

Original Research Article

A prospective observational study on the optimal management approach based on the clinical profile of renal trauma patients

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ABSTRACT

Introduction: The kidney is the most commonly injured genitourinary organ following trauma. It can be a result of both blunt and penetrating trauma to the abdomen. Both conservative and surgical managements are employed as per the clinical profile of the patient.

Methods: This prospective observational study included all the patients with renal trauma who presented at the ER. Computed tomography (CT) was done for grading of renal trauma.

Results: A total of 60 patients were included in the study. Eighty percent (n=48) patients were managed conservatively. Twenty percent (n=12) patients underwent some form of surgical management. The mean (SD) hospital stay as 11.38 (6.94) days. Twenty-eight patients (46.67%) had right renal injury. Thirty-two patients (53.33%) had left renal involvement. There were no patients with bilateral renal injury. According to American association for the surgery of trauma (AAST), 11.66% patients (n=7) were categorised in grade I, 20% patients (n=12) to grade II, 33.33% patients (n=20) to grade III, 25% patients (n=15) to grade IV and 10% patients (n=6) to grade V. The most common associated injuries were rib fracture and visceral injury.

Conclusion: Much has changed since historical times with regards to renal trauma management. Data from various studies point towards a paradigm shift from surgical to conservative management as the standard of care irrespective of the grade and mode of renal trauma.

Keywords: Trauma, Genitourinary organ, Penetrating, Computed tomography, Conservative

INTRODUCTION

The kidney is the most commonly injured genitourinary organs following trauma. It can be a result of blunt as well as penetrating trauma to the abdomen. Motor vehicle accidents, fall from height and assaults contribute to the bulk of the blunt trauma. Rapid deceleration forces and direct transmission of the energy following impact, places the kidneys at risk. Gunshot and stab injuries are the most common cause of penetrating injuries to the kidney. Usually children are more prone to renal trauma owing to

the incomplete protection by the rib cage and lack of adequate perinephric fat which acts as a cushion.

Both conservative and surgical managements were employed. Earlier it was believed that high grade renal injuries could only be managed by surgical interventions, but recent studies have challenged this dogma. Even after penetrating trauma, appropriate categorization of patients based on their hemodynamic stability and accurate staging, can be managed conservatively.

A recent meta-analysis has demonstrated that conservative management is the standard of care for both low as well as high grade blunt and penetrating renal injuries.¹ Many studies have shown higher complication rates with surgical intervention in blunt renal trauma cases.²⁻⁵

India is a diverse country. There is limited data on Indian patients, even more so for the eastern population. This study is a prospective observational study to evaluate the best mode of management for all the grades of renal trauma.

METHODS

This is a prospective observational study on the population of eastern India. This study was conducted in a tertiary care center (R.G. Kar Medical College and Hospital, Kolkata) catering to the needs of urological patients in Kolkata, during May 2015 to December 2019.

Table 1: American association for the surgery of trauma organ injury severity scale for the kidney.

Grade*	Type	Description
I	Contusion	Microscopic or gross haematuria. Urologic studies normal.
	Hematoma	Sub capsular, nonexpanding without parenchymal laceration.
II	Hematoma	Nonexpanding, perirenal hematoma confined to renal retro peritoneum.
	Laceration	<1 cm parenchymal depth of renal cortex without urinary extravasation.
III	Laceration	>1cm parenchymal depth of renal cortex without collecting system rupture or urinary 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, devascularizing the kidney.

*advance one grade for bilateral injuries upto grade III

Study was conducted as per guidelines of the Declaration of Helsinki. Ethical committee clearance was taken from the institution in April 2015. A written consent was taken in the patients' native language regarding enrolment in this study design.

All the patients who presented to the Emergency room (ER), irrespective of age or sex were included in the study design except for pregnant patients. The medical history and demographic details (age, sex, grade of renal trauma, treatment offered, side of involvement, associated injuries and length of hospital stay) were recorded for each patient.

All patients if hemodynamically stable to be taken to the radiology suite, underwent Computed tomography (CT) for grading of renal trauma and associated injuries. Renal injury grading was done according to the American association for the surgery of trauma (AAST) organ injury scale.⁶ (Table 1)

Those patients who failed to respond to conservative management were treated with surgical procedures like retrograde pyelogram, double-J stenting, percutaneous nephrostomy, percutaneous drainage of perinephric collection, open drainage, renorrhaphy and nephrectomy.

Statistical analysis was done using IBM Statistical package for social sciences (SPSS) 26.0. Categorical variables were analyzed using Chi-squared test. Quantitative analysis was done using one-way Analysis of variance (ANOVA). Games-Howell post hoc analysis of ANOVA was employed for multiple group comparisons. Correlation analysis was performed using Spearman's correlation co-efficient test. To find out the variation in the hospital stay, based on age, gender, type of treatment and associated injuries, multiple linear regression analysis was used.

