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

Edited by K Mackway-Jones

Best evidence topic reports (BETs) summarise the evidence pertaining to particular clinical questions. They are not systematic reviews, but rather contain the best (highest level) evidence that can be practically obtained by busy practising clinicians. The search strategies used to find the best evidence are reported in detail in order to allow clinicians to update searches whenever necessary.

The BETs published below were first reported at the Critical Appraisal Journal Club at the Manchester Royal Infirmary. Each BET has been constructed in the four stages that have been described elsewhere. The BETs shown here together with those published previously and those currently under construction can be seen at http://www.bestbets.org. Five topics are covered in this issue of the journal.


- Oral or intravenous β blockers in acute myocardial infarction
- Nasal diamorphine for acute pain relief in children
- Does a normal CT scan rule out a subarachnoid haemorrhage?
- Mydriatics in corneal abrasion
- Midazolam and emergence phenomena in children undergoing ketamine sedation

In addition two prehospital topics are also covered.

- Cervical collars in patients requiring spinal immobilisation
- The prehospital use of pneumatic anti-shock garments


Oral or intravenous β blockers in acute myocardial infarction

Report by Steve Jones, Clinical Research Fellow

Search checked by Ian Crawford, Clinical Research Fellow

Clinical scenario
A 45 year old man is brought to the emergency department with acute, central chest pain. You have diagnosed an acute myocardial infarction from the ECG for which he is receiving thrombolysis. You know that giving him a β blocker will improve his outcome but you only have tablets in the department and wonder whether he will be at a disadvantage for receiving this rather than an intravenous dose.

Three part question
In [an acute myocardial infarction] is [IV β block] better than [oral β block] at [reducing mortality and decreasing morbidity]?

Search strategy

Search outcome
Altogether 143 papers found of which 142 were irrelevant or of insufficient quality. The remaining paper is shown in table 1.

Comments
Although atenolol seems to improve outcomes after thrombolysis for myocardial infarction, early intravenous atenolol seems of limited value. The best approach for most patients may be to begin oral atenolol once stable. More work will need to be done.

Clinical bottom line
Oral β blockers are better than IV β blockers in stable AMI patients.

Nasal diamorphine for acute pain relief in children

Report by Mark Davies, Specialist Registrar
Search checked by Ian Crawford, Clinical Research Fellow

Clinical scenario
An 8 year old boy attends the emergency department after a fall at school. Clinically he has a displaced fracture of the right radius and ulna. He is in a lot of pain and so needs analgesia before radiography. You have heard of the use of nasal diamorphine for pain relief but wonder whether there is evidence to show whether it is as effective as injected morphine.

Three part question
[In children with acute pain] is [nasal diamorphine or injected morphine] better at [providing safe, acceptable and effective analgesia].

Search strategy
Medline 1966–01/01 using the OVID interface. [(exp heroin OR diamorphine.mp OR exp narcotics OR opioids.mp OR opiates.mp OR narcotics.mp) AND (exp nasal mucosa OR nasal.mp OR exp nose OR nose.mp OR exp administration, intranasal OR intranasal.mp)].

Search outcome
Altogether 303 papers found of which only one was relevant. An additional paper has recently been published and was not indexed on Medline at the time of searching. These two papers are shown in table 2.

Comments
These two papers would suggest that intranasal diamorphine is as effective as intramuscular morphine and is much better tolerated by children with no apparent increased risk of side effects. Further work comparing intranasal diamorphine with oral morphine would be useful.

Clinical bottom line
Nasal diamorphine is a safe and effective analgesic in children with acute musculoskeletal pain and is to be recommended.

Does a normal CT scan rule out a subarachnoid haemorrhage?

Report by Simon Carley, Specialist Registrar
Search checked by Paul Wallmann, Specialist Registrar

