RENAL TRAUMA

Urology department

RENAL TRAUMA

- **Trauma is most common cause of death in children**
- **Injuries to the kidneys account for 60% of genitourinary injuries**
  - **90% blunt trauma**
  - **Usually do not require operation**
- **10-20% penetrating trauma**
  - **More often require operation**
- **Deceleration/flexion injuries**
  - **Produce renal arterial or venous injuries**

RENAL TRAUMA

- **Children are more susceptible than adults to major renal injury (due to their kidney size and location)**
  - **Less perirenal fat**
  - **Weaker abdominal musculature**
  - **Less well-ossified thoracic cage**
- **Kidneys with congenital abnormalities are at increased risk of injury**
- **Pediatric evaluation and treatment guidelines not clearly defined for children**

RENAL TRAUMA

Indications for radiographic evaluation of children suspected for renal trauma include:

1. Blunt and penetrating trauma patients with any level of haematuria

2. Patients with associated abdominal injury regardless of the urinalysis findings

3. Patients with normal urinalyses who sustained a rapid deceleration event, direct flank trauma, or fall from height

RENAL TRAUMA

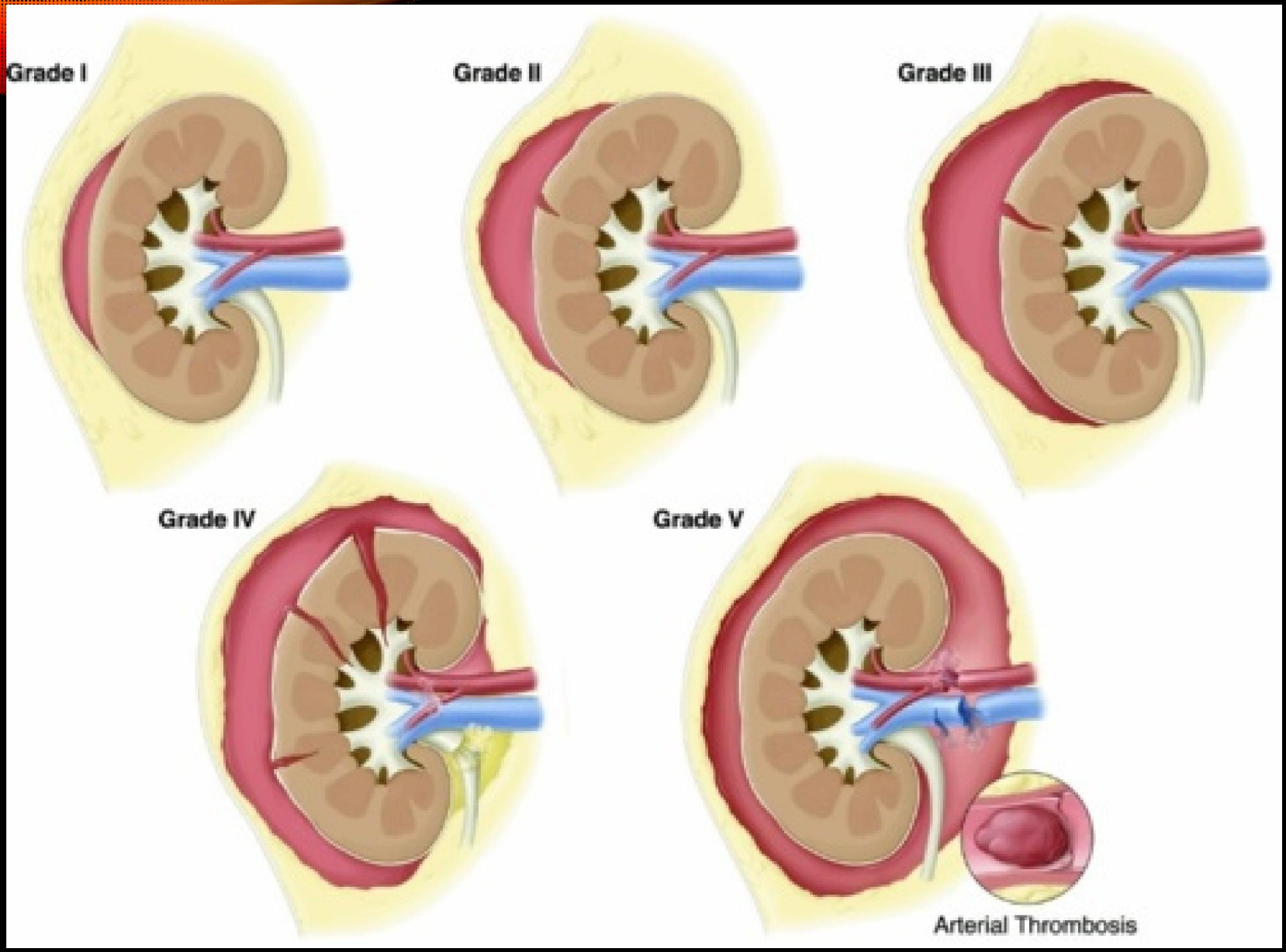
- **Ultrasonography is considered a reliable method of screening and following blunt renal injuries**
- **CT scans is the imaging study of choice for staging renal injuries**