RESULTS

A total of 60 patients were included in the study. There were 51 males (85%) and 9 females (15%) in this study group. The mean (Standard deviation (SD)) age in years was 37.5 (15.5).

Twenty-eight patients (46.67%) had right renal injury. Thirty-two patients (53.33%) had left renal involvement. None of the patients had bilateral renal injury. Eighty percent (n=48) patients were managed conservatively. Twenty percent (n=12) patients underwent some form of surgical interventions. The mean (SD) hospital stay was 11.38 (6.94) days.

The most common associated injuries were rib fracture in 15% patients (n=9). Out of these 9 patients, two patients had associated grade V splenic laceration as well as full thickness jejunal perforation within 20 cm from suspensory ligament of Treitz. Five percent patients (n=3) had hepatic injury and urinoma each. Pelvic fracture with hematoma was encountered in 5% patients (n=3) with successful per urethral catheterization. Four patients (6.66%) had associated lower limb fractures. Forty-one patients (68.33%) reported no associated injuries.

Surgical intervention was undertaken in 20% patients (n=12). Three patients (5%) five percent patients (n=3)

underwent double J stenting. Ultrasound guided percutaneous drainage of perinephric collection was performed on 5% patients (n=3). Two patients (3.33%) underwent exploratory laparotomy for splenic and jejunal injuries. Emergency nephrectomy was resorted to in 5% patients (n=3), all of whom had grade V renal injuries. (Figures A, B and C) One patient, belonging to Grade III, underwent renorrhaphy. (Table 2)

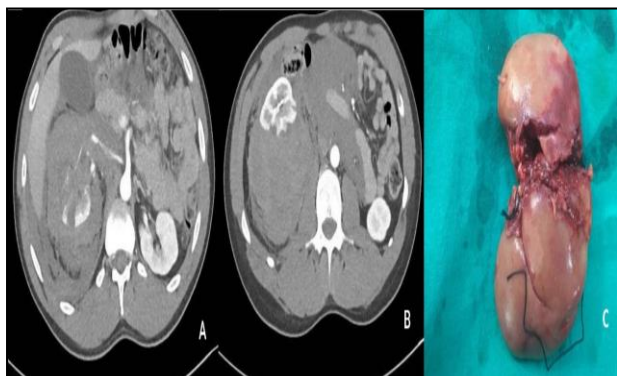


Figure 1: A and B- Transverse section of CT of the same patient taken at the level of the origin of superior mesenteric artery and L3 vertebra respectively. There is complete separation of the upper and lower half of the kidney by approximately 6 cm. The fracture extends through the right renal pelvis. A large peri and paranephric hematoma on the right extends to the anterior mesentery, peri hepatic, right paracolic gutter and to the pelvis. Contrast is seen in the proximal right renal vein which then fades off, hence suggesting transection at this site. The ascending colon is displaced medially. There is good enhancement of the upper and lower right renal poles. Appearances are consistent with a grade 5 American Association for the Surgery of Trauma (AAST) injury to the right kidney. This patient underwent nephrectomy. Image C- Left sided nephrectomy specimen of grade V renal trauma in another patient. As the patient was hemodynamically unstable, preoperative CT scan was not possible. Laceration is seen extending through the renal parenchyma to the collecting system with avulsion of renal hilum.

According to AAST, 11.66% patients (n=7) were categorized in grade I, 20% patients (n=12) to grade II, 33.33% patients (n=20) to grade III, 25% patients (n=15) to grade IV and 10% patients (n=6) to grade V.

The bulk of the patients were males (3 (42.8%), 10 (83.33%), 19 (95%), 13 (86.66%) and 6 (100%) patients with grade I, II, III, IV and V renal trauma respectively. In patients with grade I, II, III, IV and V renal trauma respectively, 85.7% (n=6), 100% (n=12), 90% (n=18), 66.66% (n=10) and 33.3% (n=2) were managed conservatively. Associated injuries were observed in patients with grades I (28.5%), grade II (8.33%), grade III (20%), grade IV (66.66%) and grade V (33.33%). Seven patients (17.94%) belonging to grade I-III (i.e. without

collecting system involvement) had associated injuries whereas this number jumped to 12 patients (38.70%) in grade IV-V injuries. Length of hospital stay was 7,11.5,11.9,14.3,15 days for patients with grade I, II, III, IV and V renal trauma respectively. The mean length of hospital stay ranged from 7 to 16 days. (Table 3).

Table 2: Demographic characteristics of patients with renal trauma.

