Towards evidence based emergency medicine: Best BETs from the Manchester Royal Infirmary

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Abstract
A short cut review was carried out to establish whether prehospital intubation was of benefit to patients with head injury. 4630 papers were found using the reported searches, of which 9 presented the best evidence to answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated. It is concluded that prehospital intubation is associated with increased mortality in these patients.

Clinical scenario
A 41 year old car driver was involved in a major road traffic accident, sustaining injuries to his head, a fracture of his right femur and multiple bruises on his chest. On scene he had altered sensorium and his GCS was estimated to be 5. He was intubated by the paramedics and brought to the Emergency Department. You wonder about the evidence in favour of endotracheal intubation as compared to bag and mask ventilation in trauma patients.

Three part question
In [patients with major trauma and head injury needing airway management in prehospital setting] is [endotracheal intubation better than bag and mask ventilation] for [improved outcomes]?

Search strategies
Medline 1966-Week 4 August 2005 using the OVID interface, {Cochrane Prehospital Search filter} AND {exp Intubation, Intratracheal/ or endotracheal intubation.mp. OR ETI.mp. OR RSI.mp OR rapid sequence intubation.mp}, Embase 1980-2005 week 37, {exp Emergency Health Service/ OR exp Rescue Personnel/ OR exp Emergency Treatment/ OR exp Emergency Department. You wonder about the evidence in favour of endotracheal intubation as compared to bag and mask ventilation in trauma patients.

