SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Surgery

Outcome and Management of Blunt Renal Trauma

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DOI: https://doi.org/10.36347/sasjs.2025.v11i02.031 | **Received:** 15.01.2025 | **Accepted:** 22.02.2025 | **Published:** 27.02.2025

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Abstract **Original Research Article**

Introduction: Blunt renal trauma is a significant concern in trauma cases, often resulting from motor vehicle accidents (MVA), falls, assaults, or sports-related injuries. This study aimed to determine the prevalence of blunt renal traumas and evaluate the outcome in patients presenting with renal injuries to Dhaka Medical College Hospital (DMCH). ***Methods:*** This observational study was conducted in the Department of Casualty & Urology, Dhaka Medical College and Hospital, Dhaka, Bangladesh, from February 2016 to July 2016. We included 50 patients admitted to the Casualty & Urology Department of our institution with clinical and radiological diagnoses of blunt renal trauma. ***Results:*** The most affected age group was 31–40 years (32%), followed by 41–50 years (22%). Males were more commonly affected across all injury grades. MVA was the leading cause (50%), followed by assault (24%) and sports injuries (14%). Macroscopic hematuria (68%) was more common than microscopic hematuria, predominantly seen in Grade III injuries. Management varied by injury severity: Grade I and II injuries were mostly treated conservatively, while higher grades required renorrhaphy, partial nephrectomy, or emergency nephrectomy. Complications occurred in 40% of patients, with sepsis (10 cases) and hemorrhage (6 cases) being the most frequent. One patient with Grade V trauma died. Follow-up compliance was 62%, with 38% of patients not returning for evaluation. ***Conclusion:*** Blunt renal trauma predominantly affects middle-aged males, with MVA being the primary cause. While most low-grade injuries can be managed conservatively, severe injuries often necessitate surgical intervention. The study highlights the importance of early intervention, proper follow-up, and monitoring for complications to improve patient outcomes.

Keywords: Blunt Renal Trauma, Renal injury, Outcome, Management.

INTRODUCTION

Renal injury occurs in approximately 1% to 5% of all traumas and can be classified as blunt or penetrating according to the mechanism [1,2]. Blunt kidney injuries typically result from high-energy impacts, such as motor vehicle accidents, falls from a height, or contact sports. However, even minor trauma can cause significant damage to kidneys that are structurally abnormal. Most cases of blunt renal trauma also involve injuries to other abdominal organs, but in most instances, the kidney injury is relatively mild [3].

Given the success of conservative management of solid organ injuries, a conservative approach to treatment has been increasingly applied to patients with renal trauma. Conservative management includes: monitoring temperature, pulse, and blood pressure; monitoring the abdominal girth, intravenous fluids infusion, blood transfusion, if necessary, intravenous antibiotics, conducting serial hematocrit, and reviewing sonography or Computed Tomography (CT) scan. With this current management, most hemodynamically stable patients with renal injuries are successfully managed non-operatively [4,5].

Improved radiographic techniques and the development of a validated renal injury scoring system have improved the identification of staging the injury severity that is relatively easy to monitor. In addition, enhanced hemodynamic management of patients in specialized units has led to improved outcomes with non-

operative management [6]. In addition, the use of targeted radiology treatments has lessened the need for surgery in many cases. Procedures like angiography and renal embolization have been successful in stopping bleeding in patients with blunt kidney injuries [2,7,8].

Renal trauma can present in dramatic ways, both for the patient and the healthcare provider. Its occurrence varies depending on the patient group, but overall, kidney injuries make up about 3% of all trauma admissions and up to 10% of those who experience abdominal trauma [9]. At most trauma centers, blunt trauma is more common than penetrating trauma, thereby making blunt renal injuries as much as 9 times more common than penetrating injuries. Both kidneys are at equal disposition for injury [10].

The approach to renal injuries has changed over time, requiring diligent attention to recent literature [6]. Namely, the tolerance for non-operative or expectant management has increased, even in the most seriously injured kidneys, replacing the past tendency toward aggressive renorrhaphy. Therefore, in this study, we aimed to determine the prevalence of blunt renal traumas and evaluate the outcome in patients presenting to Dhaka Medical College Hospital (DMCH) within the study period.

