

ROLE OF INITIAL CLINICAL AND RADIOLOGY IMAGING EVALUATION AND ITS APPLICATIONS FOR APPROPRIATE MANAGEMENT IN A RENAL INJURY PATIENT

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Abstract

Background: Genitourinary trauma accounts for 10% of total trauma victims. Globally, renal trauma is present in approximately 0.5–5% of patients with traumatic injury and 10–20% of patients with abdominal trauma. The present study aims to evaluate the clinico-radiological profile of renal trauma patients and their impact on to determine the optimal management approach among Indian patients. **Materials and Methods:** A total of 41 patients who sustained renal trauma and confirmed by investigations were included in the study. All the patients admitted with abdominal trauma undergo focused abdominal sonography for trauma (FAST) and for exact characterization and grading of renal injuries Contrast enhance CT scan imaging is done. Depending on grading of injury and clinical condition, patients underwent conservative management, non-operative management with minimal invasive procedure or surgery when required. Follow up, at 1 month and at 3 month using blood reports, renal function test, sonography and CT scan. **Results:** Of all the genitourinary organs, renal injury comprised the bulk followed by urethral injuries, renal injury has occurred in about 6.22% (41 out of 659) of all abdominal trauma, 58.57% (41 out of 70) of all genitourinary injuries. Of the total of 41 patients who sustained renal injuries, 75.60% (31 out of 41) were males and 24.39 % (10 out of 41) were females in our series with M:F ratio of 3.1:1. Young adults in the age group of 20 to 40 years, 22 out of 41 (53.66%) were found the prone to sustain renal injuries. Blunt trauma abdomen comprised majority of patients. Mainly presented with hematuria, hypotension, and loin bruise. 70.73 % (29 out of 41) of cases were managed conservatively, Surgical intervention was needed in 9.75% (4 out of 41) patients in the form of renorrhaphy or nephrectomy and in another 8 patients (19.51%) required drainage in form of DJ stent insertion or PCN insertion. **Conclusion:** We conclude there should high suspicion of renal injuries particularly in young with blunt abdominal trauma should undergo gold standard contrast enhance CT scan imaging for grading renal injury and opt for appropriate management in form of either conservative minimal invasive or surgical intervention.

INTRODUCTION

Trauma is a physical injury or a wound to living tissue caused by an extrinsic agent. Motorcyclists and cyclists have a higher death rate for road injuries in India than the global average and road injuries are the leading cause of death among young adult males in India.^[1] Genitourinary trauma accounts for 10% of total trauma victims. Renal injury is present in approximately 0.5–5% of patients with traumatic injury and 10–20% of patients with abdominal trauma. The kidney is the most injured genitourinary organ globally with

incidence of around 245,000 cases each year worldwide and is the third most commonly injured organ due to abdominal trauma after the spleen and liver.^[2-6] various studies reported an incidence of about 10-20 % genitourinary injuries in blunt trauma abdomen victims and renal injuries varied from 13-46 %. Most common mode of injuries were due to road traffic accidents.^[7-9]

Prompt diagnosis is key as the injury may be life threatening. Imaging studies, such as Focused Abdominal sonography for Trauma (FAST) allow a general abdominal preview and helps to rule out potentially fatal injuries but it is limited by its ability

to access the retroperitoneum. CT Imaging is a gold standard for the diagnosis of renal injuries. This study aims radiological evaluation in renal trauma patients, and its impact on optimal clinical management.

MATERIALS AND METHODS

In this study all trauma patients who were admitted to the emergency trauma ward in the B. J. Medical College, Ahmedabad during the period between January 2021 to January 2023 were analysed. A total of 41 patients who sustained renal injury and confirmed by investigations were included in the study.

At our institution, after resuscitation, all the patients admitted with abdominal trauma undergo focused abdominal sonography for trauma (FAST) if they are unstable or a complete ultrasonography of abdomen and pelvis if they are stable.

Following contrast CT imaging, Low grade renal injuries were defined as Grade I, II & III and High-grade injuries were as Grade IV & V. Depending on grading of injury and clinical condition patients underwent conservative management, non-operative management with minimal invasive procedure or surgery when required.

Conservative management included regular monitoring of vital signs, abdominal symptoms and signs, serial abdominal girth measurement, urine output monitoring and laboratory parameters like hemoglobin, hematocrit, renal function and electrolytes. Serial Hb gm% and RFT monitoring are done 12 hourly in the first 24 hours and then every 24 hourly. Blood transfusion was given depending on hematocrit levels and clinical condition. Strict bed rest was maintained until clinical signs had been stable for a few days and macroscopic hematuria had cleared. Adequate hydration was maintained. Patients were advised to avoid strenuous physical exertion for at least 6 weeks. Although renal lacerations caused by blunt trauma is an uncontaminated injury, antibiotics were given in the presence of urinary extravasation and extensive tissue devitalization to avoid infections. Non-operative management included minimal invasive procedures such as DJ stenting or PCN diversion and operative procedures included nephrectomy or renal salvage procedures such as renorrhaphy.