Table 1

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidence)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfisterer M et al, Switzerland, 1998</td>
<td>Patients with acute MI</td>
<td>Prospectively planned post hoc analyses of the GUSTO-I dataset (a multicentre PRCT)</td>
<td>Mortality any atenolol vs none</td>
<td>30 day mortality was significantly lower in atenolol treated patients. More likely to die (odds ratio 1.3 (95% CI 1, 1.5) p&lt;0.02)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No atenolol (n=10 073) vs any atenolol (n=30 771)</td>
<td>Mortality IV atenolol vs oral Morbidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Any intravenous atenolol (n=18 200) vs oral atenol-only (n=12 545)</td>
<td>Both intravenous and oral drug (n=16 406)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidence)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson JA et al, UK, 1996</td>
<td>58 children age 3–16 with suspected limb fractures. 0.1 mg/kg nasal diamorphine v 0.2 mg/kg IM morphine</td>
<td>PRCT</td>
<td>Degree of analgesia at 5, 10, 20 and 30 min</td>
<td>No clinical or statistical difference 100 vs 55% p&lt;0.0001 none reported</td>
<td></td>
</tr>
<tr>
<td>Kendall JM et al, UK, 2001</td>
<td>404 children aged 3 to 16 years with clinical fracture of an upper or lower limb. 0.1 mg/kg nasal diamorphine v 0.2 mg/kg IM morphine</td>
<td>PRCT</td>
<td>Degree of analgesia at 5 min</td>
<td>Less in nasal (p&lt;0.04)</td>
<td>Clinical significance of different analgesic effect not reported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 min</td>
<td>Less in nasal (p&lt;0.003)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 min</td>
<td>Less in nasal (p&lt;0.002)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 min</td>
<td>No significant difference</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parental satisfaction</td>
<td>Greater in nasal (p&lt;0.0001)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Staff satisfaction</td>
<td>Greater in nasal (p&lt;0.0001)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Side effects</td>
<td>Nil serious reported</td>
<td></td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidence)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>MacDonald A and Mendelow AD, Scotland, 1987</td>
<td>100 patients with diagnosis of SAH confirmed on angiography in tertiary centre</td>
<td>Retrospective chart review</td>
<td>Sensitivity of CT</td>
<td>99 patients had had a CT, of these 20 were normal. Sensitivity = 80% (CI=15, 25%)*</td>
<td>This paper did not specifically address the original question. It is subject to referral bias as only patients in a tertiary centre were examined. The CT scanners used at this time were early models.</td>
</tr>
<tr>
<td>Van der Wee N et al, Netherlands, 1994</td>
<td>175 consecutive patients with clinical suspicion of SAH</td>
<td>Retrospective chart review</td>
<td>Sensitivity for CT</td>
<td>117 patients had blood on CT. Of the other 58 patients, 2 had positive LP. Overall sensitivity for CT = 95% (CI=94, 98.8%)*</td>
<td>Not all patients had an LP. If the gold standard is LP findings then some of the CT cases may represent false positives.</td>
</tr>
<tr>
<td>Sames TA et al, USA, 1996</td>
<td>181 patients with SAH confirmed by LP, angiography, surgery on necropsy who had a CT prior to definitive diagnosis. Only 3rd generation scanners included</td>
<td>Retrospective chart review</td>
<td>Overall sensitivity</td>
<td>91.2% (CI=87, 95%)*</td>
<td>Retrospective design. There were 349 patients meeting entry criteria but 92 sets of notes were unavailable for review.</td>
</tr>
<tr>
<td>Sidman R et al, USA, 1996</td>
<td>140 patients with a diagnosis of non-traumatic SAH</td>
<td>Retrospective chart review</td>
<td>Sensitivity at less than 24 hours after symptoms</td>
<td>83.8%</td>
<td>Retrospective design.</td>
</tr>
<tr>
<td>Lachtaw RE et al, USA, 1997</td>
<td>Review article</td>
<td>Review article</td>
<td>Sensitivity of CT</td>
<td>11/140 (92.1% sensitivity) of patients had normal CT and positive LP. 80/80 patients had positive CT and positive LP (100% sensitivity CI 95, 100%)</td>
<td>Original data from studies is not presented. Not a systematic review.</td>
</tr>
<tr>
<td>Morgenstein LB et al, USA, 1998</td>
<td>107 patients with worst headache ever. Patients with negative CT got LP. Scans were reviewed by 2 neuroradiologists blinded to the LP results. LP findings used as gold standard for diagnosis</td>
<td>Retrospective case note and radiology review.</td>
<td>Number of patients with normal CT but positive LP.</td>
<td>Sensitivity given at 97.5% (CI 97.8%, 88.7%)</td>
<td>Retrospective design. Not all patients with positive CT had an LP performed.</td>
</tr>
</tbody>
</table>

Comments

Emergency physicians need to know if CT is sensitive enough to rule out the diagnosis of subarachnoid bleeding in patients presenting with severe headache. Subarachnoid haemorrhage is an important diagnosis to make, the risk of re-bleeding is high if the initial bleed is missed and it is a condition for which treatment is possible. We must therefore err on the side of caution and seek investigations with a very high sensitivity to rule out the diagnosis. The use of lumbar puncture (LP) as a gold standard in many of these studies can be questioned as it too has a false negative rate, particularly when performed soon after a bleed. The diagnosis of subarachnoid haemorrhage is so important that sensitivity must approach 100% for CT to obviate the need for LP. The current trials found reveal two interesting facts. (1) That CT has a high sensitivity (91–98%) for detecting subarachnoid haemorrhage, though this is not high enough to satisfactorily exclude subarachnoid haemorrhage. (2) That the sensitivity of CT for subarachnoid haemorrhage decreases with time.