METHODOLOGY & MATERIALS

This observational study was conducted in the Department of Casualty & Urology, Dhaka Medical College and Hospital, Dhaka, Bangladesh, from February 2016 to July 2016. We included 50 patients admitted to the Casualty & Urology Department of our institution with clinical and radiological diagnoses of blunt renal trauma.

These are the following criteria to be eligible for enrollment as our study participants: a) Patients aged between 5 to 60 years; b)Patients with blunt trauma in the abdomen with haematuria; c) Patients having flank Pain with tenderness; d) Patients whose FAST scan or USG W/A showed perirenal hematoma were included in the study And a) Patients with polytrauma; b) Patients with penetrating renal injury or other genitourinary injuries; c) Patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD etc.); d) Patients or legal guardians who were unwilling to participate were excluded from our study.

AAST Grading: Renal trauma grading is often done using the American Association for the Surgery of Trauma (AAST) according to the depth of damage and involvement of the urinary collecting system and renal vessels [11]:

Grade*	Type	Description
*Advance one grade for bilateral injuries up to grade III.		
I	Contusion	Normal imaging (CT Scan), non-visible or visible haematuria present
	Haematoma	Non-expanding subcapsular haematoma with no parenchymal lacerations
II	Haematoma	Non-expanding peri-renal haematoma confined to retroperitoneum
	Laceration	Cortical laceration <1 cm without urinary extravasation
III	Laceration	Cortical laceration >1 cm without urinary extravasation
IV	Laceration (a)	Laceration through corticomedullary junction into the collecting system
	Vascular (b)	Renal artery or vein injury with contained hemorrhage, partial vessel laceration, or vessel thrombosis
V	Laceration (a)	Completely shattered kidney
	Vascular (b)	Avulsion of renal hilum with devascularised kidney

Data Collection and Analysis: A written informed consent was taken from the patients or their relatives. All patients were evaluated by history, physical examinations, and relevant investigations including hematological, biochemical, and relevant imaging studies e.g. Ultra-sonogram, CT scan of the whole abdomen. Data were collected from a history, findings of clinical examination, results of investigations before surgery, operation notes, postoperatively, and at the time of follow-up.

Statistical Analysis: All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation; qualitative data was expressed as frequency distribution and percentage. Student's t-test and Pearson Chi-square test were used to analyze the data. The level of significance was set at 0.05 and P <0.05 was considered significant. Statistical analysis was performed by using SPSS 20.0 (Statistical Package for Social Sciences) for Windows version 10. This study was approved by the ethical review committee of Dhaka Medical College and Hospital.

RESULTS

Table 1: Age distribution of the patients

Age	Number=50	Percentage
5-10 Years	3	6.0
11-20 Years	6	12.0
21-30 Years	10	20.0
31-40 Years	16	32.0
41-50 Years	11	22.0
51-60 Years	4	8.0

Table 1 shows that the most common age group was 31-40 years, with 16 patients (32%), followed by the 41-50 years group having 11 patients (22%), and the 21-30 years had 10 patients (20%). While 6 patients (12%) were in the 11-20 year range, the youngest group, 5-10 years, had 3 patients (6%), and the oldest group, 51-60 years, accounted for 4 patients (8%). The mean age of the respondents was 33.3 ±12.4 which ranged from 5– 60 years old, where the youngest patient was 7 years and the eldest was 57 years.