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<tr>
<td>Winchell RJ, Hoyt DB, 1997 USA</td>
<td>All trauma patients admitted to trauma centres in San Diego county from 1991–1995 who underwent field intubation when GCS ≤ 8 (665 were intubated and 527 were not intubated in field)</td>
<td>Retrospective registry based review</td>
<td>Scene GCS scores in intubated and non-intubated groups</td>
<td>No difference</td>
<td>Retrospective design, matching may have failed to match for parameters, multivariate analysis not done, functional outcomes not compared</td>
</tr>
<tr>
<td>Sloane et al, 2000 USA</td>
<td>All adult trauma patients who underwent prehospital RSI 1988 to 1995 (47 patients) compared with those who had RSI upon arrival to trauma resuscitation suite 1992–1995 (537 patients) as per RSI protocol</td>
<td>Retrospective study</td>
<td>Field intubation versus hospital intubation success rates</td>
<td>97.9% versus 95.8%</td>
<td>Retrospective study, small sample of field intubation, matching not adequate esp. related to age, retrospective definition of number of attempts at intubation and record review, field patients had worse trauma severity scores, no blinding of data collector</td>
</tr>
<tr>
<td>Murray et al, 2000 USA</td>
<td>All adult patients with severe head injury GCS ≤ 8, head AIS score &gt; 3, over a 3 yr period 1995–1997 who were intubated (81) in the field or non-intubated (714) and unsuccessfully intubated (57)</td>
<td>Retrospective study, review of trauma registry</td>
<td>Crude mortality figures in intubated versus non-intubated group</td>
<td>82% versus 43%, OR 1.88 (CI 1.65 to 2.15)</td>
<td>Retrospective design, matching done but certain critical parameters missed out, selection bias, only patients with more severe injuries selected for intubation</td>
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<tr>
<td>Eckstein et al, 2000 USA</td>
<td>All adult patients from 1993 to 1995 who met trauma centre criteria, had airway intervention performed by paramedics and transported to medical centre, ETT or BVM done as per hospital policy, 93 patients had ETT and 403 BVM.</td>
<td>Retrospective cohort study</td>
<td>Prehospital transit time for ETT versus BVM</td>
<td>12.8 mins versus 11 mins p &lt; 0.09</td>
<td>Data obtained from paramedic field reports, retrospective study, groups compared by protocols and not true controls, effect of hyperventilation not studied, small number of patients with ETT, despite adjustment for ISS through logistic regression, ETT group had a very high mortality based on ISS, limitations of ISS, RSI not used</td>
</tr>
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<td>Bochilhio et al, 2003 USA</td>
<td>Data collected on 191 patients admitted to a trauma centre with field GCS ≤ 8, head Abbreviated Injury Scale &gt; 3 who were intubated (78) in the field or not intubated on arrival to hospital (113), patients who died within 48 hrs excluded</td>
<td>Prospective cohort study</td>
<td>Dispatch time field ETT versus hospital ETT</td>
<td>p = 0.05</td>
<td>Cohort study, death within 48 hrs excluded, individual paramedic bias in intubation, difference between ground and state police flight paramedics, lack of long term data or functional outcomes, bias on the practice of neurosurgeons</td>
</tr>
<tr>
<td>Davis et al, 2003 USA</td>
<td>Adult major Trauma victims with severe head injuries &gt; 18 yrs, suspected head injury by mechanism or physical findings, GCS 3–6, estimated time for transport &gt; 10 minutes, exclusion if unable to achieve IV access or needed PR before RSI</td>
<td>Prospective cohort study</td>
<td>Mortality in ETT versus BVM</td>
<td>33% VERSUS 24.2%, OR 1.6 (CI 1.1 to 2.2)</td>
<td>Cohort study with historical controls though matched well, GCS not used for matching as they were not consistently calculated pre-trial and omitted from trial cohort as they were paralysed and intubated, higher mortality in RSI cohort who had low GCS, possibility of hyperventilation contributing to increased mortality, Other parameters may have been present which were unmatched in the two groups</td>
</tr>
<tr>
<td>Stockinger Z, Morgan NE, 2004 USA</td>
<td>Review of reports from Dec 1999 to Sept 2002 who met level 1 trauma criteria and who received ETT or BVM ventilation</td>
<td>Retrospective cohort study</td>
<td>Overall mortality, Penetrating injury mortality, Penetrating injury and ETT mortality vs blunt injury and ETT mortality, Penetrating injury and BVM mortality, Different ISS, ETT vs BVM Prehospital time ETT vs BVM</td>
<td>65.3%, OR 1.78 (CI 1.54 to 2.05)</td>
<td>Retrospective design, record review, not controlled, small number of ETT survivors to compare functional outcomes or prehospital transit time, inadequately matched groups</td>
</tr>
<tr>
<td>Wang et al, Nov 2004 USA</td>
<td>All trauma patients &gt; 18 years sustaining severe traumatic brain injury who were intubated in prehospital or hospital setting</td>
<td>Retrospective cohort study</td>
<td>Prehospital versus hospital intubation mortality, Prehospital versus hospital intubation poor neurologic outcomes, Prehospital versus hospital intubation functional impairment</td>
<td>OR of 3.99 (CI 3.21 to 4.93)</td>
<td>Non-randomised study, use of pre-existing and unmatched registry, unvalidated functional impairment score, adjustment not done for some factors that could affect prehospital intubation, no information of course of ED airway care, Could not identify failed prehospital intubation efforts and analysis, propensity score used but matching techniques not used</td>
</tr>
<tr>
<td>Davis DP et al, 2005, USA</td>
<td>13,425 patients with moderate to severe Observational traumatic brain injury included on a country trauma registry of whom 19.5% were intubated in the prehospital environment</td>
<td>Mortality</td>
<td>Increased with prehospital intubation</td>
<td>OR 0.36 p &lt; 0.001</td>
<td></td>
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</table>
Headache in paediatric head injury

Report by Michelle Jacobs
Search checked by Ian Maconochie, Consultant
St Mary’s Hospital, London, UK
doi: 10.1136/emj.2005.031724

Abstract
A short cut review was carried out to establish whether headache was a significant indicator of the severity of head injury in children. 301 papers were found using the reported searches, of which 2 presented the best evidence to answer the clinical question. The author, date, and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated. It is concluded that headache is not an independent risk factor for intracranial injury in children.

Clinical scenario
A 10 year old girl has presented on several occasions since a recent head injury with a persistent headache. Clinical examination has previously been documented as normal. You wonder how significant the headache is with respect to the initial head injury.

Three part question
In [a child with a head injury] does [the presence of headache] predict [intracranial injury]?

