

# ORIGINAL ARTICLES

## Neonatal Head Injuries Revisited

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### Abstract

#### Background

Between 1999 and 2005, 51 neonates were admitted to the regional Neonatal Surgical Unit (NSU), Glasgow with a diagnosis of head injury. The aim of this retrospective study was to compare this cohort with those from an earlier review of similar cases.

#### Methods and Results

Cases were reviewed using a structured data collection proforma. Information obtained was then compared with the results of an identical review carried out in the same Unit between 1990 and 1996.

In the present series, the majority of the injuries were caused by a fall (n=39 [78%]) and resulted in scalp haematomata (n=31 [62%]) and associated skull fractures (n=30 [60%]). Only one patient required significant intervention.

#### Conclusion

Comparing the two study periods, there has been a marked increase in the number of cases admitted with a diagnosis of head injury (n=51 v n=25). There has also been an increase in the number of intracranial haemorrhages reported, associated with an increase in the number of CT scans performed. Non-accidental injury remains uncommon in this patient group. Outcome was excellent for all patients.

#### Keywords

Neonatal, Head Injury, Skull Fracture, CT scan

### Introduction

In 2000, Graham and colleagues<sup>1</sup> reported the outcome of an audit of admissions to the regional Neonatal Surgical Unit (NSU) at the Royal Hospital for Sick Children in Glasgow, with a diagnosis of head injury between 1990 and 1996. Since this audit was undertaken, a guideline for the management of head injuries, predominantly in adults, was published by the Scottish Intercollegiate Guidelines Network in 2000.<sup>2</sup>

We had become aware in the years following the publication of

the SIGN guideline that the number of admissions to the same unit, with a diagnosis of head injury had increased. As a consequence, we decided to undertake a further audit of these admissions for a second seven-year time period from 1999 to 2005. The aims of the audit were to determine whether there had been any significant changes in the number, nature, management and outcome of head injuries in neonates requiring admission in Glasgow between the two time periods.

### Methods

The Royal Hospital for Sick Children (RHSC) in Glasgow is the only tertiary centre for patients under the age of 13 years in Glasgow and Neonatal Surgical patients in the West of Scotland (total population approximately two million in the greater Glasgow area). At the time of the study, all neonatal patients sustaining head injuries who required admission in the region were transferred to RHSC for continuing care and admitted to a dedicated NSU. Neonates were defined as infants who were less than 44 completed post-conceptual weeks of age at the time of injury. Thus for term babies, this represents a post-natal age of up to four completed weeks.

Neonates with a diagnosis of "head injury", "skull fracture" or "subdural haematoma" were included in the study. The written patient log book for the NSU was manually searched to identify patients. All patients admitted between 1 January 1999 and 31 December 2005 were included in the audit.

A structured proforma was completed for each identified patient, showing the length of stay, mechanism of injury, site and type of injury, associated symptoms, investigations performed and management undertaken. Outcome was defined as the infant's neurological status at the time of final outpatient assessment for this admission.

### Results

A total of 51 patients were admitted to the NSU with a diagnosis of head injury during the seven year period of the audit (m:f - 29:21). The casenotes of 50 patients were available for review. The median age at admission was 16.5 days. Four neonates had been premature (31-35 weeks gestational age).

The mechanism of the head injury was a fall in 39 (78%), non-accidental injury in four (8%); four (8%) were allegedly struck by other children with objects and two (4%) were injured at delivery. Of the 39 who fell, 12 were from carers arms, 10 were from low level furniture (bed or chair), nine from carried Moses baskets or car seats and seven from prams which fell down a flight of stairs.

Symptomatically, eight presented with vomiting, six were felt to be drowsy, three irritable, two showed fleeting oxygen desaturations and one apnoeas. One patient was felt to have had a seizure, but 31 had no discernible symptoms. Ten (20%) showed no external injuries, two (4%) had scalp lacerations and thirty one (62%) had demonstrable scalp haematomata.

Of the 50 neonates admitted, 42 (84%) underwent skull radiography, 31 (62%) CT scanning, 15 (30%) cranial ultrasound scanning, one underwent MRI scanning and three had no investigations.

Thirty (60%) had skull fractures identified on x-ray of which twenty-one affected the right parietal bone. Fifteen neonates showed evidence of intracranial haemorrhage of which eight were extradural haematomata, five subdural haematomata and three contusions.

One patient required intubation in the Accident & Emergency department and subsequent ventilation for 48 hours for recurrent apnoea. Only one patient required intra venous fluids for vomiting. For the remainder, management consisted of neurological observation alone in 47 cases; six of these were discussed with the regional neurosurgical unit, because of the presence of extra axial blood on CT scanning, with no change in management recommended. One further patient had subdural haematomas, which were tapped by our neurosurgical colleagues.

