

Management of head injury in children less than 2 years of age: high time for a guideline

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Abstract

The assessment of children aged less than two years who present with head injury poses a challenge to the examining doctor due to the inability of the patient to give a history. A literature search found only two sets of guidelines which include the management of children less than 2 years of age, namely the National Institute for Clinical Excellence (NICE) and the Division of Emergency Medicine, Children's Hospital of Harvard (DEMCHH) guidelines. A retrospective study was carried to assess current practice in the A&E department of St. Luke's Hospital. Our study showed that most patients (94%) underwent radiological investigation and more than 55% were advised admission. The development and implementation of evidence based guidelines would decrease the number of radiological investigations performed and the number of patient admissions.

Key words

Head injury, children, Malta

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Introduction

Head injuries account for a significant proportion of the workload of any Accident and Emergency department. In the UK approximately 500,000 children attend A&E every year after sustaining a head injury, with a mortality of 5.3 per 100,000 attendances.¹ Clinical guidelines for the management of head injured patients aim to enable the identification and investigation of those patients at risk of having intracranial injury (ICI) thus avoiding the unnecessary utilisation of resources. Whilst in theory this would be ideal, in practice this goal is difficult to achieve in a pre-verbal paediatric patient who is unable to give a clear history of symptoms and the preceding events.

Consequently of the many head injury guidelines currently in use, only two have been found to include the management of children less than two years of age. These are the National Institute for Clinical Excellence (NICE) guidelines,² and the Guidelines proposed by the Division of Emergency Medicine, Children's Hospital of Harvard (DEMCHH).³ These guidelines outline indications for investigation, type of investigation required and criteria for admission or discharge after investigation.

Methods

Data was collected retrospectively from the notes of patients younger than 2 years of age presenting to the A&E department, St. Luke's Hospital, Malta, between 1st August and 30th September 2006. The data collected included the presenting symptoms, the mechanism of injury, radiological investigations performed, the disposition of the patient, and the eventual outcome.

Results

During the months of August and September 2006 a total of 51 children attended the A&E department due to head injury. All cases were mild (i.e. with a Glasgow Coma Scale (GCS) of more than 13) and there were no cases of moderate or severe head injury. Forty (78.4%) of the patients had been asymptomatic after the head injury, whereas 11 (21.5%) had symptoms at presentation. Five patients had 1 to 2 bouts of vomiting, two had a persistent change in behaviour whilst in A&E, two showed transient altered behaviour and two had one episode of vomiting together with a transient change in behaviour.

Forty eight (94.1%) patients underwent radiological investigations (Figure 1). Skull X-Rays (SXR) were performed on 44 (86.3%) patients, 2 of whom also underwent a CT brain. A CT brain was performed on another four (7.8%) patients who had not yet undergone SXR. Only 3 (5.8%) patients were not investigated radiologically, one of whom had been offered SXR but the parents refused.

Twenty eight (54.9%) patients were offered admission of whom 11 (21.6%) were admitted and 17 (33.3%) were discharged against medical advice. Of the patients who were discharged at the request of the parents, only one had been symptomatic after the head injury. Twenty three (45.1%) patients were discharged home after being given paediatric head injury advice. All those patients who were admitted had an uneventful recovery, while none of the patients discharged home returned to A&E.

Discussion

Our study clearly highlights the high number of patients undergoing radiological investigations (94.1%) and the high rate of patients who are being offered admission (54.9%).

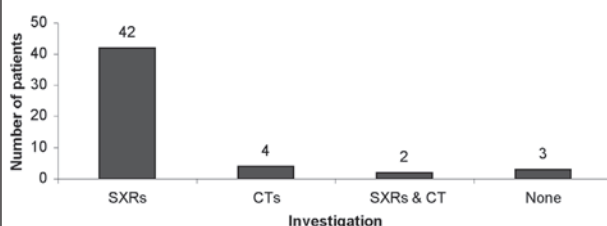
The aforementioned guidelines aim to identify, through clinical assessment, the patients who are more likely to develop intracranial injury (ICI). Clinical predictors of ICI identified in various studies include a decreased GCS, focal neurological signs and loss of consciousness (LOC).⁴ The presence of skull fractures increases the risk of ICI by four times.⁵ The mechanism of injury (MOI) may also increase the risk of ICI if there has been a fall of more than 1 metre or a motor vehicle accident.⁶

In a review by Dunning *et al.*, vomiting and post-traumatic seizures were not found to be significant in increasing the relative risk for ICI.⁷ Nonetheless both the NICE criteria and the proposed guidelines by DEMCHH include both vomiting and post traumatic seizures as being indications for investigating children with head injury.

