

Clinical Characteristics and Management of Renal Trauma: A Single-centre Observational Study

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ABSTRACT

Introduction: The management of renal trauma includes operative and non operative approach based on clinical profile of patient. However, management of the high-grade renal trauma remains controversial.

Aim: To evaluate mode of renal injury, staging and its management outcomes.

Materials and Methods: This prospective, observational study included 49 patients (>15 years of age) who presented with abdominal trauma. Computed tomography was performed for grading of renal trauma. The patients were stratified based on whether they underwent open renal surgery or conservative management for their renal injury. Demographic characteristics and a detailed history of renal injuries were recorded. The patients were evaluated based on the rate of renal preservation and complications at 6-month follow-up.

Results: The mean age was 32.10 years and majority of the patients were males (87.76%). Blunt trauma (95.92%) was most frequently reported. According to American Association for the Surgery of Trauma (AAST), 8 (16.33%) patients were

categorized in grade I, 17 (34.69%) patients in grade II, 8 (16.33%) patients in grade III, 12 (24.49%) patients in grade IV, and 4 (8.16%) patients in grade V. Microscopic haematuria (42.86%) was the most common clinical presentation. The majority of the patients were managed conservatively (89.8%). Only two belonging to grade 4 and three from grade 5 were managed operatively due to haemodynamic instability. Rib fractures (n=10) were the most frequently associated injury, and Urinary Tract Infection (UTI) (n=8) was the most common complication, followed by persistent haematuria (n=3), and hypertension (n=3). All patients with grades I to III showed 100% renal preservation rate with conservative management. However, patients with grades IV and V showed renal preservation rate of 83.33% and 50%, respectively.

Conclusion: Conservative treatment is a preferred choice of treatment in the most of the renal trauma. The present study reported high renal preservation rate in low-grade renal injuries, which were managed conservatively. However, there is still need of surgical treatment in high grade haemodynamically unstable patients.

Keywords: Complications, Conservative, Haematuria, High grade, Surgical

INTRODUCTION

Renal injury is one of the most commonly affected genitourinary organ system during trauma, caused due to blunt or penetrating trauma. Motor vehicle accidents and falls contribute to the blunt trauma while firearms and stab wounds are the most common cause of penetrating injuries to the kidney [1]. The condition must be diagnosed quickly and correctly to preserve kidney function. Also, Computed Tomography (CT) urography is important to classify the injury properly.

The AAST's Organ Injury Scaling Committee [2] developed the most widely used and accepted classification, which is based on the severity of injury. In general, grade I-III injuries are considered mild to moderate injuries and can be managed conservatively, whereas grade IV and V injuries need more attention and are managed surgically. Since last few decades, there has been a paradigm shift in the management of renal trauma from operative to non operative, irrespective of severity of injuries [3-6]. However, the European Association for Urology (EAU) recommends operative management for grade V injuries [3].

The findings from AAST Genitourinary Trauma study indicate that rate of nephrectomy remains high in high grade patients [7]. However, a recent meta-analysis concludes that non operative management of renal injuries of any grade remains the standard of care for both blunt and penetrating renal injuries [8]. Likewise, non operative strategies were found to be successful in grade IV blunt renal trauma [4]. Even for grade V injuries, there is evidence that patients were successfully managed without any surgical interventions [9-11]. Along with the good outcomes, conservative

management also reduces hospital costs by avoiding laparotomies, kidney resections, and nephrectomies.

Only a limited amount of data is available on Indian patients. Therefore, the present study aimed to evaluate renal injury, staging and its management outcomes.

MATERIALS AND METHODS

This was a prospective, observational study conducted between January 2019 and June 2021 at the Department of Urology, Kurnool Medical College, Kurnool, Andhra Pradesh, India, which is a tertiary care centre. The study protocol was approved by the Institutional Ethics Committee (No: 26/ICE KGH/MAR/2019). The study was conducted in accordance with the International Conference on Harmonization (ICH)- Good Clinical Practice guideline and the Declaration of Helsinki. Each study participant or legally acceptable representative provided written informed consent for participation in the study.

