Role of flexion/extension radiography in paediatric neck injuries

Report by Elspeth Pitt, Specialist Registrar
Checked by Shobhan Thakore, A&E Consultant
doi: 10.1136/emj.2004.022814

Abstract
A short cut review was carried out to establish the potential utility of flexion/extension views of the cervical spine in children with neck injuries. Using the reported search, 51 papers were found, 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. A clinical bottom line is stated.

Clinical scenario
A child attends the department; he has been involved in a high speed road traffic accident, complains of neck pain and midline neck spinal tenderness, but has no neurological signs/symptoms. Static cervical spine radiology (lateral, AP, and odontoid views) reveal no abnormality. You wonder if flexion/extension x-rays would show any significant injury/instability.

Three part question
In [a neurologically intact child with neck pain following trauma but normal plain x-rays] do [flexion/extension x-rays] aid [diagnosis of ligamentous or soft tissue injury with instability]?.

Search strategy


Medline: [exp neck injuries OR neck trauma.mp OR cervical spine trauma.mp OR exp spinal injuries OR exp spinal cord injuries OR exp spinal fractures OR exp vertebral fractures OR cervical spine injuries.mp OR exp dislocations OR exp cervical vertebrae OR cervical spinal cord trauma.mp OR exp spinal cord compression] AND [flexion-extension.ti OR dynamic cervical spine radiography.mp OR flexion-extension radiography.mp OR flexion-extension cervical spine radiography.mp OR flexion-extension radiographs.mp] AND [exp joint instability OR ligamentous injury.mp OR ligament injury.mp OR cervical vertebrae OR exp fractures OR ligamentous instability.mp OR exp soft tissue injuries OR soft tissue injury.mp] AND [BestBETs paediatric filter] LIMIT to human AND English language.

Embase: [exp neck injuries OR neck trauma.mp OR cervical spine trauma.mp OR exp spinal injuries OR exp spinal cord injuries OR exp spinal fractures OR exp vertebral fractures OR cervical spine injuries.mp OR exp dislocations OR exp cervical vertebrae OR cervical spinal cord trauma.mp OR exp spinal cord compression] AND [flexion-extension.ti OR dynamic cervical spine radiography.mp OR flexion-extension radiography.mp OR flexion-extension cervical spine radiography.mp OR flexion-extension radiographs.mp] AND [exp joint instability OR ligamentous injury.mp OR ligament injury.mp OR cervical vertebrae OR exp fractures OR ligamentous instability.mp OR exp soft tissue injuries OR soft tissue injury.mp] AND [BestBETs paediatric filter] LIMIT to human AND English language.
these studies. However, the utility of FECSR in patients with normal static cervical spine radiography (SCSR) is low. In the current era of imaging modalities such as CT and MRI, the need for FECSR may decline.

**CLINICAL BOTTOM LINE**

If SCSR is normal, FECSR is unlikely to be abnormal. If SCSR is equivocal/abnormal, FECSR is still unlikely to be abnormal but may help may help to rule out injury in an alert child with no neurological signs complaining of pain and neck tenderness.

**Abstract**

A short cut review was carried out to establish the utility of troponin levels in diagnosing myocardial contusion following blunt chest trauma. Using the reported search, 75 papers were found, of which six 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. A clinical bottom line is stated.

**Clinical scenario**

A 45 year old man attends the emergency department after being involved in a road traffic accident. He has sustained a blunt chest injury during the impact and has bruising across his chest wall. His ECG shows non-specific ST segment changes and the chest radiograph are normal. You wonder about the benefit of performing a troponin level to aid the diagnosis or exclusion of myocardial contusion.

**Three part question**

Is [troponin] level a good indicator of underlying [cardiac damage] after [blunt chest trauma]?

**Search strategy**

Medline 1966-11/04 using the Ovid interface. [exp troponin OR troponi$.mp] AND [exp Wounds, Nonpenetrating OR exp Thoracic Injuries OR blunt chest injury.mp OR blunt chest trauma.mp OR blunt thoracic injury.mp OR blunt thoracic trauma.mp] AND [exp Heart Injuries OR myocardial contusion.mp OR cardiac contusion.mp OR myocardial damage.mp]