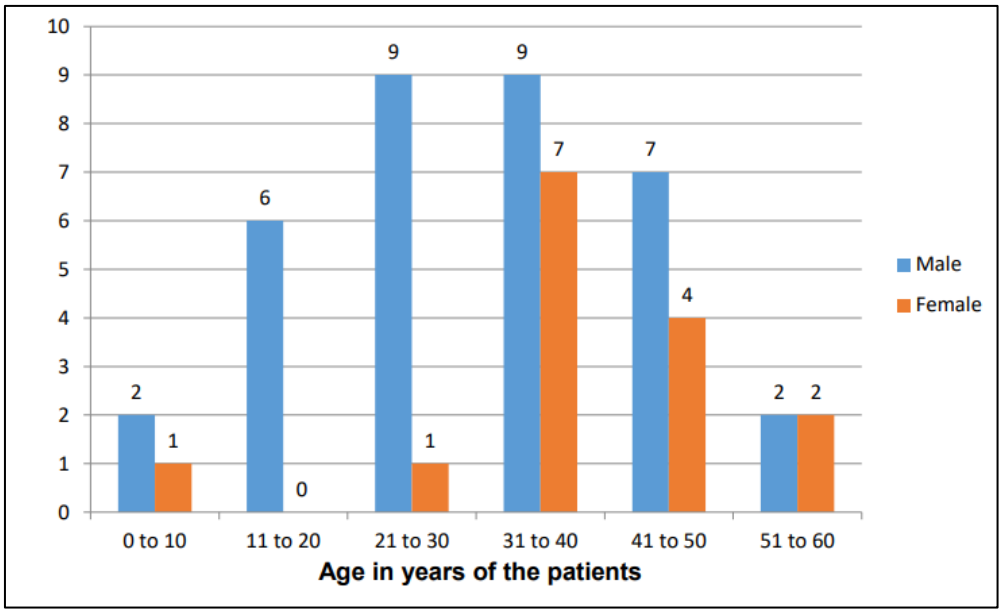

Figure 1: Comparison of the age groups of males and females presenting with blunt renal trauma

Figure 1 shows that in the youngest age group (0–10), there are slightly more male patients (2) than female patients (1), followed by in the 11–20 age group, only male patients (6) are recorded. The 21–30 age group shows a significant increase in male patients (9), while female patients remain low (1). The female patient count is lower in younger age groups but becomes more comparable to males in older groups.

Table 2: Pattern of incidence in causes of blunt renal trauma

Mode of Injury	Number	Percentage
MVA (Motor Vehicle Accident)	25	50.0
Pedestrians	2	4.0
Fall	4	8.0
Sports Injury	7	14.0
Physical Assault	12	24.0

Table 2 shows the most common cause of injury is motor vehicle accidents (MVA), which account for 25 cases (50%). Physical assault is the second most frequent cause, with 12 cases (24%), followed by sports injuries contributing to 7 cases (14%), and falls (8%), while pedestrian-related injuries are the least common, with only 2 cases (4%).

Table 3: Haematuria in patients with blunt renal trauma

				AAST			Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Haematuria (number of patients)	**Macroscopic**	06	8	15	3	2	34
	Microscopic	10	2	3	1	0	16
Total		16	18	10	4	2	50

Table 3 shows that macroscopic haematuria is more common, with 34 cases. It is most frequently observed in Grade III injuries (15 cases), followed by Grade II (8 cases) and Grade I (6 cases). Severe cases (Grades IV and V) have fewer occurrences, with 3 and 2 cases, respectively. Microscopic haematuria is less frequent, with 16 cases in total. It is most commonly seen in Grade I injuries (10 cases), while higher grades (III to V) show very few cases, with only 3, 1, and 0 cases, respectively.

Table 4: Blunt Renal Trauma according to AAST grade and mode of injury

				AAST			Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Mode of injury (number of patients)	**MVA**	4	12	3	4	2	25
	Pedestrians	2	0	0	0	0	2
	Fall	0	2	2	0	0	4
	Sports Injury	6	1	0	0	0	7
	Physical Assault	4	3	5	0	0	12
Total		16	18	10	4	2	50

Table 4 shows that motor Vehicle Accidents (MVA) are the most common cause of injury, accounting for 25 patients, with the highest number in Grade II (12 cases) and fewer in Grades IV (4 cases) and V (2 cases), followed by pedestrian-related injuries with only 2 cases classified as Grade I injuries, falls primarily affecting Grades II and III (2 cases each), and sports injuries account for 7 cases, mostly seen in Grade I (6 cases), with only 1 case in Grade II. Physical assault results in 12 injuries, widely distributed across Grades I to III, with most cases in Grade III (5 cases). There are no cases in Grades IV and V.