Inclusion criteria: Patients of either sex, aged more than 15 years, who presented with abdominal trauma and Ultrasonography (USG) or CT showed renal injury were included. Patients who have experienced penetrating renal injury resulted from gunshot wounds, stab wounds, or blunt renal injuries (rapid deceleration such as motor vehicle crash, fall from heights; or direct blow to the flank) were also included.

Exclusion criteria: Patients with renal cell carcinoma or other tumours of the kidney, iatrogenic renal injuries (e.g., endourological procedures, extracorporeal shock wave lithotripsy, renal biopsy, and percutaneous renal procedures), intraoperative renal injuries, or

other renal injuries like renal transplant rejection, spontaneous renal lacerations during childbirth were excluded from the study.

Renal injuries were graded by using AAST of renal injury (grades I to V) [2].

Patients were stratified according to initial management of renal injury into two groups- open renal surgery (partial nephrectomy, renorrhaphy, auto transplant, nephrectomy), and conservative management (absolute bed rest, appropriate fluids and blood transfusion, serial Hb%, haematocrit, complete urine examination, prophylactic antibiotic coverage and careful continuous observation [vitals, abdominal examination]).

Indications for laparotomy

- Deterioration with conservative management
- Surgical management for selected cases, which were haemodynamically unstable
- Patients who did not require active urological intervention during the index hospitalisation were specifically noted
- If the patient was haemodynamically unstable even after resuscitation, such patients were taken directly to theatre, underwent exploratory laparotomy, and on table intravenous pyelogram (IVP) was performed to know the function of the opposite kidney and nephrectomy or required procedure done.
- If the patient was initially stable, and became unstable during observation, underwent exploratory laparotomy, delayed nephrectomy or required procedure done.

Post discharge, follow-up was continued for six months, with IV monthly for first three months and next visit after six months from the discharge, and when and where needed in between also. During the follow-up clinical history, recording of blood pressure, local examination, complete urine examination, haematocrit, serum creatinine, and IMAGING with Ultrasonography (USG), Contrast Enhanced Computerized Tomography (CECT) scan of the Kidneys Ureter Bladder was done. During follow-up patients developed UTI, hypertension, urinoma, haematuria, and ileus. UTI was treated with antibiotics according to urine culture and sensitivity. Urinomas were treated with double J stenting. Hypertension was treated with medical management.

STATISTICAL ANALYSIS

This study was done using descriptive analysis, and data analysed using MS excel.

RESULTS

A total of 49 patients were included in this study. The mean (SD) age was 32.10 (12.94) years, and majority of patients 18 (36.73%) belonged to the age group of 21-30 years. There were 43 (87.76%) males and 6 (12.24%) females. Motor vehicle crash (67.35%) was the most common mechanism of injury, followed by fall from height (12.24%), Thirty-one patients had right side kidney injury. Microscopic haematuria (42.86%) was the most common clinical presentation followed by gross haematuria (20.41%) and local symptoms and signs (18.37%). Rib fracture (10) was the most commonly reported associated injury, followed by liver injury. However, 32 patients did not report any associated injuries. A total of 33 (67.33%) patients reported grade I-III renal injury [Table/Fig-1].

Parameter	N=49
Age (years), mean (SD)	32.10 (12.94)
Age group (years)	
15-20	10 (20.41)
21-30	18 (36.73)
31-40	9 (18.37)
41-50	6 (12.24)
>50	6 (12.24)

Sex	
Males	43 (87.76)
Females	6 (12.24)
Mechanism of injury	
Motor vehicle crash	33 (67.35)
Fall from height	6 (12.24)
Motor cycle crash	4 (8.16)
Assault	4 (8.16)
Penetrating injury	2 (4.08)
Side of kidney injury	
Right	31 (63.27)
Left	18 (36.73)
Clinical presentation	
Microscopic haematuria	21 (42.86)
Gross haematuria	10 (20.41)
Local symptoms and signs	9 (18.37)
Gross haematuria+shock	5 (10.20)
No haematuria, no shock	4 (8.16)
Associated injuries	
No injuries	32 (65.31)
Rib fracture	10 (20.41)
Gr-I splenic injury*	1 (2.04)
Gr-II liver injury**	2 (4.08)
Gr-III liver injury**	1 (2.04)
Gr-IV liver injury+penetrating bowel injury**	1 (2.04)
Laceration of back muscles	1 (2.04)
Bladder injury with L2 wedge compressing fracture	1 (2.04)
Grade of renal injury#	
Grade I	8 (16.33)
Grade II	17 (34.69)
Grade III	8 (16.33)
Grade IV	12 (24.49)
Grade V	4 (8.16)