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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>Woods WA et al, 1998, USA</td>
<td>137 alert 0–18 year olds following blunt trauma who underwent static cervical spine radiography (SCSR) and flexion extension cervical spine radiography (FECSR)</td>
<td>Retrospective descriptive study</td>
<td>Radiological instability on FECSR</td>
<td>93 (70%) normal SCSR—all had normal FECSR 30% (40) abnormal SCSR of whom 7 (5%) had abnormal FECSR but none required invasive spinal surgery and all had satisfactory neurological outcome No complications of FECSR</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Dwek JR &amp; Chung CB, 2000, USA</td>
<td>247 1–6–18 year olds with history of trauma who had SCSR followed by FECSR done at the time the GCS permitted (could be delayed days)</td>
<td>Retrospective observational study</td>
<td>Radiological abnormality on SCSR and FECSR</td>
<td>All with normal SCSR—had normal FECSR Abnormality on FECSR assessed qualitatively by radiologists 8% of dynamic CSR inadequate—not further commented on other than no late instability in those attending at 2/52</td>
<td>Retrospective Abnormality on FECSR assessed qualitatively by radiologists 8% of dynamic CSR inadequate—not further commented on other than no late instability in those attending at 2/52</td>
</tr>
<tr>
<td>Ralston ME et al, 2001, USA</td>
<td>129 patients &lt;17 years of age with blunt trauma who had SCSR and FECSR within 7 days of injury</td>
<td>Retrospective review</td>
<td>Radiographic assessment of abnormality on SCSR and FECSR</td>
<td>83 suspicious SCSR led to 75 normal and 8 abnormal FECSR Normal SCSR unlikely to have an abnormal FECSR OF 46 normal SCSR, one had an abnormal FECSR (abnormal subluxation) but was given a clinical diagnosis of physiological subluxation based on clinical course Abnormal SCSR—FECSR limited use in confirming injury but useful to rule out injury No permanent complications</td>
<td>Retrospective Don’t correlate radiographic review with clinical findings Only 1 radiographic reviewer looked at all films</td>
</tr>
</tbody>
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**Use of troponin for the diagnosis of myocardial contusion after blunt chest trauma**

Report by Lorna Jackson, *SpR in Emergency Medicine*

Checked by Alison Stewart, *SHO III in Emergency Medicine*

doi: 10.1136/emj.2004.022822
### Table 1

<table>
<thead>
<tr>
<th>Author, date and country</th>
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</tr>
</thead>
<tbody>
<tr>
<td>AdamsJE, 1997, USA</td>
<td>Patients with suspected cardiac trauma</td>
<td>Review article including 3 relevant papers</td>
<td>Serial TnT and total CK, CK and TnI over first 72 hours and ECHO TnI, CK and CK-MB at 12 and 24 hours and ECHO TnI v TnI</td>
<td>Sensitivity 0.63 and specificity 0.71 for TnI; Sensitivity 1 and specificity 0.68 for TnI; Specificity 0.72 for TnI; TnI specificity better than TnT specificity</td>
<td>Excluded those with pre-existing cardiac disease; Very small numbers involved</td>
</tr>
<tr>
<td>Ferjani M et al, 1997, France</td>
<td>128 consecutive patients who had suffered blunt chest trauma. All patients had TnT measured at admission, 4 and 24 hours after admission. Cardiac contusion defined as abnormal echocardiography compatible with contusion, severe cardiac rhythm abnormality, severe cardiac conduction abnormality or haemopericardium. Patients who had suffered blunt chest trauma</td>
<td>Prospective observational study</td>
<td>Sensitivity and specificity of troponin T: &gt;=0.5 ug over 1st 24 hours</td>
<td>ROC curve analysis performed AROC = 0.69 with 95% C.I. of 0.56 to 0.80</td>
<td>Excludes patients with pre-existing coronary artery disease</td>
</tr>
<tr>
<td>Mori F et al, 2001, Italy</td>
<td>32 patients with clinical or radiological signs of acute blunt chest trauma. All patients had cTnI measured at 6, 12, 24, 48 and 96 hours post injury. Cardiac contusion defined as abnormal trans-oesophageal echocardiography</td>
<td>Prospective observational study</td>
<td>Sensitivity of raised troponin</td>
<td>Troponin versus CKMB: TnT of 0.5 ug has specificity of 0.91 but sensitivity of 0.31, indicating that it is unreliable. Trop T had greater AROC than CKMB or CKMB/CK ratio. All with normal or minimally raised TnI (&lt;0.4 ng/ml) had a normal echo (mean 0.6 +/-1.4)</td>
<td>Only measured TnT at admission, 4 and 24 hours. Used TnI not TnI trop of &gt;=0.5 ug is a high level</td>
</tr>
<tr>
<td>Kaye P et al, 2002, UK</td>
<td>Patients with suspected myocardial contusion. ECG and ECHO used to define significant blunt cardiac injury.</td>
<td>Review article including 3 relevant papers</td>
<td>Utility of troponin to diagnose myocardial contusion</td>
<td>Specificity of raised troponin: Mean TnI was higher in those with abnormal echo (mean 2.6 +/-1.6) compared to 0.0001. Animal studies suggest troponin may be useful. 2 Human studies show high sensitivity, 1 shows low specificity (but had questionable gold standard). Authors concluded cardiac troponins seem to be highly specific and sensitive for myocardial injury. They may offer the possibility of stratification of severity and risk of adverse outcome.</td>
<td>Small numbers included in the study; Papers used variable gold standards, abnormal ECG, clinically significant finding and/or ECHO. 1 paper looked at ventilated trauma patients and none had an abnormal echo</td>
</tr>
<tr>
<td>Velmahos G et al, 2003, USA</td>
<td>333 consecutive patients with significant blunt thoracic trauma. TnI was performed on all patients at admission, 4 and 8 hours post admission. Significant blunt cardiac injury was determined by any of the following: hypotension in the absence of bleeding or a neurogenic cause, cardiac arrhythmia, echocardiographic abnormality, severe arrhythmia, or shock of unexplained origin</td>
<td>Prospective observational study</td>
<td>Clinical diagnosis of significant blunt cardiac injury. Serial ECG and TnI analysis</td>
<td>None with normal ECG and TnI at 8 hours were felt to have significant blunt cardiac injury. Tnl was considered abnormal if values were greater than 1.5 ng/mL.</td>
<td>Small numbers involved in the trials; The diagnosis of significant blunt cardiac injury was made clinically</td>
</tr>
<tr>
<td>Sybrandy KC et al, 2003, Netherlands</td>
<td>Patients with suspected cardiac contusion</td>
<td>Review article including 2 further relevant papers</td>
<td>Utility of troponins to detect myocardial contusion</td>
<td>Sensitivity 100%, all with normal TnI had no problems. Specificity 83-87.5%</td>
<td>High cut of for raised TnI (1.5 ng/mL); One paper excluded intubated and haemodynamically unstable patients; Small numbers involved in the trials</td>
</tr>
</tbody>
</table>
Scorpion envenomation: does administration of antivenom alter outcome?