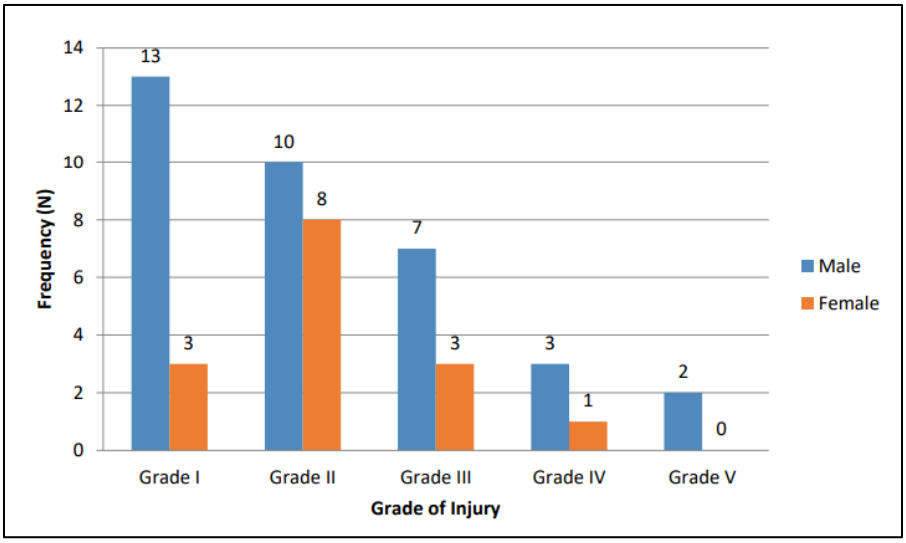

Figure 2: Comparison of the grade of blunt renal trauma according to AAST between male and female

This bar chart illustrates that grade I injuries are the most frequent, with 13 males affected compared to 3 females, followed by grade II injuries affecting 10 males and 8 females, and grade III injuries with 7 males and 3 females. The figure also shows that grade IV injuries were less frequent, affecting 3 males and 1 female, and grade V injuries affected only 2 males and no females.

Table 5: Method of Treatment of Blunt Renal Trauma

				AAST		Total	
	Grade I		Grade II	Grade III	Grade IV	Grade V	
Treatment option (number of patients)	**Conservative**	16	16	5	0	0	37
	Renorrhaphy	0	1	3	0	0	4
	Partial nephrectomy	0	0	2	0	0	3
	Nephrectomy	0	0	1	4	2	7
Total		16	17	11	4	2	50

Among the patients who survived the first 24 hours, nearly all with Grade I and Grade II renal injuries were successfully managed with conservative treatment. However, one patient with a Grade II injury required renorrhaphy. For Grade III injuries, most patients were treated conservatively. However, one out of 11 patients required a delayed nephrectomy, while three underwent renorrhaphy and two had partial nephrectomies. Among those with Grade IV injuries, one patient initially managed conservatively and later required a delayed nephrectomy, while the rest needed emergency nephrectomies. Both patients with Grade V renal injuries underwent emergency nephrectomies.

Table 6: Complications Following Blunt Renal Trauma

Complications		None	Hemorrhage	Perinephric Abscess	Sepsis	Urinoma	Death	Total
AAST Grade (number of patients)	**Grade I**	16	0	0	0	0	0	16
	Grade II	11	5	0	1	0	0	17
	Grade III	3	1	1	4	1	0	10
	Grade IV	0	0	0	4	1	0	5
	Grade V	0	0	0	1	0	1	2
Total		30	6	1	10	2	1	50

Table 6 shows that 30 patients (60%) had no complications, while the remaining 20 patients (40%) experienced at least one complication, including hemorrhage (6 cases), sepsis (10 cases), and death (1 case). Grade IV & V injuries were more severe, while grade I injuries no complications.

Table 7: Percentage of patients returning for outpatient follow up

Follow up	Frequency	Percentage (%)
Returns for F/U	31	62
No F/U Visit	19	38
Total	50	100

This table shows the follow-up status of 50 patients after their initial treatment, where we found that 31 patients (62%) returned for follow-up visits and 19 patients (38%) did not attend any follow-up visits.

DISCUSSION

Blunt renal trauma is the most common mechanism accounting for 80 to 85% of all renal injuries [12]. Blunt trauma due to motor vehicle is the most common mechanism of renal injury [13]. Motor vehicle accident was also the major cause of blunt renal trauma (50%) in our study. All the patients with grade IV and V injuries in our study were involved in motor vehicle accidents. It seems that a large impact force is required to cause high-grade injury [13]. Others found that motor vehicle accident (MVA) was the predominant mechanism of injury, accounting for 60.9% and 89% of injuries respectively [14,15]. The study findings correlate with existing literature which shows that MVA is the most common cause of blunt renal trauma.

