PREHOSPITAL CARE

Prehospital rapid-sequence intubation of patients with trauma with a Glasgow Coma Score of 13 or 14 and the subsequent incidence of intracranial pathology

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Aim: To identify the incidence of intracranial pathology in a population of patients with trauma with an on-scene Glasgow Coma Score (GCS) of 13 or 14, and the proportion that required prehospital intubation and ventilation.

Method: A retrospective review of a prehospital trauma database was carried out over a 12-month period, and 81 patients were reviewed. All had a traumatic mechanism of injury and had an on-scene GCS of 13 or 14 recorded by a prehospital doctor. 43 patients required prehospital rapid-sequence intubation. Overall, 31.5% of patients with a GCS of 13 or 14 had an abnormal computed tomography scan of the head and 20.5% had an intracranial haemorrhage.

Results: For this group of patients with trauma with a drop of only one or two points on the GCS, the incidence of intracranial pathology was almost one in three and that of intracranial haemorrhage was one in five.

The primary aim of prehospital management of the patient with head injury is prevention of secondary brain injury. This is achieved by preservation of a clear airway, adequate oxygenation and ventilation, and prevention of hypotension.[1] A proportion of patients with head injury require intubation and ventilation to achieve these aims; this is usually carried out in the emergency department, but can be achieved in the prehospital phase if necessary. Intubation and ventilation can be carried out without drugs or as part of rapid-sequence intubation (RSI). Patients with a higher Glasgow Coma Score (GCS) usually require RSI to facilitate tracheal tube placement. Anaesthesia may also be necessary to facilitate safe and efficient further management—for example, imaging. On the basis of recommendations from the American College of Surgeons Committee on Trauma,[2] the European Society of Intensive Care Medicine[3] and the Eastern Association for the Surgery of Trauma,[4] a GCS $\leqslant 8$ is used as the level at which intubation is considered mandatory. Unfortunately, patients who are seen after head injury in the prehospital phase often have a GCS >8 but are difficult to manage safely without anaesthesia. The European Society of Intensive Care Medicine recognises that this group of patients may require prehospital RSI,[3] and the National Association of Emergency Medical Service Physicians also recognises that combative behaviour in a seriously injured patient can warrant RSI.[5] Although there is evidence that RSI in the prehospital setting can be performed safely when carried out by properly trained practitioners,[6–10] the risks are well recognised.[11–17]

With these controversies in mind, this study set out to identify the incidence of intracranial pathology in a population of patients with trauma who had dropped only one or two points on their GCS. We also identified the proportion of this patient group that required prehospital RSI after assessment by a prehospital doctor.

METHODS

A retrospective trauma database review was carried out from 1 September 2002 to 31 August 2003. Anonymised data were used, and ethical committee approval was not required. The search strategy was prospectively defined. All patients with an initial prehospital GCS of 13 or 14 (as recorded by a prehospital doctor) who were brought back to the base hospital were included. Patients aged <16 years were excluded, as were patients with a non-traumatic mechanism of injury (eg, hanging, drowning).

Patients were divided into two groups: those who underwent RSI on-scene before transfer and those who were transferred to hospital awake. Our service uses etomidate and suxamethonium for prehospital induction.

Computed tomography scan reports of the head were analysed; a scan was considered abnormal if brain trauma had been reported by a radiologist. If computed tomography scan reports were unavailable, information was taken from the trauma database which uses multiple sources to code injuries and generate an Injury Severity Score (eg, postmortem reports, operative findings, radiology, etc).

The same sources were used to divide patients into those with multiple trauma and those with isolated head injuries. Multiple trauma was defined as coexisting chest injury, abdominal injury, pelvic fractures or lower limb fractures. Isolated head injury included only those patients with coexisting facial fractures or closed upper limb fractures. Neurosurgical procedures, mechanism of injury and death within a week of admission were also recorded. A neurosurgical procedure was defined as craniotomy for evacuation of a clot or the placement of an intracranial pressure monitor. The results of long-term follow-up were not available.

p Values were calculated for the intubated versus non-intubated group with Fisher's exact test; $p \leqslant 0.05$ was considered to be significant.

RESULTS

In all, 81 patients fulfilled the inclusion criteria; 43 had on-scene RSI and 38 were transferred awake.

Abbreviations: GCS, Glasgow Coma Score; RSI, rapid-sequence intubation

Table 1 Rapid-sequence intubation group versus awake transfer group

	RSI group	Awake transfer group	p Value (Fisher's exact test)
Total patients	43	38	
Data available	40	33	
Multiple trauma	29 (72)	9 (27)	<0.001
Isolated head injury	11(28)	24 (73)	<0.001
Abnormal CT scan	15 (38)	8 (24)	0.312
Intracranial haemorrhage	11 (28)	4 (12)	0.148
Neurosurgical procedure	5 (13)	0	0.06
Died	7 (16)	0	0.014

CT, computed tomography; RSI, rapid-sequence intubation.
Values are number (percentage of the total number) of patients.