The NICE guidelines advocate investigation in the following circumstances:

- a GCS of less than 13 at any point after the injury
- a GCS equal to 13 or 14 at two hours after the injury suspected open or depressed skull fracture, any sign of basal skull fracture
- post traumatic seizure
- focal neurological deficit

Figure 1: Radiological investigations performed on the sample studied



- more than one episode of vomiting after the head injury (clinical judgment should be used regarding the cause of vomiting if the patient is less than 12).

They also suggest investigation for those with a significant mechanism of injury and for patients with a coagulopathy.² Applying these guidelines to the patients included in our study would have resulted in 7 (13.7%) as opposed to 48 (94.1%) being investigated by either CT or skull X-rays. Five of these would have been performed due to a significant mechanism of injury and 2 due to vomiting.

The guidelines proposed by the DEMCHH stratify patients into low, intermediate or high risk categories for intracranial injury (Table 1). Investigation is advocated for all high risk patients and for none of those in the low risk category. For the group with moderate risk, the physician can choose between investigation and observation. Applying the risk stratification of the DEMCHH guidelines to the patients in this study would result

Table 1: Classification of children less than 2 years with minor head injury into high, intermediate and low risk. (Proposed guidelines by DEMCHH).¹

High risk

- Depressed mental status
- Focal neurological findings
- Seizure
- Irritability
- Bulging fontanelle
- Acute skull fracture
- LOC > 1 minute
- Vomiting > than 5 times or for >6 hours

Intermediate risk

- Vomiting 3-4 times
- LOC <1 minute
- Transient episode of lethargy or irritability
- Carers concerned about child's behaviour

Additional risk factors that should be considered in those at intermediate risk

- Significant mechanism of injury (Fall > 1 metre, MVA)
- Non frontal haematoma
- Unwitnessed trauma
- Falls on hard surfaces

Low risk

- Mechanism of injury not significant
- No signs and symptoms more than 2 hours after injury

Exclusion criteria: birth trauma, penetrating injury, pre-existing neurological damage, bleeding diathesis, multiple trauma, non-accidental injury.

in 6 (11.7%) patients being classified as having an intermediate risk for ICI (all of whom had a transient or persistent change in behaviour) and the remaining 45 (88.2%) being classified as low risk. None would have been considered high risk for ICI. Therefore the use of these guidelines would have resulted in a maximum of 6 (11.7%) patients being investigated.

The NICE guidelines advise the use of CT brain over SXR in all circumstances except when CT is not available and when there is suspicion of NAI, in view of typical radiological changes that can be seen in the SXR of these patients.

The guidelines proposed by the DEMCHH suggest CT for the high risk group. For patients in the intermediate risk group the guidelines allow a choice between a CT scan and an observation period of six hours. Patients in the intermediate group who are more likely to have sustained a skull fracture, namely patients with non frontal haematomas, falls of more than 1 metre, and falls onto hard surfaces (Table 1), can be alternatively also investigated by SXR.

Many studies have in fact questioned the utility of SXR in head injury. Studies show that the inexperienced eye can miss up to 50% of skull fractures, with a high number of false positives.^{8,9} Moreover, a fracture was only found in 60-80%

of ICI,⁴ which means that the absence of a fracture does not exclude ICI. A study by Reed *et al.*, showed that the abolition of SXR in management of head injury did not lead to an increase in missed ICI, while at the same time there was a reduction in the dose of radiation per head injury.⁸ In this light they suggest that SXR can be abandoned in children aged 1 to 14. Another study carried out by the same group, focused on patients aged less than 1 year.¹⁰ Their findings suggest that in this age group, unless non accidental injury is suspected, SXR should only be performed when there are non-frontal scalp haematomas. This suggestion is also supported by a number of studies which show that the presence of a scalp haematoma in an infant increases the risk of underlying skull fractures significantly^{11,12} while also being up to 80-100% sensitive for skull fractures.³

Therefore, if the NICE guidelines were to be applied the sample in this study, only 7 CT brain scans would have been performed (Figure 2). With the application of DEMCHH guidelines there would have been a maximum of 6 CT brain scans and 2 SXR being performed (Figure 2). Therefore if the guidance set out in the above guidelines were to be applied collectively in the most conservative manner possible, only 11 patients would have required investigation (Figure 2), with a maximum of 11 CT brain scans and 2 SXR. This significantly contrasts with the 6 CT brain scans and 44 SXR performed on the patients in our study (Figure 2). Consequently, the application of these guidelines would have drastically decreased the number of SXR performed with a slight rise in the number of CT scans.