Search strategies
Medline 1966- Week 4 August 2005 [exp brain injuries/ or brain injur$.mp. or exp cranioencephalic trauma/ or head injur$.mp.] AND [exp headache/ or headache.mp.] AND [BestBETs Paediatric filter ] LIMIT to human AND English. Embase 1980–2005 week 37 [cranioencephalic trauma.mp. OR exp Head Injury/ OR exp Brain injury/ OR brain injur$.mp.] AND [exp headache/ OR headache.mp.] LIMIT to Human, English Language, Abstracts and (infant <1 to one year> or child <unspecified age> or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>) The Cochrane Library Issue 3 2005 Exp brain injuries [MeSH] OR exp cranioencephalic trauma [MeSH] AND exp headache [MeSH] AND exp Child [MeSH]

Search outcome
Altogether 301 papers were found, of which one was a meta-analysis. One further paper postdated the meta-analysis. These two papers are shown in the table.

Comments
The consensus opinion is that the presence of headache does not correlate with the presence of or severity of intracranial injury in children. Several retrospective studies found high levels of association between extradural haemorrhage and initial presentation symptoms including headache. However, these were a highly selected group of patients and small numbers were involved.

S-100b protein levels as a predictor for long-term disability after head injury

Report by John-Paul Lomas, House Officer
Search checked by Joel Dunning, Clinical Research Fellow
Manchester Royal Infirmary, Manchester, UK
doi: 10.1136/emj.2005.031732

Abstract
A short cut review was carried out to establish whether levels of S-100b were predictive of long-term disability after head injury. 200 papers were found using the reported searches, of
<table>
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<th>Author, country, date</th>
<th>Patient group</th>
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<th>Study weaknesses</th>
</tr>
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<tbody>
<tr>
<td>Waterloo K et al, 2005, Norway</td>
<td>7 patients with high S-100b after mild head injury matched with 7 patients with no detectable S-100b</td>
<td>Case control study</td>
<td>Overall cognitive function</td>
<td>No difference</td>
<td></td>
</tr>
<tr>
<td>Rothauel et al, 1998, Germany</td>
<td>30 patients with a severe head injury (GCS&lt;11) and minor head injury (GCS 13-15) admitted to a neurosurgical unit S-100 levels measured mean 2.5 hrs after injury</td>
<td>Diagnostic Cohort study (4)</td>
<td>Glasgow Outcome Scale on discharge (Mean day 19 in severe group and mean day 1.3 in minor head injury group) Detectable level of S-100 (&lt;0.5mcg/l)</td>
<td>Increased in raised S-100b group Reduced in raised S-100b group Patients with GOS 1-2: 5/100 level mean 1.2mcg/l SD 1.8</td>
<td>Non-independent gold standard</td>
</tr>
<tr>
<td>Townsend WJ et al, 2002, UK</td>
<td>148 adult head injury patients (GCS 4-15) in 4 hospitals. Most had a minor head injury. S-100 levels taken within 6 hours of head injury</td>
<td>Diagnostic study (2b)</td>
<td>Extended Glasgow outcome score at 1 month</td>
<td>S-100 &lt; 0.5mcg/l predicted severe disability (11 patients with GOS&lt;5)</td>
<td>Non-consecutive</td>
</tr>
<tr>
<td>Spinalesa et al, 2003, USA</td>
<td>27 children &lt;18yrs with traumatic brain injury</td>
<td>Diagnostic cohort study (3b)</td>
<td>Pediatric Cerebral performance category score (PCPC) assessed at discharge and 6 months</td>
<td>Data not clearly presented</td>
<td>No cut off points or ROC curves calculated Non-consecutive</td>
</tr>
<tr>
<td>Semola O &amp; Hillbom M, 2003, Finland</td>
<td>172 consecutive patients with mild head injury (GCS 13-15)</td>
<td>Diagnostic cohort study (2b)</td>
<td>Post concussional symptoms defined by Rivermead Post-Concussion Symptoms Questionnaire at 2-6 weeks</td>
<td>Sensitivity 68% Specificity 95%</td>
<td>No confidence intervals or sample size calculations</td>
</tr>
</tbody>
</table>

**Table 3**
A 17 year old male presents to the Emergency Department after a road traffic accident. His GCS was 8 on arrival but an immediate CT scan showed no focal abnormality. His GCS returned to 14 after 4 hours. You are talking to his mother who is reassured that he does not need urgent neurosurgery, but she asks whether he will suffer any long term consequences from this injury. You tell her that it is difficult to predict. You have recently heard that S-100 protein measurement is available in your hospital for research purposes. You wonder whether S-100 could help predict his long term prognosis.