The sensitivity given in the more recent trials is approximately 95%. This is not high enough to rule out subarachnoid haemorrhage. It is more sensitive the earlier it is performed, this is the converse of LP. The advantage of CT is that it quick and easy to perform, may be positive in the early stages of subarachnoid haemorrhage and it may give information on the cause or size of the bleed. It may also exclude a space occupying lesion.
Clinical bottom line
Patients with lone acute severe headache should have urgent CT; if this is negative then a LP should be performed.


Mydriatics in corneal abrasion
Report by Fiona Carley, Specialist Registrar Ophthalmology
Search checked by Simon Carley, Specialist Registrar

Clinical scenario
A 20 year old man presents to the emergency department with a history of something having blown into his eye. Clinical examination reveals a small abrasion to the cornea. You prescribe chloramphenicol ointment and discharge the patient. A friendly ophthalmologist suggests that you should have given a dilating drop as well. You wonder if there is any evidence to support this.

Three part question
[In patients with simple corneal abrasions] is [a mydriatic better than simple lubrication] at [reducing pain and discomfort]?  

Search strategy
Medline 1966–12/00 using the OVID interface. [(exp cornea OR exp eye injuries OR corneal abrasion.mp) AND (exp mydriatics OR cycloplegics.mp OR exp cyclopentolate OR cycloplegics.mp OR exp atropine OR homatropine.mp OR exp tropicamide OR tropicamide.mp)] LIMIT to human, english AND abstracts.

Search outcome
Altogether 98 papers found of which 97 were relevant or of insufficient quality. The remaining paper is shown in table 4.

Comments
The use of cycloplegics/mydriatics is traditional and common practice for the treatment of corneal abrasions. However, there is no good evidence to support this. The only study pertinent to the three part question is flawed because of poor follow up and a number of compounding factors. However, even this study found no benefit to mydriatics (homatropine 2%).

Clinical bottom line
Cycloplegics cannot be recommended for use in patients with corneal abrasion.


---

Table 4

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Study type (level of evidence)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brahma AK et al, UK, 1996</td>
<td>PRCT</td>
<td>Difference in pain score over 24 hour period and use of oral analgesia</td>
<td>No difference between homatropine and simple lubrication. No difference between the two groups receiving flubiprofen</td>
<td>Only 55% of patients followed up. All patients also received chloramphenicol ointment. Study not blinded</td>
</tr>
</tbody>
</table>

---

Midazolam and emergence phenomena in children undergoing ketamine sedation
Report by Simon Carley, Specialist Registrar
Search checked by Bruce Martin, Specialist Registrar

Clinical scenario
A 4 year old boy presents to the emergency department with a 4 cm laceration to the thigh. You decide to sedate him using ketamine intramuscularly. You are successful and close the wound. However, while he is recovering he seems to be experiencing unpleasant hallucinations. You wonder whether a small dose of midazolam given with the ketamine would have prevented this.

Three part question
[In children undergoing ketamine sedation in the emergency department] is [benzodiazepines plus ketamine better than ketamine alone] at [reducing emergence phenomena and minimising complications and time of sedation]?
Table 5

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidenced)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sherwin TS et al, USA, 2000</td>
<td>104 children aged 1–15 years. 68% had orthopaedic injuries and 30% had wounds. Ketamine 1.5 mg/kg + ketamine 1.5 mg/kg plus midazolam 0.05 mg/kg 2 min later</td>
<td>PRCT</td>
<td>Time to discharge</td>
<td>96 min ± 105 min (not significant) 64% ± 61% (not significant) No difference</td>
<td>Large age range. No data on IM ketamine use. Low power for low incidence complications.</td>
</tr>
<tr>
<td>Wathen JE et al, USA, 2000</td>
<td>266 patients aged 4 months to 18 years. 65% had fractures and 25% had lacerations. Ketamine 1 mg/kg plus glycopyrrolate 5 microgram/kg (137) + Ketamine 1 mg/kg plus glycopyrrolate 5 microgram/kg plus midazolam 0.1 mg/kg</td>
<td>PRCT</td>
<td>Distress (Observational score of behavioural distress) Total sedation time Adverse events</td>
<td>78 min ± 70 min (not significant) Less vomiting (19.4% ± 9.6%) and nightmares (0% ± 3.1%) with midazolam</td>
<td>Large age range. No data on IM ketamine use. Low power for low incidence complications.</td>
</tr>
</tbody>
</table>

Search strategy
Medline 1966–02/01 using the OVID interface. [(exp ketamine OR ketamine.mp) AND (exp benzodiazepines OR benzodiazepines.mp OR exp midazolam OR midazolam.mp OR exp diazepam OR diazepam.mp OR VERSED.mp OR exp lorazepam OR lorazepam.mp OR hyponotics and sedatives.mp OR hypnovel.mp) AND (child.mp OR children.mp)] LIMIT human, english AND abstracts.

