Pediatric Renal Trauma

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Advanced Urology Course
15th & 16th June 2013
Introduction

• Trauma
  • Leading cause of morbidity and mortality in children \(^1\)
  • Responsible for more childhood deaths than the total of all other causes\(^1\)
  • Paediatric hospital trauma centers: 3% of children seen have significant GU trauma

\(^1\) McAninch et al, J Urol 1991
Etiology

• **Blunt trauma** (usually via sudden deceleration)
  – Falls
  – Car accidents
  – Sports injuries
  – NAI; Physical assault/ sexual abuse

• **Penetrating**
  – Falls onto sharp objects
  – Gun shot/ knife wounds
Anatomical factors in children

Children more likely to sustain renal trauma

• Kidneys to Body size ratio higher in children

• Fetal lobulations: blunt trauma more likely to cause local parenchymal injury

• Paediatric kidney less well protected than adult kidney
  – Less perirenal fat
  – Weaker abdominal musculature
  – Less ossified rib cage
    » More elastic and compressible thoracic rib cage
Diagnosis

• History
  – Mechanism of injury

• Physical examination
  – Abdominal/Flank tenderness
  – Lower rib fractures
  – Fractures of vertebral pedicles
  – Trunk contusions/abrasions

• Lab
  – Urinalysis: Haematuria
  – FBC
  – RP
  – GxM
Haematuria

<table>
<thead>
<tr>
<th>Gross heamaturia</th>
<th>Microscopic heamaturia</th>
<th>No haematuria</th>
</tr>
</thead>
<tbody>
<tr>
<td>65%</td>
<td>33%</td>
<td>2%</td>
</tr>
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</table>

• Significance of haematuria
  – Threshold for radiographic evaluation
  – Some centres have a threshold of 50 RBS’s / HPF
  – However, many reports of significant renal injuries with little or no haematuria
    • Mee SL, McAninch JW, Robinson AL et al, J Urol 1989
  – Compulsory to consider all aspects to form diagnostic algorithm
    • History
    • PE
    • Overall clinical status
    • GCS
    • LAB findings

Role of haematuria in diagnosis of significant paediatric renal trauma

- **Nguyen MM, Das S**, Urology, May 2002

**Pediatric renal trauma**

Department of Urology, University of California at Davis School of Medicine

10 year data; n = 61

<table>
<thead>
<tr>
<th></th>
<th>BLUNT TRAUMA</th>
<th>PENETRATING</th>
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</thead>
<tbody>
<tr>
<td>Haematuria</td>
<td>Grade 1</td>
<td>Grade 2 - 5</td>
</tr>
<tr>
<td>Macroscopic</td>
<td>29%</td>
<td>63%</td>
</tr>
<tr>
<td>Microscopic</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>Normal urinalysis</td>
<td>21%</td>
<td>13%</td>
</tr>
</tbody>
</table>
Blood pressure

• Children can maintain BP even with hypovolaemia
  – Compliance of vascular tree
  – Mechanisms for cardiac compensation
    » Stein JP et al, Urology, 1994

• BP: unreliable predictor of renal injury severity
Choice of imaging method

• CT is the best imaging
  – Cornerstone of modern staging of blunt renal injuries
  – Rapid, (especially relevant when dealing with small children and movement artifacts)
  – 2\textsuperscript{nd} series of images needed to show extravasation as first run finishes in 60s and may miss it
**Staging**

Table 15: Renal injury classified according to the kidney injury scale of the American Association for the Surgery of Trauma (7).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type of injury</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Microscopic or gross haematuria</td>
</tr>
<tr>
<td></td>
<td>Haematoma</td>
<td>Normal urological studies</td>
</tr>
<tr>
<td>II</td>
<td>Haematoma</td>
<td>Non-expanding subcapsular haematoma</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Laceration of the cortex of less than 1.0 cm</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Laceration &gt; 1.0 cm without rupture of collecting system</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Through the cortex, medulla and collecting system</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Vascular injury</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Completely shattered kidney</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Avulsion of the renal hilum</td>
</tr>
</tbody>
</table>
U/S and IVU

• U/S
  – Can be used as a screening tool
  – Also for following the course of the renal injury
  – limited value in the initial and acute evaluation of trauma

• IVU
  – a good alternative imaging method if a CT scan is not available
Management

• ABC of resuscitation
• Multidisciplinary
  — paediatricians, emergency physicians, surgeons, urologists, and other specialties
• Non-surgical conservative management
  — bed rest, fluids, monitoring
  — standard approach for treating blunt renal trauma
  — Even in high-grade renal injuries
    — a conservative approach is effective and recommended for stable children
    — However requires close clinical observation
    — serial CT scans
    — frequent re-assessment
Indications for surgical intervention

EAU 2013

**Absolute**

- persistent bleeding into an expanding or unconfined haematoma

**Relative**

- massive urinary extravasation
- extensive non-viable renal tissue
19.2.3 Guidelines for the diagnosis and treatment of paediatric renal trauma

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>GR</th>
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<tr>
<td>Imaging is recommended in all children who have sustained a blunt or penetrating trauma with any level of haematuria, especially when the history reveals a deceleration trauma, direct flank trauma or a fall from a height.</td>
<td>B</td>
</tr>
<tr>
<td>Rapid spiral CT scanning is the cornerstone in the diagnostic work-up and allows accurate staging.</td>
<td>B</td>
</tr>
<tr>
<td>Most injured kidneys can be managed conservatively.</td>
<td>B</td>
</tr>
<tr>
<td>Haemodynamic instability and a Grade V renal injury are absolute indications for surgical intervention.</td>
<td>A</td>
</tr>
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</table>
Conservative management of high grade injuries

High-grade renal injuries in children--is conservative management possible? (Review article)
Rogers CG, Knight V, MacUra KJ, Ziegfeld S, Paidas CN, Mathews RI
Brady Urological Institute, Johns Hopkins Hospital, Baltimore

80% of grade 4 renal injuries were successfully treated conservatively with bed rest and catheter drainage
Surgical options

- Nephrectomy
- Renal Salvage
- Partial Nephrectomy
Technical considerations

• Transperitoneal approach
• Midline or upper transverse incision
  • Depends on age
• Advantages
  • Examination of other viscera
  • Better access for vascular control
• Control of pedicle with slings prior to exposure of kidney
• Confirmation of a normally functioning contralateral kidney before nephrectomy
Outcome

Follow up

• Early complications
  – Urinoma
  – Infection
  – Abscess formation
  – 2\(^0\) haematuria
    • 1\(^{st}\) few weeks

• F/U
  – U/S and DMSA
  – Best deferred for 2 -3/12

• Long-term
  – HPT
    • True incidence difficult to access (no data)
    • Overall risk probably 2 – 3%
    • Relative risk higher with a sig. amount of devascularized tissue left in-situ
    • Some evidence that HPT risk greatest within 1\(^{st}\) 2 yrs
    • Life-long annual BP check for those with sig. parenchymal injury

Reference: Essentials of Paeds Urol 2\(^{nd}\) ed;
Thank You