[Table/Fig-1]: Patients' baseline and demographic characteristics. Data shown as n (%), unless otherwise specified. *AAST spleen injury scale; **AAST liver injury scale; #AAST renal injury scale; AAST: The American association for the surgery of trauma

In grades I-III, all patients were managed conservatively. Out of 49 patients, three patients considered for emergency nephrectomy because of haemodynamic instabilities and the remaining 46 patients were kept on initial conservative management. Of these, two patients were considered for delayed surgical interventions, including one delayed nephrectomy and one lower pole nephrectomy because of haemodynamic instability. A total of 44 (89.79%) patients were treated with successful conservative management and only five patients were considered for emergency nephrectomy because of haemodynamic instabilities [Table/Fig-2].

Grade of injury	Conservative management Total number=44	Operative management Total number=5
Grade I	8 (18.18%)	0
Grade II	17 (38.64%)	0
Grade III	8 (18.18%)	0
Grade IV	9 (20.45%)	3 (60.00%)
Grade V	2 (4.55%)	2 (40.00%)

[Table/Fig-2]: Grade wise management.

In grade I-III, renal injury renal preservation rate was 100% (n=33; 33 kidneys preserved). In grades IV and V renal injury renal preservation rate was 83.33% and 50%, respectively [Table/Fig-3].

Grade of injury	Kidneys preserved, n	Renal preservation rate (%)
Grade I-III (33)	33	100.00
Grade IV (12)	10	83.33
Grade V (4)	2	50.00

[Table/Fig-3]: Renal preservation rate.

Complication rate was 36% (18/49) during the follow-up period of 6 months duration. UTI in 8 (16.32%) patients was the most frequent complication followed by persistent haematuria in 3 (6.12%) patients and hypertension in 3 (6.12%) patients [Table/Fig-4].

Complications	Frequency (49)
Urinary tract infection	8 (16.33%)
Persistent haematuria	3 (6.12%)
Hypertension	3 (6.12%)
Persistent urinoma	2 (4.08%)
Prolonged ileus	2 (4.08%)

[Table/Fig-4]: Complication rate.

DISCUSSION

In the past decades, management of high-grade renal trauma with operative methods has been a matter of research and debate. Recent studies have demonstrated successful outcomes of conservative treatment in patients with high grade renal trauma [12-14]. This single-centred study was conducted to evaluate renal injury, staging, and its management outcomes. The key findings of this study were; majority of patients had grade I-III renal injury managed conservatively with 100% renal preservation rate and UTI (16.33%) was the most common complication observed during 6 months follow-up.

In the present study, the mean age was 32.10 years and majority of patients were male. These observations are in accordance with the previous studies where renal injuries were commonly reported in young adult population, predominantly in males [7,15,16]. The occurrence rate of renal trauma among trauma patients ranges from 1-5% [17] and the most common cause of renal injury is blunt trauma rather than the penetrating one [18]. van der Wilden GM et al., reported blunt trauma as the most important cause of renal trauma, [16]. Similarly, blunt injuries (90.7%) were found to be more common compared to penetrating injuries (9.3%), by GlyKas I et al., [15]. These findings are consistent with the present study, where blunt renal trauma accounted for 95.91% of patients and motor vehicle crash, assaults and fall from height were the common mechanism of injury associated with it. However, prevalence of blunt and penetrating trauma varies worldwide [19].

The presence of microscopic or gross haematuria is considered as early sign of renal injury [20]. In the present study, majority of patients reported presence of microscopic (42.86%) and gross (20.41%) haematuria at the time of presentation. Previous studies reported significant haematuria (both microscopic or gross) in the range of 50-86% in patients with renal injury [15, 21, 22]. Contrary to this, May AM et al., did not report haematuria in patients with high grade blunt renal injuries at the time of presentation [4]. Research also highlighted that absence of haematuria was more common with penetrating renal trauma [23]. However, there is no relationship between presence of haematuria with type and severity of renal injury.