The mean age of the 50 patients was 33.3±12.4 years ranging from 5-60 years. A study done in Lahore found that the mean age of 65 patients was 29±12.1 years ranging from 18 to 65 years [15]. Similarly, Thanapaisal and Sirithanaphol found the mean age was 29.8 years ranging from 1 to 68 years [16]. Herschorn *et al.*, found mean age was 32 years ranging from 13 to 87 years [17].

In this study, males were enrolled 2.3 times more than females. In a study in Srinagarind Hospital, males were enrolled 4.5 times more than females [16]. Shoobridge *et al.*, also found that 74.9% of patients were male who had blunt renal trauma [14]. Another study done at Sunnybrook Medical Centre found that male to male-to-female ratio was 3:1 [17].

The majority (68%) of patients presented with gross haematuria and 32% of patients presented with microscopic haematuria. A study done at Jinnah Hospital found that 60% of patients presented with gross haematuria and 13% of patients had microscopic

haematuria [15]. Similarly, Baverstock *et al.*, found 80% of patients had gross haematuria [18].

In our study, all the patients had CT scans of the whole abdomen for the detection of grading of injury. In other studies, Computed Tomography (CT) is considered the gold standard imaging modality of renal trauma [19,20]. Herschorn *et al.*, stated that CT was more sensitive and specific [17].

In this study, 88% of renal injuries were graded low (Grade I, II, III) and 12% as high (Grade IV and V). In Jinnah Hospital, they found that 62% of renal injuries were graded low and 38% as high renal injuries [15]. Herschorn *et al.*, found that 89% of patients had low-grade injuries and 11% had high-grade injuries [17].

In this study all patients of grade IV, and V and one patient of grade III underwent nephrectomy. A study in Jinnah Hospital found that all patients of grade V and three patients of grade lV underwent nephrectomy [15]. Another study done at Vancouver General Hospital stated 90.9% nephrectomy rate was done in grade V renal injury [18].

No death was observed in the non-operative group of this study. All patients of grades I, II, and III (except one) in this study were treated conservatively. In Jinnah Hospital, they also reported no death in the non-operative group of patients and that all patients of grade I, II, and III and 81% of grade IV injuries were treated conservatively [15]. The successful rate of conservative management in this study was 74% when compared to 87.1% and 90% [21, 22]. Shoobridge *et al.*, found conservative management was successful in all grade I and II renal injuries and 94.9%, 90.7%, and 35.1% of grade III, IV, and V injuries respectively [14]. A study in Srinagarind Hospital reported the success rate in conservative management was 87.2% [16]. Similarly, Vancouver General Hospital revealed that 87.5% of patients with grade III injuries and 77.7% of patients with grade IV injuries were managed conservatively [18].

The mean duration of hospital stay in the operative group was 21.1 days and in the case of non-operative group, it was 13.4 days. A study in Srinagarind Hospital found the mean duration of hospital stay in the operative group was 19 days and in the non-operative group, it was 11.8 days [16].

The lowest complication rate was seen amongst the patients managed conservatively. Shoobridge *et al.*, also found the same kind of result in those patients who were managed conservatively [14]. Robert *et al.*, showed pyelonephritis (9%), residual perinephric fluid collection (36%), and ureteral stenting for urinary extravasation in 36% of cases of patients with conservative management [23]. In this study, patients had similar complications like hemorrhage (24%), infections (20%), urinoma (4%) and perinephric abscess (4%). Iqbal and Chughtai (2004) reviewed the literature on blunt renal trauma and found among 52 patients treated conservatively 4% developed fever and 15% developed hypertension. Two (4%) patients of grade III underwent delayed exploration for perinephric collection [15].

Limitations of the study

Our study was a single-center study. We took a small sample size due to the short study period. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

The findings of this study show that renal injury, primarily caused by road traffic accidents, can be life-threatening but is often manageable without nephrectomy, especially in less severe cases. Blunt trauma accounts for most renal injuries, with low-grade injuries (Grade I–III) being more common than severe ones (Grade IV–V). A lack of standardized guidelines for conservative renal trauma management has led to recommendations from a multi-disciplinary team, including urologists, radiologists, and infectious disease specialists, to establish best practices and encourage further research. This study found that patients undergoing surgery had longer hospital stays, but non-operative management was also highly successful. While conservative treatment should be the first choice for stable patients, surgery remains necessary for unstable cases, ensuring the best possible outcomes.

Further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: This study was approved by the ethical review committee.

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