Blunt abdominal trauma and the absence of abdominal bruising
Implications in critical care

Presenter Dr Brendon Bowkett
Author(s): Goddard L.¹, Bowkett B.², Kenwright D.³

Institute(s):
1 Wellington Children’s Hospital, Clinical School, Dept of Paediatric Surgery, Wellington, New Zealand, 2 Wellington Children’s Hospital, Dept of Paediatric Surgery, Wellington, New Zealand, 3 Dept of Paediatric Pathology, Wellington Clinical School, Wellington, New Zealand
NO DISCLOSURES
NZ STATS

Traumatic death from child abuse is common in NZ

- NZ currently ranked 25th out of 27 OECD countries in respect to child deaths from Maltreatment?
- Approximately 23,000 children suffer from abuse or neglect in NZ each year? (2012/13)
- Equates to 3-4% of child population of NZ
Duodenal Perforations in children under 4 (nonMVA)
Child abuse a most likely cause.

- Bowkett et al  ANZ J Surg 1998 Vol 68
- 14 year review  7 cases 5 cases child abuse 2 MVA
- No case due to falls or objects falling
- Falls leading cause of admission
- Pokorny et al  JPS 1986  only one case due to child abuse.
  ( objects falling on or child falling)
• Bowkett et al  ANZ J Surg  1998 vol 68

• 4/5 cases due to abuse had no evidence of abdominal bruising even with delayed presentation
TRAUMATIC RUPTURE OF DUODENUM

Ruptured duodenum

Identify abuse
Protect the child
Document evidence
TRAUMATIC RUPTURE OF DUODENUM

Abdominal wall

Duodenum

Vessels within abdominal wall
TRAUMATIC RUPTURE OF DUODENUM

Vessels within abdominal wall stretch with the force

Punch/blow to the abdomen

Duodenal injury
8 year review of duodenal trauma including perforations
All children < 4 with perforations in non MVA (n=3) mechanism (child abuse)
2/3 initially diagnosed with appendicitis due to absence of abdominal wall bruising
PURPOSE

Our hypothesis to explain this observation is that subcutaneous blood vessels in small children have enormous elasticity. When a small paediatric abdomen is subjected to a diffuse force, such as from a punch, the elasticity of the vessels prevent rupture and hence no bruise is formed. Our study investigated the degree of elasticity in the abdominal wall vessels of young children.
METHODS

20 children aged less than five years who received routine elective hernia or orchidopexy repair were included in our study.

After a standard skin incision, the wound edges were distracted and the subcutaneous blood vessels identified. Vessels were secured with artery forceps at the margins of the wound and the length of the vessel between the forceps recorded without applying any tension. The vessels were then stretched maximally and their length under tension recorded.
VESSEL MEASUREMENT

Subcutaneous vessel at resting length

Subcutaneous vessel under tension
RESULTS

Vessels routinely could be easily distracted up to 3 times their resting length without rupture.
# TABLE OF RESULTS

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Vessel Length Resting (mm)</th>
<th>Vessel Length Max Stretch (mm)</th>
<th>Increase in Length (Ratio)</th>
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<td><strong>Average:</strong> 3.3</td>
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This was true for both arterioles and venules, as confirmed by subsequent histology.
RESULTS

Also when maximal stretch was achieved considerable more force was then required to rupture the vessel.
CONCLUSIONS:

1. Subcutaneous vessel flexibility is likely the reason why severe diffuse forces that can cause major intra-abdominal trauma are not necessarily associated with abdominal bruising.

2. Paediatric surgeons commenting on mechanisms of injury in suspected child abuse cases need to consider these research findings. The absence of clinically visible abdominal bruising is often still associated with severe intra-abdominal disruption in blunt trauma due to child abuse.