

Adult Blunt Renal Trauma: Routine Follow-up Imaging Is Excessive

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OBJECTIVE	To determine the yield of follow-up imaging in patients sustaining renal trauma at our level-1 trauma center and hence, whether the 2013 European Association of Urology guidelines are clinically applicable.
METHODS	All patients who attended Cork University Hospital with a diagnosis of renal injury from 2000-2012 were identified. Review of all medical records and radiologic imaging was undertaken. Injuries were graded using the American Association for the Surgery of Trauma Organ Injury Scale and were grouped as low-grade injuries (I, II, and III) or high-grade injuries (IV and V).
RESULTS	One hundred and two patients (105 renal units) were identified with a median age of 23 years (interquartile range, 18-39 years). The mechanism of injury was blunt force in 98 of 102 cases (96%). Injuries were diagnosed at the time of admission using contrast-enhanced computed tomography (CT) imaging. Low-grade injuries accounted for 78 of 102 cases (77%); all were managed conservatively with a complication rate of 2 of 78 (3%). Twenty-four patients (23%) had high-grade injuries; 2 cases required nephrectomy, 22 of 24 (92%) were managed conservatively with a complication rate of 5 of 24 (21%). All patients with complications were symptomatic, prompting repeat imaging. Overall, 38 of 102 patients (37%) underwent at least 1 follow-up CT: 20 of 78 (25%) of low-grade injuries and 18 of 24 (75%) of high-grade injuries. Concurrent thoracoabdominal injuries mandated the need for repeat CT evaluation in 21 of 38 patients (55%). Thirty-one (30%) patients were reimaged by renal ultrasonography.
CONCLUSION	Selective reimaging of renal injuries based on clinical and laboratory criteria would have detected all complications. The 2013 European Association of Urology guidelines on urologic trauma are clinically appropriate in a major tertiary-trauma unit. UROLOGY 84: 62–67, 2014. © 2014 Elsevier Inc.

Renal injury is the most common genitourinary problem encountered by urologists in trauma situations, accounting for 1%-5% of all trauma injuries.¹ In most cases, the mechanism of injury is blunt force, with penetrating injuries reported less frequently outside the United States of America and South Africa.² A nonoperative approach to both blunt and penetrating renal injuries has yielded higher rates of renal salvage and decreased morbidity compared with primary operative management.³⁻⁵ There is mounting evidence in the literature that routine reimaging, in the absence of clinical deterioration or altered laboratory findings, has little impact on decision-making or clinical outcomes and therefore may not be justified.⁶⁻⁸ All reported adult series to date used repeat computed tomography (CT) imaging to follow up renal injuries. However, the pediatric

literature has demonstrated that ultrasonography (US) is a safe and effective alternative imaging modality to monitor blunt renal trauma patients.⁹ The benefits of US in terms of cost and radiation are weighed against its lack of sensitivity and specificity when compared with CT. Our series is the first to examine adult patients that had only US follow-up and those with CT follow-up.

The purpose of this study was to determine the yield of repeat follow-up imaging in patients sustaining renal trauma and its impact on patient outcomes. We hypothesized that our current liberal reimaging strategy does not predict complications or alter patient outcomes and is excessive.

MATERIALS AND METHODS

Cork University Hospital serves a population of 620,000 and is the only level-1 trauma center in Ireland. After approval from the research and ethics committee, all patients who were admitted with a diagnosis of renal injury from 2000-2012 were identified from the hospital in-patient enquiry database. A retrospective review of all patients' medical records and radiologic imaging was undertaken.

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Patient data collected included demographics, mechanism of injury, blood pressure, hemoglobin level, and Glasgow Coma Scale value on admission and Injury Severity Score. Operative records, complications, date, and results of follow-up imaging were also reviewed.

Injuries were diagnosed at the time of admission using contrast-enhanced CT imaging. Final staff radiologist reports were reviewed, and all kidney injuries were graded according to the American Association for the Surgery of Trauma (AAST)-Organ Injury Scale.¹⁰

The modality and timing of follow-up renal imaging was at the discretion of the managing urologist but also mandated by concurrent injuries. As a general rule, patients with isolated grade-I renal injuries had no follow-up imaging, patients with isolated renal injuries graded II-III had follow-up US imaging, and patients with renal injuries graded IV-V had follow-up CT imaging.