Comments
These two well designed studies investigate the question directly. There seems to be no advantage in the addition of midazolam for IV ketamine sedation. Its use in IM ketamine sedation may be different as the pharmacokinetics of both drugs may be different via the IM route.

Clinical bottom line
Midazolam is not needed as an adjunct to ketamine sedation in children.


Table 6

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidenced)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickinson K and Roberts I, UK, 1999</td>
<td>2 prospective randomised controlled trials including 1202 patients Adults &gt;15 years with blunt or penetrating injuries and a systolic BP ≤90 mm Hg. Patients excluded where PASG was only used for fracture splinting. PASG v no PASG</td>
<td>Meta-analysis</td>
<td>Overall mortality Length of hospital stay Length of time spent in ICU</td>
<td>Pooled relative risk of mortality for patients randomised to PASG group was 1.13 (95% CI 0.97, 1.32) No reduction in length of hospital stay No reduction in length of time spent in ICU</td>
<td>Poor quality allocation concealment in both trials Loss of 14% of patients from one trial with disparity in the two groups</td>
</tr>
</tbody>
</table>
maximally sensitive RCT filter]} LIMIT to human AND English.

Search outcome
Altogether 68 papers were found of which 66 were irrelevant. Both of the two relevant papers had been meta-analysed by the Cochrane Injuries Group (table 6).

Comments
The use of PASG may actually be associated with an increase in overall mortality in hypotensive patients after trauma. In addition, no reduction was demonstrated in length of hospital stay or length of time spent in ICU.

Clinical bottom line
The use of PASG in hypotensive patients following trauma cannot be supported.


Cervical collars in patients requiring spinal immobilisation
Report by John Butler, Specialist Registrar
Search checked by Damien Bates, Specialist Registrar

Clinical scenario
A paramedic crew brings a 27 year old patient with a suspected cervical spine injury to the emergency department after an RTA. At the scene of the accident the patient had full spinal immobilisation, which consisted of a long spinal board, a correctly sized cervical collar, and head blocks with straps to secure the head to the board. In the emergency department the patient is becoming increasingly distressed by the presence of the neck collar and requests that it is removed. You wonder whether the cervical collar provides any additional benefit in terms of immobilising the spine.

Three part question
In [patients requiring full spinal immobilisation] is [the use of a cervical collar, long board and head blocks better than long board and head blocks alone] at [cervical spinal immobilisation]?

Search strategy
Medline 1966–03/01 using the OVID interface and hand searching relevant pre-hospital journals. {(exp spinal injuries OR spinal injury$.mp OR back injuries OR back injury$.mp OR exp fractures OR spinal fractures$.mp OR exp lumbar vertebrae OR lumbar spine injury$.mp OR exp thoracic vertebrae OR thoracic spine injury$.mp OR exp cervical vertebrae OR vertebral fracture$.mp OR exp cervical spinal injury$.mp OR exp multiple trauma OR multiple trauma.mp OR exp wounds and injuries OR trauma.mp) AND (exp immobilization OR spine boards$.mp OR neck collar$.mp OR spinal immobilization$.mp OR cervical collar$.mp OR hard collar$.mp OR semi-rigid collar$.mp OR rigid collar$.mp)} LIMIT to human AND English.

Search outcome
Altogether 855 papers found of which 854 were irrelevant or of insufficient quality. The remaining paper is shown in table 7.

Comments
There is no evidence of the effect in patients with cervical spinal injuries. Furthermore, goniometric techniques do not assess the movement at an individual vertebral level.

Clinical bottom line
Cervical collars are of no additional benefit to patients already immobilised using a long spine board with straps.

1 Houghton L, Driscoll P. Cervical immobilization—are we achieving it? Prehosp Emerg Care 1999;3:17–21.

Table 7

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidence)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houghton I and Driscoll P, UK, 1999</td>
<td>24 healthy volunteers. Two different cervical collars with and without head blocks and straps. Movement was assessed using goniometric techniques.</td>
<td>Clinical trial</td>
<td>Percentage neck movement</td>
<td>Collars produced a reduction of movement of 31–45%. Head blocks and straps produced a reduction of between 58–64%. When head blocks and straps were in place the addition of a collar was not beneficial.</td>
<td>Goniometric techniques can overestimate the actual cervical spine movement.</td>
</tr>
</tbody>
</table>