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.1 Each BET has been constructed in the four stages that have been described elsewhere.2 The BETs shown here together with those published previously and those currently under construction can be seen at http://www.bestbets.org3 Six topics are covered in this issue of the journal.

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**The accuracy of abdominal ultrasound in paediatric trauma**

Report by Ross Murphy, Senior Clinical Fellow
Search checked by Angaj Ghosh, Senior Clinical Fellow

**Clinical scenario**

An 8 year old boy is taken to the emergency department after falling out of a tree. He has no signs of injury apart from abrasions and tenderness across his upper abdomen; he is haemodynamically stable. He undergoes an abdominal ultrasound that is normal but you wonder how accurate this is at identifying intra-abdominal injury compared with the current gold standard, abdominal computed tomography.

**Three part question**

In [a paediatric patient with blunt abdominal trauma] how [accurate is an ultrasound scan] at [identifying intra-abdominal injury]?

**Search strategy**

Medline 1966–12/00 using the OVID interface. [(exp child OR children.mp OR exp Pediatrics OR pediatric.mp OR paediatric.mp) AND (exp abdominal injuries OR abdominal trauma.mp)] AND (exp tomography, x-ray computed OR CT.mp OR computerised tomography.mp OR exp ultrasonography OR ultrasonography.mp OR exp ultrasonics OR ultrasonics.mp OR ultrasound.mp) LIMIT to human AND english.

**Search outcome**

Altogether 511 papers found of which 505 were irrelevant or of insufficient quality. The remaining six papers are shown in table 1.

**Comments**

The evidence indicates a variability in the accuracy of ultrasound at identifying intra-abdominal injury in children. This is probably related to the skill of the ultrasonographer. Ultrasound can have a high diagnostic specificity and it may be useful as part of a rule in strategy in these situations. Focused abdominal sonography for trauma (FAST) seems to be neither sensitive nor specific enough.

**Clinical bottom line**

Abdominal ultrasound can be used to rule in intra-abdominal fluid or organ damage in children. Negative ultrasound does not rule out intra-abdominal injury and, if clinical suspicion persists, abdominal computed tomography with contrast should be performed.

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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>Krupnick AS et al, 1996, USA</td>
<td>32 children with blunt abdominal trauma and splenic injury diagnosed on abdominal CT with contrast. 32 controls.</td>
<td>Diagnostic test study</td>
<td>Splenic injury detected by USS</td>
<td>Sensitivity 69%</td>
<td>Ultrasound done on average within 5.5 days of CT and 6.5 days of the injury. All data not given. Specificity calculated from control group, none of whom had been victims of trauma. No power study.</td>
</tr>
<tr>
<td>Richardson MC et al, 1997, UK</td>
<td>26 children who had scans performed within 48 hours of blunt abdominal trauma. Abdominal CT with contrast as gold standard</td>
<td>Diagnostic test study</td>
<td>Intra-abdominal fluid or organ injury detected by USS</td>
<td>Sensitivity 87.5%</td>
<td>Retrospective. Only 2 patients had no intra-abdominal injury implying that this sample group may have been more severely injured than most children with blunt abdominal trauma. Retrospective. Sample group selective</td>
</tr>
<tr>
<td>Partrick DA et al, 1998, USA</td>
<td>100 children with blunt abdominal trauma who has abdominal ultrasound performed by an emergency physician. Abdominal CT as gold standard</td>
<td>Diagnostic test study</td>
<td>Intra-abdominal fluid or organ injury detected by USS</td>
<td>Specificity 100% NPV 40% Sensitivity 42%</td>
<td></td>
</tr>
<tr>
<td>Mutabagani KH et al, 1999, USA</td>
<td>46 children with suspected intra-abdominal injury undergoing focussed abdominal sonography for trauma (FAST) Abdominal CT as gold standard</td>
<td>Diagnostic test study</td>
<td>Intra-abdominal fluid or organ injury detected by FAST</td>
<td>Specificity 100% NPV 71% Sensitivity 64.7–70.6%</td>
<td>Intervals between scans up to 24 hours with CT scan performed first. All data not given. No power study.</td>
</tr>
<tr>
<td>Benya EC et al, 2000, USA</td>
<td>51 children with blunt abdominal trauma. Abdominal CT with contrast as gold standard</td>
<td>Diagnostic test study</td>
<td>Intra-abdominal fluid or organ injury detected by USS</td>
<td>Specificity 70.6–79.4% Sensitivity 55%</td>
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<tr>
<td>Coley BD et al, 2000, USA</td>
<td>107 children with blunt abdominal trauma undergoing focussed abdominal sonography for trauma (FAST)</td>
<td>Diagnostic test study</td>
<td>Intra-abdominal fluid or organ injury detected by FAST</td>
<td>Specificity 18% NPV 50%</td>
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</table>

EMLA or amethocaine (tetracaine) for topical analgesia in children

Report by Russell Boyd, Consultant
Search checked by Michelle Jacobs, Specialist Registrar

Clinical scenario
A 5 year old child is to undergo venepuncture for a diagnostic blood test. You wonder if the application of Ametop (4% amethocaine gel) or EMLA (eutectic mixture of local anaesthetics (2.5% lignocaine (lidocaine) with 2.5% prilocaine)) will be better at reducing the pain of venepuncture.