RENAL TRAUMA

- **Management goal: renal salvage**
- **Indications for immediate exploration**
  - **Hemodynamic instability**
  - **Associated non-renal injuries**
  - **Incidental finding of pre-existing renal pathology requiring surgical therapy**
- **Nephrectomy required in less than 10% of cases**
- **Non-operative management: bed-rest, prophylactic antibiotics, and continuous monitoring of vital signs until haematuria resolves**

AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA INJURY SCALE

Grade	Injury	Description of Injury
I	Contusion	• microscopic or gross hematuria • urologic studies normal
	Hematoma	• subcapsular, nonexpanding • no parenchymal laceration
II	Hematoma	• nonexpanding perirenal hematoma confined to renal retroperitoneum
	Laceration	• < 1.0-cm parenchymal depth of renal cortex • no urinary extravasation
III	Laceration	• > 1.0-cm parenchymal depth of renal cortex • no collecting system rupture or extravasation
IV	Laceration	• parenchymal laceration extending through renal cortex, medulla, and collecting system
	Vascular	• main renal artery or vein injury with contained hemorrhage
V	Laceration	• completely shattered kidney
	Vascular	• avulsion of renal hilum that devascularizes kidney


Grade I
Grade II
Grade III
Grade IV
Grade V
Arterial Thrombosis

RENAL TRAUMA

- **Stable grade I-III injuries**
  - **Managed non-operatively**
- **Severe grade IV-V**
  - **Require careful selection based on**
    - **hemodynamic stability**
    - **mechanism**
    - **associated non-renal injuries**
  - **Stable patients may need monitoring in ICU setting**

RENAL TRAUMA

- **Early complications:**
  - **bleeding, infection, perinephric abscess, sepsis, urinary fistula, hypertension, urinary extravasation and urinoma.**
- **Delayed complications:**
  - **hydronephrosis, calculus formation, chronic pyelonephritis, hypertension, arteriovenous fistula, pseudoaneurysms**

RENAL TRAUMA

- **Ureteral stent indications**
  - **80% of grade IV and V collecting system injuries heal without intervention**
  - **If collecting system extravasation does not resolve within two weeks, stenting is then considered**
  - **Symptomatic urinomas may require stenting**
  - **Lack of contrast in ipsilateral ureter may indicate significant injury, necessitating stent**

Minerva Pediatr. 2012 Jun;64(3):319-23.

Natural history of non-operative treatment for renal injuries in children.

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⊕ Author information

Abstract

AIM: Kidney is one of the solid organs injured in blunt abdominal traumas. Conservative management is well recognized in adults, but is still controversial in children. We performed a retrospective review regarding children with renal injuries observed at our Centre, analyzing the importance of a prompt diagnosis and the role of conservative treatment according to the degree of renal injury and natural history.

METHODS: We reviewed 15 cases of blunt abdominal trauma with renal injuries observed during a period of 11 years. The diagnosis was confirmed by abdominal computed tomography (CT) scan and ultrasonography (US). Conservative treatment started monitoring the hemodynamic stability, the hematocrit value, the hemoglobin, the red cell count, the urine analysis. If necessary blood transfusion was performed. A follow-up from 1 month to 2 years monitored the lesions healing.

RESULTS: Age of patients varied from 3 to 15 years (mean age = 6.3). Nine were males and six females. Two patients had an associated spleen lesion, thirteen had an isolated renal injury. Injury grades were classified as follows: grade I, 5 cases; grade II, 3 cases; grade III, 5 cases and grade IV, 2 cases. Non operative management was successful in 14 out of 15 cases; 1 patient with grade IV required a partial nephrectomy. At follow-up good healing of the lesions was observed.

CONCLUSION: Most of renal injury related to abdominal trauma can be successfully and safely managed conservatively. Hemodynamic stability, a prompt clinical and instrumental diagnosis and grading of lesions by CT are necessary to start an effective non operative treatment.