Three part question
In [patients with a head injury] do [levels of S-100B protein] predict [long-term disability]?

Search strategy
Medline 1966-Week 4 August 2005 using the OVID interface [(exp S100 Proteins/ OR s100.mp OR s-100.mp) AND (exp Brain Injuries/ OR brain injury.mp OR exp Craniocerebral trauma/ OR head inj$.mp.)] Embase 1980-2005 week 37 [exp Protein S 100/ OR s100.mp OR s-100.mp] AND [exp Brain Injury/ OR brain injury.mp. OR craniocerebral trauma.mp. OR exp Head Injury/] LIMIT to Human and English Language The Cochrane Library Issue 3 2005 Exp Brain injuries [MeSH] OR exp Craniocerebral trauma [MeSH] AND exp s100 proteins [MeSH]

Search outcome
200 papers were found of which 13 were found to be relevant.

Two relevant papers described the same patient population. The remaining 12 papers are shown in the table.

Comments
All studies were under 200 patients in size and most were under 100 patients. The studies find sensitivities from 27%–95% and specificities from 70% to 97%. The reasons for this great variation in findings may in large part be due to the small sample sizes. The specificities seem to perform better than the sensitivities and thus the finding of a high S-100 may indicate that your patient is at high risk of long term disability. The cut-points for a significant S-100 level differ between studies also and are generally much higher when applied to patients after a severe head injury. Most studies agree that S-100 levels must be taken within 6 hours of head injury.

Aspirin and the risk of intracranial complications following head injury
Report by Magdy Sakr, Consultant in Emergency Medicine
Search checked by Libby Wilson, Clinical Research Fellow
University of Coventry and Warwickshire, UK
doi: 10.1136/emj.2005.031740

Abstract
A short cut review was carried out to establish whether pre-injury aspirin increases the risk of intracranial complications following head injury. 124 papers were found using the reported searches, of which three presented the best evidence to answer the clinical question. The author, date, and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated. It is concluded that aspirin may increase the risk of developing intracranial complications. More research is needed.

Clinical scenario
A 65 year old man on aspirin presents to the Emergency Department having fallen sustaining a minor head injury. You wonder whether he is at higher risk of intracranial bleeding due to aspirin.

Three part question
In [adults with head injury] does [pre-injury aspirin] adversely [affect clinical outcome]?

Search strategies
Altogether 103 were found in Medline and 104 in Embase. Three were relevant to the three part question, these are shown in the table below:

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<tr>
<td>Reymond MA et al, 1992, Switzerland</td>
<td>189 patients with severe head injury</td>
<td>Retrospective Risk analysis</td>
<td>Chronic subdural haematoma</td>
<td>Aspirin is a risk factor for chronic subdural haematoma</td>
<td>Retrospective nature of the study</td>
</tr>
<tr>
<td>Mina AA et al, 2002, USA</td>
<td>37 patients admitted with intracranial injury on anticoagulants 37 case matched patients</td>
<td>Retrospective case controlled</td>
<td>Mortality due to head injury</td>
<td>Higher percentage of those on aspirin than any other anticoagulant died</td>
<td>Retrospective, Subgroup analysis, and small sample size</td>
</tr>
<tr>
<td>Spektor S et al, 2003, Israel</td>
<td>Mild (GCS13-15) and moderate (GCS 9-12) head injuries in 231 patients &gt;60 years old, 110 of which were on aspirin therapy</td>
<td>Prospective cohort study</td>
<td>Intracranial haemorrhage</td>
<td>No difference in frequency or type of ICH whether on aspirin or not</td>
<td>Small sample size.</td>
</tr>
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</table>

**Comments**

There was conflicting evidence that prior chronic use of aspirin increases the risk of intracranial haemorrhage following minor head injury. However, there is some evidence to suggest that there is increased risk of chronic subdural haemorrhage. A well designed prospective cohort study with adequate sample size and follow up is needed to address such important and common problem.

**CLINICAL BOTTOM LINE**

Pre-injury aspirin may increase the risk of intracranial complications following head injury. More research is needed.

**References**