Three part question
In a 5 year old child is [EMLA or amethocaine gel] better at [reducing the pain of venepuncture].

Search strategy
Medline 1966–12/00 using the OVID interface. [(exp tetracaine OR tetracaine.mp OR amethocaine.mp) AND (exp prilocaine OR prilocaine.mp OR EMLA.mp OR exp lidocaine OR lidocaine.mp)] AND (exp anaesthetics, combined OR exp anaesthetics, local)] LIMIT to human AND english.

Search outcome
Altogether 72 papers found of which 67 were irrelevant or of insufficient quality. The remaining five papers are shown in table 2.

Comments
The studies listed are of variable quality but the trend seems to favour Ametop as the superior anaesthetic. This product may also have advantages in terms of speed of onset and vasodilatation.

Clinical bottom line
Ametop is superior to EMLA for topical anaesthesia before venepuncture in children.
Cautery or cream for epistaxis in children

Report by Angaj Ghosh, Senior Clinical Fellow

Search checked by Rupert Jackson, Specialist Registrar

Clinical scenario
A child presents to the emergency department with a nosebleed that came on spontaneously and that has not responded to simple first aid measures. The bleed appears to be from the front of the nose and the patient has no underlying disease. You wonder whether silver nitrate cautery or application of nasal antiseptic cream is the best method of obtaining haemostasis.

Three part question
In [children with spontaneous epistaxis and no underlying disease] is [silver nitrate cautery better than nasal antiseptic cream] at [stopping bleeding and preventing recurrences]?

Search strategy
Medline 1966–12/00 using the OVID interface. 
{(exp epistaxis OR epistaxis.mp OR nose-bleed$.mp) OR [(exp hemorrhage OR hemorrhage.mp OR haemorrhage.mp OR bleed$.mp) AND (exp nose OR nose.mp OR exp nasal mucosa OR nasal mucosa.mp OR nasal.mp OR nares.mp)]} AND (exp cautery OR cautery$.mp OR exp silver nitrate OR nasal cautery.mp OR exp anti-infective agents OR anti-infective agents.mp) LIMIT to human AND english.

Comments
This BET combines two patient groups—children with primary anterior epistaxis at first presentation and children with recurrent epistaxis. The final outcome being the same—stopping any further bleeds.

Clinical bottom line
Cautery and naseptin are equally effective. Given the ease of application naseptin is the best method of obtaining haemostosis.

Study type
PRCT

Outcomes
Key results
Study weaknesses

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidence)</th>
<th>PRCT</th>
<th>Recurrent epistaxis rate</th>
<th>50% ± 46% (no significant difference)</th>
<th>Low power</th>
<th>PRCT</th>
<th>Recurrent epistaxis rate</th>
<th>9% ± 11% (p=0.7569)</th>
<th>14 lost to follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawson RA et al, 1995, UK</td>
<td>Convenience sample of 94 children age 5–12 years undergoing pre-op cannulation Amethocaine v EMLA</td>
<td>PRCT</td>
<td>Self reported absence of pain</td>
<td>62% (34/55) v 32% (18/55) (p&lt;0.05)</td>
<td>40 minute application time for EMLA too short No standardised method of pain scoring.</td>
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<tr>
<td>Van Kam HJM et al, 1997, Netherlands</td>
<td>Convenience sample of 68 children age 1–15 years undergoing cannulation or venepuncture Tetracaine v EMLA</td>
<td>PRCT</td>
<td>Adequacy of analgesia reported by phlebotomists</td>
<td>76% (26/34) v 97% (31/32) (p=0.02)</td>
<td>Variable time from removal to cannulation in tetracaine group. Very small numbers and no power calculation</td>
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<tr>
<td>Romsing J et al, 1999, UK</td>
<td>Convenience sample of 60 children age 3–15 years undergoing pre-op cannulation</td>
<td>PRCT</td>
<td>Self reported pain score</td>
<td>Significantly lower in tetracaine group (p&lt;0.05)</td>
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<td>Choy L et al, 1999, UK</td>
<td>Convenience sample of 34 children aged over 1 year undergoing outpatient venepuncture Amethocaine v EMLA</td>
<td>PRCT</td>
<td>Self reported pain score</td>
<td>No significant difference</td>
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<tr>
<td>Arrowsmith J and Campbell C, 2000, UK</td>
<td>Convenience sample of 120 children age 1–15 years undergoing cannulation Amethocaine v EMLA</td>
<td>PRCT</td>
<td>Observational behaviour score</td>
<td>72% (43/60) nil or mild v 55% (33/60)</td>
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</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>PRCT</th>
<th>Adequacy of analgesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author, date and country</td>
<td>Patient group</td>
<td>Study type (level of evidence)</td>
<td>PRCT</td>
<td>Adequacy of analgesia</td>
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<tr>
<td>Ruddy J et al, 1991, UK</td>
<td>48 consecutive children with anterior epistaxis attending an emergency department. Antiseptic nasal carrier cream (Naseptin) v silver nitrate cautery</td>
<td>PRCT</td>
<td>Recurrent epistaxis rate</td>
<td>50% ± 46% (no significant difference)</td>
</tr>
<tr>
<td>Murthy P et al, 1999, UK</td>
<td>64 consecutive patients with recurrent epistaxis attending an outpatient clinic. Antiseptic nasal carrier cream (Naseptin) alone v silver nitrate cautery and antiseptic cream</td>
<td>PRCT</td>
<td>Recurrent epistaxis rate</td>
<td>9% ± 11% (p=0.7569)</td>
</tr>
</tbody>
</table>
Standard bone marrow needles or special needles for intraosseous access
Report by Simon Carley, Specialist Registrar
Search checked by Russel Boyd, Consultant