Comparison was made with the earlier cohort (1990 - 1996).<sup>1</sup> There was a doubling in numbers of admissions, from 25 to 51 (1999 - 2005). There were also other interesting differences in various parameters (tables I - III). Using the  $\chi^2$  analysis and Fishers exact test\* to compare the two cohorts there was a statistically significant increase in the number of CT scans performed and the number admitted without other external injuries. While the number with an intracranial injury doubled in percentage terms, this did not reach statistical significance (NS).

## Discussion

The number of admissions to the regional Neonatal Surgical Unit in Glasgow with a head injury has clearly doubled when compared with the results of the previously published audit from the same department.<sup>1</sup> Possible reasons for this may be the current fashion to lay hard wooden flooring - sales of laminate flooring in Europe have increased six times between 1996 and 2005.<sup>6</sup> As the majority of injuries were sustained due to falls from a low height, the surface which the baby lands upon will be of some significance in determining the severity of the injury sustained. There were no road traffic accident related injuries within our second cohort. The reasons for this are far from clear but it might be worth speculating that changes in car seat design and use might afford neonates better protection.

The introduction of Scottish guidelines for the acute management of head injuries in 2000,<sup>2</sup> the beginning of our second cohort, suggested that in adults certain predictors of intracranial injury should trigger a cranial CT scan at an early stage of assessment. These predictors included; post traumatic amnesia, skull fracture and decreased conscious level. A caveat was included for the management of children, which suggested that the presence of a skull fracture alone was not predictive of intracranial injury in children, and that observation by experienced paediatric medical and nursing staff in an

Table I: Mechanism of Head Injury in Admitted Neonates.

	1990-1996 n=25	1999-2005 n=50	
Fall	17 (68%)	39 (78%)	P=NS
Road Traffic Accident	3 (12%)	0	P=NS*
Other	3 (12%)	7 (14%)	P=NS*
Non-Accidental Injury	2 (8%)	4 (8%)	P=NS*

Table II: Investigations Performed on Neonates with Head Injury.

	1990-1996 n=25	1999-2005 n=50	
Skull X-ray	24 (96%)	42 (84%)	P=NS*
Cranial Ultrasound	11 (44%)	15 (30%)	P=NS
Computed tomography (CT)	8 (32%)	31 (62%)	P=0.014
No Investigation	0	3 (6%)	P=NS*
Magnetic Resonance (MRI)	0	1 (2%)	P=NS*

Table III: Injuries Sustained - Final Diagnoses.

	1990-1996 n=25	1999-2005 n=50	
Scalp Haematoma	20 (80%)		P=NS
Skull Fracture	18 (72%)	30 (60%)	P=NS
Intracranial Injury	4 (16%)	15 (30%)	P=NS
Scalp Laceration	2 (8%)	2 (4%)	P=NS*
No external Injury	0	10 (20%)	P=0.02*

appropriate unit was an acceptable alternative to urgent CT scan. Despite this, this audit has demonstrated a significant increase in the number of CT scans performed. It should not be too surprising therefore that the number of intracranial haemorrhages detected has also increased. Many recommendations have been made about the most appropriate imaging and treatment of infants with head injuries. Some suggest that all such patients should undergo cranial CT scanning. If this scan is normal the patient could be discharged home.<sup>5</sup> Others have suggested that skull radiographs carried out in a centre where they are regularly interpreted, on patients with signs of external injury, may be appropriate<sup>3</sup> although may not change management. Most suggested imaging and treatment regimes would agree that a period of observation in experienced hands would distinguish those who require further imaging from those who do not.<sup>2,3,4</sup> Lethargy would appear to be the most reliable symptom suggestive of significant intracranial injury.<sup>3,4,5</sup>

A significant increase in admissions of babies without obvious external injuries and minimal symptoms has occurred. Some of these were admitted because of the mechanism of presumed injury. One baby fell down a flight of stairs but remained strapped into its pram. Others were admitted for parental anxiety or problems differentiating between normal behaviour and symptoms of head injury.

The study has shown that there has been an increase in the number of patients undergoing CT scanning leading to an increase in the diagnosis of intracranial bleeds following trauma in neonates. It also, however, shows that these intracranial injuries seen on imaging do not correlate with worse outcomes or escalated treatment.

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Juliette King initiated the study, discussed core ideas, participated in data collection, analysed the results and wrote the paper. Graham Haddock discussed core ideas and contributed to the paper. Dr David Young assisted with the statistical analysis. Juliette King and Graham Haddock are the guarantors for the paper.

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