Parameters	Number of subjects
Age (years), mean (SD)	37.5 years (15.5)
Gender	
Males	51 (85%)
Females	9 (15%)
Site of involvement	
Right kidney	28 (46.67%)
Left kidney	32 (53.33%)
Bilateral kidney	0
Mode of treatment	
Conservative	48 (80%)
Surgical	12 (20%)
Mean hospital stay	11.38 days
Associated injuries	
Rib fractures only	4 (6.66%)
Rib fractures + splenic + laceration + jejunal perforation	2 (3.33%)
Rib fracture + urinoma	3 (5%)
Liver injury	3 (5%)
Pelvic fracture + pelvic hematoma	3 (5%)
Femur fracture	4 (6.66%)
Types of intervention	
Double J stenting	3 (5%)
Percutaneous drainage of perinephric collection	3 (5%)
Exploratory laparotomy with splenectomy and repair of jejunal perforation	2 (3.33%)
Nephrectomy	3 (5%)
Renorrhaphy	1 (1.66%)

No deaths were reported in the study population. The length of hospital stay was positively correlated with the severity of renal trauma but was not statistically significant between grades. In multiple linear regression analysis, associated injuries, sex, age, grade of trauma and type of treatment were insufficient to explain variation in length of hospital stay ($r=0.438$, $r^2=0.192$; adjusted $r^2=0.095$; $p=0.087$).

DISCUSSION

Much has changed since the last few decades with regards to renal trauma management. Data from various studies

point towards a paradigm shift from surgical to conservative management as the standard of care irrespective of grade of renal trauma.⁷⁻¹⁰

This study focuses on the best mode of treatment for the eastern Indian population based on the clinico-radiological profile of renal trauma patients.

Table 3: Comparison among study subjects in different grades of renal trauma.

Parameters	Grade I (n=7)	Grade II (n=12)	Grade III (n=20)	Grade IV (n=15)	Grade V (n=6)
Males	3 (42.85%)	10 (83.33%)	19 (95%)	13 (86.66%)	6 (100%)
Females	4 (57.14%)	2 (16.66%)	1 (5%)	2 (13.33%)	0
Type of intervention					
Conservative	6 (85.7%)	12 (100%)	18 (90%)	10 (66.66%)	2 (33.33%)
Surgical	1 (14.28%)	0	2 (10%)	5 (33.33%)	4 (66.66%)
Associated injuries	2 (28.57%)	1 (8.33%)	4 (20%)	10 (66.66%)	2 (33.33%)
Length of hospital stay (in days)					
	7	11.5	11.9	14.3	15

In our study, the mean age group was 37.5 years and 85% of the patients were males. This is in corroboration with previous studies, which showed incidence of renal trauma being more prevalent in males from the age group 31-38 years.⁹⁻¹⁴ All the patients had unilateral renal injuries and 80% of the patients were managed conservatively. Most of the patients fell in categories between grades II-IV. In a review study by Voelzke et al, the distribution of renal trauma was grade I (26%), grade II (28%), grade III (20%), grade IV (19%) and grade V (7%).¹¹ These observations are in agreement with present study except grade I injury which in our study is 11.66% of patients. The reason most probably stems from the fact that even now only plain radiograph of the abdomen is available in most peripheral centers and there is decreased referral to higher centers for clinically stable patients.

Bjurlin et al and Voelzke et al, in their study have shown 2.7-5.4% of failure with conservative management.^{10,11} In a study by Zabkowski et al, conservative management was found useful only in grade I and II renal trauma. In our study, 12 patients (20%) underwent some form of surgical interventions, out of which, two patients underwent laparotomy for non-renal causes (both had splenic lacerations with jejunal perforation). Others include double J stenting (5%), ultrasound guided percutaneous drainage of perinephric collections (5%), emergency nephrectomy (5%) and renorrhaphy (1.66%). This result has been corroborated in a study by Narendra et al, where 23.14% patients underwent surgical interventions (double J stent (8.26%), percutaneous drainage, open drainage, ultrasound guided aspiration-1.65% each, nephrectomy (3.30%)).¹⁶ Bjurlin et al, reported having managed 16.6% patients surgically and 83.4% patients conservatively.¹⁰

In our study, the length of hospital stay was directly proportional to the severity/grade of renal trauma as well as associated injuries. The range of length of hospital stay was from 7 to 15 days. In a similar study by Lanchon et al,

surgically managed patients and conservatively managed patients, stayed for an average of 25 days and 12 days respectively.¹⁵

Bjurlin et al, in his study observed that grade III or higher renal trauma were more susceptible to failure of conservative management. He did not analyze the risk factors of non-operative failure with increasing severity.¹⁰ The present study also corroborates with the notion that increased severity is directly proportional to the length of hospital stay.

CONCLUSION

Conservative management is the standard of treatment for all grades and modes of renal trauma with primary focus on resuscitation. Haemodynamically unstable patients, failing to respond to resuscitative measures, are offered surgical interventions, which in most cases in emergency settings, culminate to nephrectomy. Patients with persistent urinoma or perinephric collections could be managed with double J stenting and percutaneous drainage. The primary goal should always be to preserve the kidney.

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