Urology. 2004 Sep;64(3):574-9.

High-grade renal injuries in children--is conservative management possible?

Rogers CG[1], Knight V, MacUra KJ, Ziegfeld S, Paidas CN, Mathews RI.

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Abstract

OBJECTIVES: To review our experience with the management of high-grade (grade IV and V) renal injuries to clarify the role of conservative management.

METHODS: From 1991 to 2003, 79 consecutive patients (age range 2 to 14 years) with renal injuries were treated in an urban level I pediatric trauma center. Twenty children were identified as having high-grade renal injury (grade IV, 10 children and grade V, 10 children). The mechanism of injury was blunt trauma in 17 patients (85%) and penetrating trauma in 3 (15%).

RESULTS: Of the 10 patients with grade IV injury, 8 (80%) were successfully treated conservatively with bedrest and catheter drainage. Two patients with persistent urine leaks required ureteral stenting, and one subsequently required open operative repair. The initial radiographic findings in both patients demonstrated complete renal fracture with retained vasculature to both renal segments. All 10 patients with grade V injury required open operative management and only 3 (30%) achieved long-term renal salvage.

CONCLUSIONS: Most children with grade IV renal injury can be treated conservatively. Patients with complete renal fracture or significant urinary extravasation on initial radiographic imaging may be less likely to undergo spontaneous resolution. Patients with a persistent urinary leak can be successfully treated with internal drainage. Grade V injuries are associated with an increased risk of requiring open operative intervention, and the renal preservation rates are low.

Urology. 2009 Sep;74(3):579-82. doi: 10.1016/j.urology.2009.04.049. Epub 2009 Jul 9.

Nonoperative management of nonvascular grade IV blunt renal trauma in children: meta-analysis and systematic review.

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Abstract

OBJECTIVES: To evaluate nonoperative management of grade IV blunt renal trauma in pediatric patients by performing a systematic review and meta-analysis of published studies.

METHODS: MEDLINE, EMBASE, Cochrane, and Scopus databases were searched between January 1992 and June 2008 for studies of pediatric renal trauma management. Inclusion criteria were patient age <or= 18 years and use of the American Association for the Surgery of Trauma renal injury scale.

RESULTS: A total of 95 children with grade IV injuries were identified. No intervention was required in 72% (68/95). Hemodynamic instability necessitated surgical exploration in 11% of patients (11/95). Of these, 46% (5/11) required a partial nephrectomy, 27% (3/11) underwent nephrectomy, and 27% (3/11) were salvaged. Angiographic infarction was not used for patients with delayed or persistent hemorrhage. Symptomatic urinoma developed in 17% (16/95). Of these patients, 81% (13/16) were successfully managed by percutaneous drainage or ureteral stent placement, and open intervention to manage complications became necessary in the remaining 19% (3/16). Partial renal preservation was possible in 95% of patients (90/95).

CONCLUSIONS: Nonoperative management of children with grade IV blunt renal injuries is highly successful, with at least partial renal preservation possible in 95% (90/95) of patients.

Eur Urol. 2010 Jan;57(1):154-61. doi: 10.1016/j.eururo.2009.02.001. Epub 2009 Feb 10.

Nonoperative management of grade 5 renal injury in children: does it have a place?

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Abstract

BACKGROUND: Nonoperative treatment of blunt renal trauma in children is progressively gaining acceptance; grade 5 renal trauma is associated with a significant rate of complications.

OBJECTIVE: To assess the feasibility and outcome of initial nonoperative management of grade 5 blunt renal trauma in children.

DESIGN, SETTING, AND PARTICIPANTS: This retrospective study included 18 children (12 boys and 6 girls; mean age: 8.4+/-3.4 yr) who presented to the authors' institutes with grade 5 blunt renal trauma between 1990 and 2007.

MEASUREMENTS: An intravenous contrast-enhanced computed tomography (CT) scan demonstrated grade 5 renal trauma in all patients. Associated major vascular injuries were suspected in four patients. All were initially managed conservatively. Indications for intervention included hemodynamic instability, progressive urinoma, or persistent bleeding. Dimercaptosuccinic acid (DMSA) scans were performed at a mean time of 3.1 yr (range: 1-17) following the injury in nine patients.