RSI group

Of the 43 patients, 31 had multiple trauma and 12 had isolated head injuries. There were 15 falls, 26 road traffic crashes (14 were occupants/riders and 12 pedestrians) and 2 people hit by trains. Full data were available for 40 patients (29 multiple trauma and 11 isolated head injuries). Of the patients, 15 (37.5%) had an abnormal computed tomography scan of the head, 11 (27.5%) had an intracranial haemorrhage and 5 (12.5%) required a neurosurgical procedure; 7 (16%) patients in the RSI group died.

Awake transfer group

Of the 38 patients, 10 had multiple trauma and 28 isolated head injuries. There were 11 falls, 24 road traffic crashes (of which 12 were occupant/rider and 12 were pedestrians), 2 assaults and 1 accidental blow to the head.

Full data were available for 33 patients (9 multiple trauma and 24 isolated head injuries); 8 (24.2%) patients had an abnormal computed tomography scan of the head, 4 (12%) had an intracranial haemorrhage and none required a neurosurgical procedure. No patient in the non-RSI group died.

All the seven patients who died had polytrauma, except for one whose computed tomography scan showed a spontaneous subarachnoid haemorrhage that may have caused the subsequent road traffic crash. Postmortem reports were available on four patients and all showed multiple injuries as the cause of death.

When all 73 patients in both the RSI and awake transfer groups were combined, 23 (31.5%) had abnormal computed tomography scans of the head, 15 (20.5%) had an intracranial haemorrhage and 5 (7%) required a neurosurgical procedure.

Statistically, only death rate (7 *v* 0 ($p = 0.01$)) was significantly different between the two groups (table 1).

Box 1: Helicopter Emergency Medical Service (London) indications for prehospital rapid-sequence intubation

1. Actual or impending airway compromise
2. Ventilatory failure
3. Airway soiling
4. Unconsciousness
5. Humanitarian indications
6. Patients unmanageable or severely agitated after head injury
7. Expected clinical course

DISCUSSION

The results of this study confirm that in patients with a traumatic mechanism of injury, a drop of even one or two points on the GCS in the prehospital phase is associated with a significant rate of intracranial pathology. This has been previously documented in the early inhospital phase,[18–23] and current UK guidelines advise computed tomography scanning of all patients who have a GCS <15 two hours after injury.[24] Of the patients who met the inclusion criteria, more than half were judged to require RSI on-scene. The patients who were anaesthetised in the prehospital phase had a higher rate of multiple trauma, intracranial haemorrhage, neurosurgical intervention and death (table 1). The standard operating procedures of this prehospital service list the indications for prehospital RSI (box 1).

The application of these guidelines varies with the clinical judgement of the doctor on-scene and at least 12 different doctors would have been operational during the time of collection of these data.

A considerable amount has been written about the potential risks of prehospital RSI when carried out by paramedics.[11–17] The adequacy of paramedic training and skill retention for this procedure is a major issue that has been highlighted recently.[25 26] None of these studies have looked at prehospital RSI performed by doctors. Data on doctor-delivered RSI are scarce. However, several European services, including our own, have published data on the success rate of prehospital intubation, which is between 97% and 100%.[27] We believe that if patients have an immediate need for intubation and ventilation and adequate skills are available on-scene, then they should not have to wait until admission to hospital to have the procedure performed. In the UK and in many other developed countries, most of the first hour after trauma is spent in the prehospital phase.[28–30]

Prehospital RSI has many potential risks, and we believe that even when experienced doctors administer the procedure, a robust clinical governance structure is required to minimise risk. In addition to a regularly reviewed standard operating procedure, our doctors are instructed to make an on-scene "risk–benefit assessment" in every case before conducting RSI—that is, in each specific situation they need to decide that the potential benefits of RSI outweigh the potential risks. The data presented suggest that this guidance does lead to the doctors anaesthetising patients with more serious pathology.

We did not set out to statistically compare the non-intubated versus intubated groups and the statistical interpretation of these data is limited by the relatively small numbers. In addition, data were missing for 8 (10%) of the patients and this could potentially skew the results. We also recognise that the dispatch criteria for our service specifically target major trauma and, as such, our patient population may not be representative of patients with GCS 13 or 14 who have had minor trauma.

Guidelines on anaesthesia and intubation in patients with trauma state that patients with a GCS $\leqslant 8$ require intubation.[2–4] Some US and European guidelines recognise that there are patients with a higher GCS who may still require prehospital anaesthesia and oral intubation.[2 5] We find that we are sometimes specifically requested by ambulance crews to attend patients with noticeable mechanisms of injury who are unmanageable because of cerebral agitation.

We assume that patients with trauma with a prehospital GCS of 13 or 14 have intracranial pathology until proved otherwise. There is a small group of patients with head injury and GCS >8, who are difficult to manage without RSI. This procedure is usually carried out in the emergency department but can, with a robust clinical governance structure, be achieved in the prehospital phase.

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