Report by Bernard Foe¨x, Consultant in Emergency Medicine (Manchester)
Checked by Lee Wallis, Consultant in Emergency Medicine (Cape Town)

doi: 10.1136/emj.2004.022830

Abstract
A short cut review was carried out to establish the clinical utility of antivenom in scorpion poisoning. Using the reported search, 69 papers were found, of which four 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. A clinical bottom line is stated.

Clinical scenario
A woman presents to the emergency department after being stung by a scorpion, which was hiding in a bunch of bananas in her local supermarket. She is in great pain and feels sick. You wonder whether she should be given an antivenom.

Scorpion envenomation: does antivenom reduce serum venom concentrations?

Report by Bernard Foe¨x, Consultant in Emergency Medicine and Critical Care
Checked by Lee Wallis, Consultant in Emergency Medicine

doi: 10.1136/emj.2004.022848

Abstract
A short cut review was carried out to determine if antivenom reduces serum venom concentrations. Using the reported search, 69 papers were found, of which four 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. A clinical bottom line is stated.

Clinical scenario
A woman has been stung by a scorpion while buying bananas in her local supermarket. She is showing some signs of systemic envenomation and you wonder whether giving her antivenom will reduce her serum venom concentration.
Three part question
In [scorpion envenomation] does [antivenom serotherapy] [reduce serum venom concentration]?

Search strategy

Search outcome
Altogether, 69 papers were found, only four of which addressed the serum kinetics of scorpion venom after administration of antivenom.

Comment(s)
The vast majority of patients had only grade I envenomation. Serum venom concentrations were higher in grade II than grade I envenomations.

Two studies showed that one dose of antivenom administered intramuscularly was not effective in reducing serum venom concentrations. Intravenous antivenom was effective in reducing serum venom concentrations compared to controls in two studies. Higher doses were more effective. Two studies documented clinical improvements with antivenom treatment.

CLINICAL BOTTOM LINE
There is good evidence that intravenous administration of antivenom reduces serum venom concentrations. Whether this is clinically relevant is open to question.