Clinical scenario
A 5 year old shocked child is presented to the emergency department via ambulance. Intravenous access is not possible and you decide to place an intraosseous needle. You find that the trolley has been stocked with standard bone marrow aspiration needles rather than the special intraosseous (IO) needles that you are used to. You swear loudly and eventually gain access with great difficulty using a cutdown technique. You later wonder whether you could have used the standard bone marrow needle instead.

Three part question
[In patients requiring IO access] are [specifically designed IO needles better than standard bone marrow aspiration needles] at [obtaining safe and speedy IO access]?

Table 4

<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>Halm B and Yamamoto LG, 1998, USA</td>
<td>8 paramedics and 26 paediatric residents singing a turkey thigh model. Jamshidi vs Cook</td>
<td>Experimental</td>
<td>Operator assessment of difficulty of insertion (10 cm VAS)</td>
<td>3 vs 7.1 (p&lt;0.001)</td>
<td>Model was bone only rather than bone and flesh</td>
</tr>
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<td></td>
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<td></td>
<td>Time to placement</td>
<td>25.5s ± 56.2s (p&lt;0.001)</td>
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<td></td>
<td></td>
<td></td>
<td>Incorrect placement rate</td>
<td>2 ± 1 (non-significant)</td>
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</tbody>
</table>

Abdominal ultrasound in the diagnosis of childhood appendicitis
Report by Rob Williams, Specialist Registrar
Search checked by Kevin Mackway-Jones, Consultant

Clinical scenario
An 8 year old patient presents to the emergency department with a six hour history of right iliac fossa pain; examination is suggestive of acute appendicitis. You wonder whether an ultrasound scan would be helpful for diagnosis.

Three part question
In [a paediatric patient with clinical signs of appendicitis] how [useful is an ultrasound scan] at [confirming or refuting the diagnosis]?

Search strategy
Medline 1966–12/00 using the OVID interface. [(exp child OR children.mp OR exp pediatrics OR pediatric.mp OR paediatric.mp) AND (exp appendicitis OR acute appendicitis.mp)] AND [(exp ultrasonography OR ultrasonography.mp OR exp ultrasound OR ultrasonics.mp OR ultrasound.mp)] LIMIT to human AND english.

Search outcome
Altogether 173 papers found of which 170 were irrelevant or of insufficient quality. The remaining three papers are shown in table 5.

Comments
These studies show that ultrasound has a high sensitivity and specificity for the diagnosis of appendicitis. While specificity is high enough to SpIn, sensitivity is too low to SnOut. Further work investigating the diagnostic utility in high, moderate and low risk groups is warranted.

Clinical bottom line
A positive ultrasound is highly specific and can be used to rule in acute appendicitis in children. Sensitivity of this test is too low to rule out the diagnosis.