The next step in the management of head injury is the decision to admit or discharge the patient. NICE indications for admission include:

- patients with new, clinically significant abnormalities on imaging
- patients who have not returned to a GCS of 15 after imaging
- patients who fulfill the criteria for CT scanning but this cannot be done from A&E
- the presence of continuing worrying signs such as persistent vomiting
- patients who might have had non-accidental injury

The proposed guidelines of the DEMCHH suggest admission for those who have a CT brain showing ICI, or a depressed or basilar fracture. These guidelines also suggest an observation period of six hours for those with intermediate risk for ICI when a CT brain scan is not performed immediately. All those patients with a normal CT brain and those at low risk for ICI can be safely discharged home after adequate paediatric head injury advice. These guidelines also allow patients with an isolated skull fracture on CT brain scan to be discharged home. The incidence for late deterioration in such children with isolated skull fracture was found to be zero in several studies.¹³

In the UK the rate of admission for head injury is about 10-15%.¹⁴ In our study 28 (55.5%) patients were advised admission, of whom 17 (33.3%) were discharged at the parents' request and 11 (21.6%) were admitted. This reflects the hesitancy of A&E

Figure 2: Radiological investigations performed with and without the application of guidelines

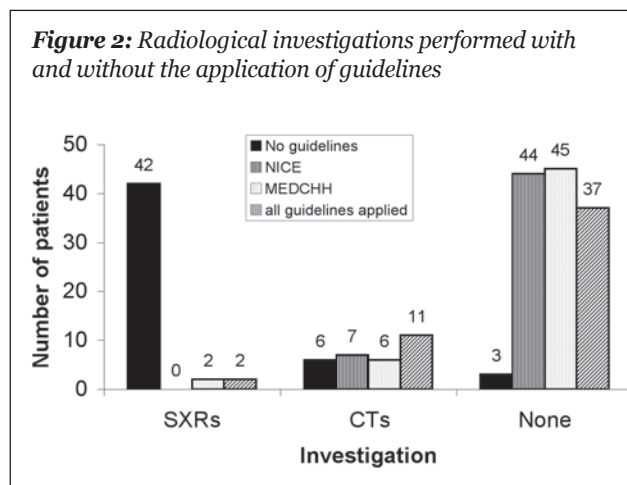
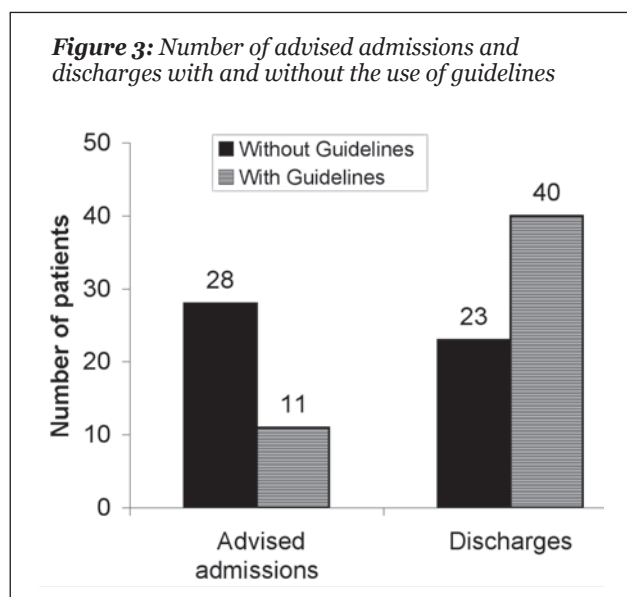


Figure 3: Number of advised admissions and discharges with and without the use of guidelines



doctors in discharging children with mild head injury home. Collective application of the guidelines would have resulted in a maximum of 11 (21.6%) children requiring admission. This number would have been further reduced if the patients would have undergone CT scanning from the A&E department. Furthermore, most of the 11 patients admitted would have only required a six hour observation period rather than overnight hospital stay.

Conclusion

Our study highlights the fact that local practice in the management of head injury in children younger than 2 years of age is not in line with current guidelines. This calls for the design of evidence based guidelines that also take into consideration the resources of our hospital. The implementation of such guidelines would help to reduce the total number of investigations performed and the number of patients being offered admission to hospital.

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