high number of patients presenting to A&E departments with head injuries. This figure equates to approximately ''600,000 per annum attending A&E in England and Wales with a head injury''.[3] Of this figure, 90% present with minor or mild head injuries and 10% with moderate or severe head injury. Of the 600,000 patients, 4000 will require some form of neurosurgery and although the majority of these will be accounted for in the moderate to severe head injury group, there is a small but significant number of this 4000 that need to be identified from the minor/mild head injury group.[3]

Until recently, guidelines supplied by a working party of Neurosurgeons have been used to assess the management of head injuries. These guidelines relied heavily on the use of skull radiography as the primary diagnostic tool, and observation on wards for patients who were at risk of developing intracranial haematoma (ICH), with computed tomography (CT) being reserved for patients who had severe to moderate head injuries.[4]

The Royal College of Radiologists (RCR) stated, ''80% of patients with intracranial haematoma have skull fractures''.[5] This reported link between ICH and skull fractures gave rise to the high utilisation of plain skull radiography in the UK during the 1980s. However, the correlation between skull fractures and the development of ICH appears to be controversial. Briggs et al. believed the risk to be substantially lower than first thought stating that, ''in patients with a fracture who are fully conscious the risk of haematoma is about 1 in 30, and in those who are confused but have no fracture it is 1 in 100''.[4]

More recent studies also oppose theories, which suggest that the presence of a skull fracture is directly related to ICH. ''It is a misconception born of the belief that a skull fracture is invariably associated with significant intracranial injury (and conversely, that the absence of a fracture excludes such injury). Such an association does not exist.''[6]

A study carried out by Hofman et al. found that the use of plain skull radiography did not assist in the assessment of minor head injuries with associated ICH. It was identified that ''of the 735 patients who had an ICH in the 13 studies, only 322 (44%) had a skull fracture''.[7] This is considerably lower than the 80% stated by the Royal College of Radiologists in 1981. However, it is comparable to the suggestions of the working party of Neurosurgeons in 1984. The sensitivity for radiographic findings of skull fractures aiding diagnosis of ICH was 0.38, with a corresponding specificity of 0.95. This meant that a low number of patients actually had a skull fracture that led to a finding of an ICH. Therefore, patients could not be cleared of developing an ICH simply because no skull fracture was identified on a plain skull radiograph.[7]

As CT has developed there has been an increased understanding of the relationship between head injuries and intracranial damage.

> ''Concepts of certain intracranial events that occur soon after injury are changing in the light of evidence from computed tomography. In particular, it is clear that intracranial haematomas are more frequent and develop sooner after injury than previously realised.''[4]

An article by The Royal College of Neurosurgeons (1984) outlined guidelines in the British Medical Journal, which could be used for the initial management of head injuries in adults. This article introduced the need for a change in UK policy in order to prevent ICH occurring and to improve the overall management of patients with head injuries. They called for a change in current practice to reduce rates of avoidable mortality and morbidity caused by ICH. They also recognised the need for an increase in CT facilities and the need for a thorough clinical examination to determine which patients required immediate transfers to neurological centres where the majority of CT units were housed.

In North America, there has been a major shift towards the use of CT in minor head injuries. CT is being used extensively in some areas, with no clear guidelines for its use. The yield of patients being identified for intracranial lesions only amounts to between 0.7 and 3.7% and is costing approximately $135–216 million per annum.[2] Stiell et al. also state that ''current guidelines provide conflicting recommendations for use of CT and previous studies to develop guidelines have been methodologically weak and inconclusive''.[2]

When considering the use of CT, factors such as economic cost and radiation dose to the patient need to be considered. The effective dose for a skull radiograph is 0.07 mSv, compared to 2 mSv for a CT head. This highlights the need for tight controls and valid guidelines for CT scanning which has a higher effective dose than other methods of imaging. IR(ME)R (2000), states that ''doses arising from the exposure are kept as low as reasonably practicable consistent with the intended purpose''.[8]

In order for the use of CT to be effective and not economically draining, there was a need to establish guidelines which clinicians could use to ensure continuity of care. Guidelines, which have recognition from NICE, are the Canadian Head Rules, largely based on work by Stiell et al.[2]

Stiell et al.[2] believed that although CT was the best tool for evaluating ICH in patients with minor head injuries, it was also an expensive modality and therefore its use needed to be more selective. These rules took into account clinical information such as the patient's Glasgow Coma Score (GCS), neurological findings, and the suspicion of certain fractures such as depressed, open or basal skull fractures, amnesia and loss of consciousness. Other criteria such as mechanism of injury, age and history of anticoagulation were also taken into account.

This prospective study of 3121 patients was carried out using a multi-centred approach. Staff in all centres had attended a training session to assess the patients to the criteria outlined in these guidelines. A second radiologist reviewed all the CT images to increase the reliability of the definitive diagnosis.