Table 5

<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>Hahn HB et al, 1998, Germany</td>
<td>3859 children age 1–17 years with suspected acute appendicitis. Gold standard was operative findings or result of clinical observation and repeat ultrasound</td>
<td>Diagnostic cohort</td>
<td>Appendicitis</td>
<td>Sensitivity 90% Specificity 97% LR +30 LR −0.1</td>
<td>Inhospital follow up only.</td>
</tr>
<tr>
<td>Schulte B et al, 1998, Germany</td>
<td>1285 children age 1–15 years with acute appendicitis. Gold standard was operative findings or result of clinical follow up</td>
<td>Diagnostic cohort</td>
<td>Appendicitis</td>
<td>Sensitivity 92% Specificity 98% LR +42 LR −0.08</td>
<td>Follow up rate unclear. Follow up time not specified.</td>
</tr>
<tr>
<td>Sivit CJ et al, 2000, USA</td>
<td>386 patients age 1–21 years with suspected acute appendicitis. Analysed for under and over 10 years old. Gold standard was operative findings or result of clinical follow up</td>
<td>Diagnostic cohort</td>
<td>Appendicitis &lt;10 years old</td>
<td>Specificity 96% LR +5.1 LR −0.34 Sensitivity 84% Specificity 86% LR +6 LR −0.18</td>
<td>Unblinded. Excludes an unknown number of ”obvious” appendicitis cases.</td>
</tr>
</tbody>
</table>

Table 6

<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>Del Beccaro MA et al, 1992, USA</td>
<td>138 children age 2.5 weeks to 12 years admitted with acute hip pain</td>
<td>Diagnostic test study</td>
<td>Septic arthritis of the hip Raised ESR alone Raised ESR and temperature</td>
<td>Sensitivity 79% Specificity 97%</td>
<td>Retrospective chart review including neonates. Gold standard not universally applied. Diagnostic tests were not universally applied. Numbers do not appear to add up. Number too small to be meaningful. Only 1 case of septic arthritis found. 14 patients excluded due to loss of data. Retrospective identification of cases. Cohort identified retrospectively</td>
</tr>
<tr>
<td>Taylor GR and Clarke NMP, 1994, UK</td>
<td>417 consecutive paediatric admissions with hip pain identified on retrospective chart review</td>
<td>Diagnostic test study</td>
<td>Septic arthritis of the hip Raised ESR alone Raised ESR and temperature or severe spasm/tenderness Septic arthritis of the hip Raised ESR alone</td>
<td>Sensitivity 90.5% Specificity 97% Sensitivity 100%</td>
<td></td>
</tr>
<tr>
<td>Fink MA et al, 1995, Switzerland</td>
<td>50 consecutive children age 1–10 years with acute hip pain</td>
<td>Diagnostic test study</td>
<td>Septic arthritis of the hip Raised ESR alone</td>
<td>Sensitivity 98% LR +2.0 LR −0.08</td>
<td></td>
</tr>
<tr>
<td>Eich GF et al, 1999, USA</td>
<td>114 children with acute hip pain</td>
<td>Diagnostic test study</td>
<td>Septic arthritis of the hip Raised ESR alone Raised ESR and temperature or CRP Septic arthritis of the hip Raised ESR alone Raised ESR and temperature and WCC and inability to weight bear</td>
<td>Sensitivity not given Specificity not given</td>
<td></td>
</tr>
<tr>
<td>Kocher M et al, 1999, USA</td>
<td>282 children with diagnosis of irritable hip</td>
<td>Diagnostic test study</td>
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</table>

Erythrocyte sedimentation rate and septic arthritis in children

Report by Russell Boyd, Consultant
Search checked by Bruce Martin, Specialist Registrar

Clinical scenario
A 3 year old child presents to the emergency department with a short history of limp, temperature and difficulty in weight bearing on the left leg. The pain is principally located at the hip joint and you fear this may be a septic arthritis. You wonder if an erythrocyte sedimentation rate (ESR) will help in excluding the diagnosis of septic arthritis.

Three part question
In [children presenting with acute hip pain] is [a raised ESR] useful in [diagnosing septic arthritis].

Search strategy
Medline 1966–12/00 using the OVID interface. [(exp child OR children.mp OR pediatric.mp OR paediatric.mp) AND (exp hip OR exp hip joint OR hip.mp OR exp arthritis, infectious OR exp osteomyelitis OR septic arthritis.mp)] AND (exp laboratory techniques and procedures OR laboratory techniques.mp OR exp ultrasonography OR exp blood cell count OR exp c-reactive protein)] AND maximally sensitive diagnostic filter LIMIT to human and english.

Search outcome
Altogether 334 papers found of which 329 were irrelevant or of insufficient quality. The remaining five papers are shown in table 6.

Comments
An isolated ESR is of variable sensitivity and not suitable to rule out septic arthritis, however in combination with an increased temperature and inability to weight bear or reduced mobility it becomes a useful rule out tool with sensitivities consistently above 95%.

Clinical bottom line
An isolated ESR test cannot exclude septic arthritis. In combination with temperature and ability to weight bear it can be used as a SnOut.