Management of patients with renal injury is more complex when there is presence of associated injuries. In such scenario, CT scan is considered as gold standard for patients with high possibility of occurrence of associated injuries. Rib fracture was the most common associated injury in the present study followed by splenic and liver injuries. In contrast, previous studies have reported splenic, liver and other abdominal injuries as the most frequently reported associated injuries [15,16].

Most of the studies have reported data regarding management of low to high grade renal injuries (grade I-V) by operative and nonoperative approach. However, Glykas I et al., analysed the patients with grades IV and V specifically. They reported that high grade renal trauma can be successfully managed conservatively only when patients are haemodynamically stable [15]. In the current study, patients were classified according to AAST grading system (Grade I-V). Most of the patients had grade I-III injuries. Out of 49 patients, 44 (89.79%) patients were treated with successful conservative management. While five patients underwent emergency nephrectomy due to hemodynamic instabilities (grade 4 [n=3] and grade 5 [n=2]) [15,24]. A meta-analysis done by Mingoli A et al., reported non operative approach as a treatment of choice for the management of blunt or penetrating renal trauma, irrespective of the severity [25]. There is conflicting data regarding management of blunt and penetrating renal trauma. According to the EAU trauma guidelines panel, conservative or minimally invasive techniques are suggested as standard of care in the management of renal injuries [3]. However, several guidelines emphasise on nonoperative management for low-grade (grade I-III) renal injuries while operative management for high grade (grades IV and V) [3,26,27]. Initiation of conservative management of high-grade renal injuries in haemodynamically stable patients was also suggested by AUA [27]. Several global and Indian studies have been reported successful outcomes with conservative management in patients with blunt renal trauma [16,28,29]. These findings highlight that patient with high grade blunt renal trauma can be managed conservatively when patients are haemodynamically stable. Now-a-days physician's perspective has shifted towards non operative management of renal trauma, where imaging and angioembolisation are widely accepted approach rather than renal exploration [30]. Despite this, there is inconsistency regarding use of non-operative approach in patients with high grade renal trauma. Management of renal trauma is a major challenge for physicians on the basis of patients' risk benefit ratio and physicians experience.

In the present study, overall complication rate was 36% and UTI (16.32%) was the most common complication followed by persistent haematuria and hypertension. However, we could not compare the complications rate between operative and non operative management. Comparative studies have reported higher complication rate in operative management [31-34]. Contradictory to this, van der Wilden GM et al., reported high complication rate in conservative group [16]. These variations in complication might be due to different methods and reporting of classification. Common complications reported by previous literatures are fever, worsening flank pain, ongoing blood loss, and abdominal distension [35,28]. Few studies have reported increasing complication rates in the conservative management; however, difference was insignificant [16,31]. It is difficult to conclude the higher complication rate in conservative management group because of heterogeneity and variation in sample size of published literatures.

Limitation(s)

The comparison between operative and conservative management in terms of complication rate, renal preservation rate, and mortality rate could not be done due to the limited number of patients who underwent operative management. More aggressive follow-up and diagnostic evaluations are required to estimate real renal preservation rate. Confounding factors, such as number of patients who required additional interventions or developed long-term complications after their discharge, were not taken care of, which might have affected renal preservation rate.

CONCLUSION(S)

Preserving kidneys with minimal complications is the primary goal in the management of renal trauma. In the present study, haemodynamically stable patients with grade I to V were successfully managed with conservative approach while haemodynamically

unstable patients were only considered for emergency nephrectomy. UTI was the most common complication associated with the management of renal trauma. However, prospective trials with a larger sample size and longer follow-up are necessary to conclude robustly which treatment modality is better.

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AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval Obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: May 06, 2022
- Manual Googling: Jun 22, 2022
- iThenticate Software: Aug 09, 2022 (13%)

ETYMOLOGY: Author Origin

Date of Submission: **May 01, 2022**
Date of Peer Review: **Jun 04, 2022**
Date of Acceptance: **Jun 23, 2022**
Date of Publishing: **Jan 01, 2023**