In line with standard practice, we take a nonoperative approach to treating all renal trauma patients unless absolute indications for operative intervention exist, that is, hemodynamic instability, peritonitis, and clinically unevaluable patient.

Using the AAST-Organ Injury Scale, renal injuries were grouped as low-grade (I, II, and III) or high-grade (IV and V). Outcomes noted included complications (classified according to the Clavien-Dindo grading system for surgical complications¹¹), mortality, and hospital and intensive care length of stay. We correlated clinical outcomes with repeat imaging results.

Descriptive statistics focused on frequencies and proportions for categorical variables. Medians and interquartile ranges (IQRs) were reported for continuous data. The chi square test was used to compare frequencies for categorical data. Reported *P* values are 2-sided, with *P* ≤ .05 considered to indicate statistical significance.

RESULTS

Between 2000 and 2012, a total of 102 patients (91 male and 11 female) were admitted to Cork University Hospital, with a total of 105 renal injuries. Patient demographics and clinical presentations are listed in Table 1. The median age was 23 years (IQR, 18-39 years). The mechanism of injury was blunt force in 98 patients (96%). On admission, the median hemoglobin level was 13.1 g/dL (IQR, 11.1-14.3 g/dL); the median Glasgow Coma Scale value was 15 (IQR, 14-15). Thirty-two patients required admission to intensive care unit (ICU), with median length of ICU stay of 4 days (IQR, 2-7 days). All ICU admissions had concurrent injuries except 1 isolated grade-V renal injury. The median length of stay was 5 days (IQR, 3-11 days).

Table 2 lists complications by injury grade, type of complication, intervention required, and Clavien-Dindo classification. Low-grade injuries accounted for 78 of 102 (77%) cases; all were managed conservatively with a complication rate 3% (2 of 78). Twenty-four patients (23%) were classified as having high-grade injuries (IV or V), with a complication rate of 21% (5 of 24).

Two patients (1 grade-I and 1 grade-IV renal injury) were readmitted with pain on day 2 after discharge, both had stable injuries on reimaging, and their pain settled with analgesia. Two patients (1 grade-II and 1 grade-IV

Table 1. Demographics, clinical presentation, length of stay, and mortality

Variables	n (%)	IQR
Number of patients	102	
Age (y), median	23	18-39
Gender		
Male	91 (89)	
Female	11 (11)	
Mechanism of injury		
Blunt	98 (96)	
Penetrating	4 (4)	
Cause of injury		
Road traffic accident	45 (44)	
Fall from height	22 (22)	
Sports related	19 (18)	
Assault	7 (7)	
Farming related	7 (7)	
Suicide attempt	2 (2)	
Side of Injury		
Left	52 (51)	
Right	47 (46)	
Bilateral	3 (3)	
Visible hematuria		
Yes	56 (55)	
No	46 (45)	
Glasgow coma scale, median	15	14-15
Injury severity score, median	16	9-36
Hemoglobin on admission (g/dL), median	13.2	11.2-13.4
Blood pressure on admission (mm Hg), median	120/70	110/60-135/80
ICU admissions	32 (31)	
ICU length of stay (d), median	4	2-7
Total length of stay (d), median	5	3-11
Mortality	3 (3)	

ICU, intensive care unit; IQR, interquartile range.

renal injury) were noted to be febrile, with an elevated white cell count on day 2 and day 3, respectively. Repeat imaging revealed stable injuries with no evidence of collection or abscess formation, and both were managed successfully with intravenous antibiotics. After this febrile episode, the patient with a grade-IV injury was noted to be hypertensive in the outpatient clinic at 3 months. She was treated with an antihypertensive for 2 years and currently does not require medication. Another patient with a grade-V injury was noted to be hypertensive at day 3 after admission. He was treated with an antihypertensive and remains on medication. Two patients (both grade-IV injuries) developed a urinoma. The first patient was successfully managed conservatively. The second patient was noted to have a large urinoma at presentation and had a percutaneous nephrostomy drain placed. On day 3, a nephrostogram showed no extravasation of contrast, the nephrostomy was clamped and removed on day 5. The median length of time to presentation with a complication was 3 days (range, 0-60 days).

Two cases (both grade-IV renal injuries) required operative management. After major road traffic accidents, both patients were hemodynamically unstable on admission and had exploratory laparotomies. Intraoperatively,

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