Table 1

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<th>Study weaknesses</th>
</tr>
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<tbody>
<tr>
<td>Sofer S et al, 1994, Israel</td>
<td>Children admitted to PICU after scorpion envenomation. Comparison of 52 children given antivenom between 10 July 1985 and 1 July 1989 and 52 children treated without antivenom between 1 July 1989 and Dec 31 1992</td>
<td>Cohort</td>
<td>Duration of PICU stay</td>
<td>No significant difference</td>
<td>Historical comparison. Children treated without antivenom may have benefited from improved supportive care</td>
</tr>
<tr>
<td>Belghith M et al, 1999, Tunisia</td>
<td>Patients participating in a study on the efficacy of high-dose hydrocortisone after scorpion sting. Matched pair comparison of 135 patients given scorpion antivenom in addition to their triplay medication</td>
<td>Cohort</td>
<td>Duration of hospital stay, Full recovery, Death</td>
<td>No significant difference</td>
<td>Retrospective review of patients recruited into another trial. Results not stratified according to hydrocortisone treatment</td>
</tr>
<tr>
<td>Abroug F et al, 1999, Tunisia</td>
<td>825 consecutive patients aged 10 or older presenting to a non-teaching hospital emergency department</td>
<td>Randomised placebo controlled trial of intravenous scorpion antivenom</td>
<td>Clinical improvement</td>
<td>50% of antivenom group, 64% control group</td>
<td></td>
</tr>
<tr>
<td>Ghalim N et al, 2000, Morocco</td>
<td>275 patients with scorpion envenomation, 179 of whom were treated with antivenom (IM, SC or both routes)</td>
<td>Prospective cohort</td>
<td>Effectiveness of antivenom according to sting admission interval</td>
<td>Antivenom more effective if sting admission interval &lt;1 hour</td>
<td>Statistical analysis of clinical features unclear. There appears to be a 50% baseline difference in incidence of systemic symptoms between the antivenom and no antivenom groups in favour of the antivenom group</td>
</tr>
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</table>

Local symptoms: Greater reduction in local pain and burning reported with antivenom
Systemic symptoms: Lower incidence of systemic symptoms in the antivenom group

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</tr>
</thead>
<tbody>
<tr>
<td>De Rezende NA et al, 1995, Brazil</td>
<td>18 patients with signs of systemic envenomation</td>
<td>Cohort</td>
<td>Serum venom concentrations measured by ELISA before and after intravenous antivenom treatment</td>
<td>Venom antigens cleared 1 hour after antivenom</td>
<td>No serum venom kinetics in a control group not treated with antivenom</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Antivenom concentrations measured by ELISA before and after intravenous antivenom treatment</td>
<td>High antivenom titres persisted for 24 hours</td>
<td></td>
</tr>
<tr>
<td>Krifi MN et al, 1999, Tunisia</td>
<td>147 children under 15 years with grade II and III scorpion envenomation, divided into 6 groups according to whether given 1 or 2 doses of antivenom (IM or IV or IM and IV) and no antivenom</td>
<td>Cohort</td>
<td>Intramuscular administration</td>
<td>No significant effect on toxicokinetic curve or recovery time, when only one dose given</td>
<td>Unclear whether retrospective analysis or prospective study. No apparent blinding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Intravenous administration</td>
<td>Rapid clearance of venom and shortened recovery time</td>
<td></td>
</tr>
<tr>
<td>Ghalim N et al, 2000, Morocco</td>
<td>275 patients, of which 179 were treated with antivenom. Antivenom administered intramuscularly (77.6%) or subcutaneously (6.2%) or both (16.2%)</td>
<td>Prospective cohort study</td>
<td>Epidemiology of envenomation</td>
<td>247 showed only grade I symptoms. No patients with grade III symptoms</td>
<td>Venom kinetics not studied in grade II patients as they constituted only 10% of cohort</td>
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<td></td>
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<td></td>
<td>Toxokinetics in grade I envenomation</td>
<td>Reduction in serum venom concentration. Greater effect of 10 ml versus 2–5 ml antivenom</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Clinical course</td>
<td>Symptoms improved with antivenom</td>
<td></td>
</tr>
<tr>
<td>Hammoudi-Triki D et al, 2004, Algeria</td>
<td>182 patients (adults and children) stung by scorpions. Retrospective review of charts and blood results for those treated with intramuscular antivenom</td>
<td>Cohort</td>
<td>Epidemiology</td>
<td>No grade III (severe) envenomations</td>
<td>Retrospective review. Intramuscular rather than intravenous route used. Only one dose of antivenom given. Only 40 patients had post immunotherapy blood samples taken. Venom concentrations lower than in Krifi (1999) and Ghalim (2000) studies, although this may be due to ELISA differences</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Venom kinetics</td>
<td>10 ml of intramuscular antivenom did not alter venom kinetics</td>
<td></td>
</tr>
</tbody>
</table>


Scorpion envenomation: does administration of antivenom alter outcome?

Bernard Foëx and Lee Wallis

doi: 10.1136/emj.2004.022830

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