RESULTS AND LIMITATIONS: Four patients (22%) with suspected major vascular injuries required nephrectomy 1-21 d following the trauma. Two patients with continuing hemorrhage required selective lower-pole arterial embolization (11%). Three patients (17%) had their progressive urinoma drained percutaneously, and two of them required delayed reparative surgery for ureteropelvic junction (UPJ) avulsion. Nine patients (50%) were successfully managed nonoperatively. Kidneys were salvaged in 78% of patients. DMSA scanning showed a split function >40% in 44% of evaluated kidneys. Two patients (22%) had split function <30%. At last follow-up, none of the children were hypertensive or had any abnormality on urine analysis.

CONCLUSIONS: Nonoperative management of grade 5 renal trauma is feasible. Prompt surgical intervention is required for those with major vascular injuries. Superselective arterial embolization can be an excellent option in patients with continuing hemorrhage and who have pseudoaneurysms. Patients with UPJ disruption can be salvaged by initial drainage of the urinoma followed by deferred correction.

J Urol. 2007 Jul;178(1):246-50; discussion 250. Epub 2007 May 17.

Management of high grade renal trauma: 20-year experience at a pediatric level I trauma center.

Henderson CG[1], Sedberry-Ross S, Pickard R, Bulas DI, Duffy BJ, Tsung D, Eichelberger MR, Belman AB, Rushton HG.

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Abstract

PURPOSE: In the last 20 years the management of high grade, blunt renal trauma at our institution has evolved from primarily an operative approach to an expectant nonoperative approach. To evaluate our experience with the expectant nonoperative management of high grade, blunt renal trauma in children, we reviewed our 20-year experience regarding evaluation, management and outcomes in patients treated at our institution.

MATERIALS AND METHODS: We retrospectively studied all patients sustaining renal trauma between 1983 and 2003. Medical records were reviewed for mechanism of injury, assigned grade of renal injury, patient treatment, indications for and timing of surgery, and outcome. Injuries were categorized as either low grade (I to III) or high grade (IV to V).

RESULTS: We reviewed the medical records of 164 consecutive children who sustained blunt renal trauma between 1983 and 2003. A total of 38 patients were excluded for inadequate information. Of the remaining 126 children 60% had low grade and 40% had high grade renal injuries. A total of 11 patients (8.7%) required surgical or endoscopic intervention for renal causes, including 2 for congenital renal abnormalities and 1 for clot retention. Eight patients (6.3%) required surgical intervention for isolated renal trauma, of whom 2 (1.6%) required immediate surgical intervention for hemodynamic instability and 6 (4.8%) were treated with a delayed retroperitoneal approach. Only 4 patients (3.2%) required nephrectomy. All patients receiving operative intervention had high grade renal injury.

CONCLUSIONS: Initial nonsurgical management of high grade blunt renal trauma in children is effective and is recommended for the hemodynamically stable child. When a child has persistent symptomatic urinary extravasation delayed retroperitoneal drainage may become necessary to reduce morbidity. Minimally invasive techniques should be considered before open operative intervention. Early operative management is rarely indicated for an isolated renal injury, except in the child who is hemodynamically unstable.

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Conservative Management vs Early Surgery for High Grade Pediatric Renal Trauma—Do Nephrectomy Rates Differ?

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Results—Nephrectomy was performed less often in patients treated conservatively (RR 0.24, 95% CI 0.16 to 0.36, adjusted for age, renal injury grade and injury mechanism). The decreased risk of nephrectomy was more marked among children with grade IV vs grade V renal injuries (adjusted RR 0.16, 95% CI 0.08 to 0.23). Multiple procedures were more common in patients initially observed. Of pediatric patients with grade IV and V renal injuries 11% still underwent nephrectomy.

Conclusions—Conservative management of high grade renal injuries is common in children. Although mechanism of injury and renal injury grade impact initial clinical management decisions, the risk of nephrectomy was consistently decreased in children with high grade renal trauma managed conservatively regardless of injury characteristics.

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Nonoperative management of blunt renal injury: a need for further study

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RENAL TRAUMA

- **In some cases, conservative management fails and patients undergo delayed exploration. A study evaluating the epidemiological, clinical and laboratory findings of these patients, as well as the operative findings should be able to highlight prognostic factors for the non-operative management of renal injuries.**
- **Another future study objective should be blunt trauma grade 5 patients, as it appears that some of them may benefit from non-operative management.**
- **Safety and long-term effectiveness of minimal invasive techniques in isolated renal injuries.**

RENAL TRAUMA

- **CMH is currently participating in multi-institutional, prospective, randomized trial with long-term follow-up**
  - **Patients allowed out of bed when physically able**
  - **Daily UA while in hospital**
  - **Once discharged, weekly UA until hematuria is cleared**
  - **Discharged when patients meet general discharge criteria**
  - **3 year follow-up for hypertension**

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