A follow up imaging with USG/CT is done if the patient had continued hematuria, hypotension, delayed hematuria or decreasing hematocrit/alterd RFT/leukocytosis. After discharge, the patient was followed up, at 1 month with USG (A+P), CECT (A+P), CBC, RFT and at 3 months with USG (A+P), CECT (A+P), CBC, RFT.

RESULTS

In the present study, out of 659 total patients admitted with abdominal trauma, 70 had some form of urological injuries (10.62%). Of all the genitourinary organs, renal injury comprised the bulk followed by urethral injuries, renal injury is occurred in about 6.22% (41 out of 659) of all abdominal trauma, 58.57% (41 out of 70) of all genitourinary injuries. Of the total of 41 patients who sustained renal injuries, 75.60% (31 out of 41) were males and 24.39% (10 out of 41) were females in our series with M:F ratio of 3.1:1. Young adults in the age group of 20 to 40 years, 22 out of 41 (53.66%) were found the most prone to sustain renal trauma. This age group is prone to road traffic accidents due to frequent use of two-wheeled motorized vehicles and mostly the accidents generally occur at high speed and thus delivering high kinetic energy. In our study 25 (60.97%) patients had injury following RTA, 11 (26.82%) following fall from height, 5 (12.19%) had assault of which 3 were stab injury, 1 had gunshot injury and 1 had injury with blunt object. Blunt trauma abdomen comprised the majority of patients 90.24% in our study whereas 9.76% patients were victims of penetrating injury.

In the present series, hematuria, either microscopic or gross was present in 43.09% (18 out of 41) of all patients who sustained renal trauma. Hypotension (systolic blood pressure < 90 mm Hg) was present in 19.51% (8 out of 41) patients of our cohort. On subgroup analysis, 3 out of 17 (17.64%) patients with Grade IV renal injuries and 3 out of 10 (30%) patients with Grade V renal injuries presented with shock at admission.

All renal injury patients underwent renal imaging with CT with intravenous contrast, as per protocol and shown following distribution of renal injury.

In the present study, 70.73% (29 out of 41) of cases were managed conservatively without any surgical intervention and all these patients recovered well. Surgical intervention was needed in 9.75% (4 out of 41) patients in the form of renorrhaphy or nephrectomy and in another 8 patients (19.51%) required drainage in form of DJ stent insertion or PCN insertion.

Of all Grade V injuries (n=10), 2 patients (20%) needed nephrectomy and rest 80% (8 out of 10) patients were managed conservatively. The overall nephrectomy rate in this study was around 4.87% (2 out of 41). No patient needed delayed nephrectomy. One patient had associated duodenal and pancreatic injury and the patient's death was attributed to the complications of the bowel injury. On scheduled follow up, out of 34 patients seven patients presented with complications in form of Urinary extravasation on two patients, perinephric abscess in one, Secondary hemorrhage in two and UTI in two patients which were all managed conservatively. All

the complications were seen in Grade IV and V injuries.

Table 1: Distribution of Patient According to AAST Grade

S.NO	GRADE (American Association for Surgery of Trauma)	No of Patients
1	I	2 (4.87%)
2	II	4 (9.75%)
3	III	8 (19.51%)
4	IV	17 (41.46%)
5	V	10 (24.39%)

Table 2: Distribution According to Grade Wise Management and Outcome

S.NO	Grade	I (n=2)	II (n=4)	III(n=8)	IV(n=17)	V(n=10)
1	Conservative Management (n= 30)	2 (100%)	4 (100%)	7 (87.57%)	8 (47.05%)	8 (80%)
2	Minimal Invasive Intervention (n=8)	0	0	1 (12.5%)	7 (41.17%)	0
3	Operative Management (n=4)	0	0	0	2 (11.76%)	2 (20%)
5	Complications (n=8)	0	0	2 (25%)	4 (25.32%)	2 (20%)
6	Nephrectomy (n=2)	0	0	0	0	2 (20%)
7	Mortality (n=1)	0	0	0	0	1 (10%)

DISCUSSION

In our study, a total of 659 patients were presented with abdominal trauma. Of which, Renal trauma comprised 6.22% of all abdominal trauma and 58.57% of genitor-urinary trauma. Blunt trauma abdomen comprised the majority of patients 90.24% in our study whereas 9.76 % patients were victims of penetrating injury.

In our study road traffic injuries (RTA) were the most common mechanism (60.97%), followed by fall from height (26.82%). Our study is comparable to other studies with blunt trauma abdomen and RTA comprising the major mode of trauma.

On subgroup analysis RTA was the commonest mode of injury, with 62.96% (17 out of 27) of high-grade injuries and 57.14% (8 out of 14) of low-grade injuries being caused by road traffic accidents, whereas fall caused 22.22% (6 out of 27) of high grade and 35.72% (5 out of 14) of low-grade injuries. Assault was the cause of high-grade injuries in 14.81% (4 out of 27) and 7.14% (1 out of 14) of low-grade injuries. There was a male predominance in patients with renal injuries in our study as expected, with 75.6% of renal injuries being seen in male patients. This observation parallels the incidence pattern of motor vehicle accidents, which is equivalent to 60.97%. The mean age in our study was 26.5 years (range, 5-88 years). The majority of our patients belonged to the age group of 20-40 years, which is comparable to the study by Sarang et al,^[9] and Shoobridge et al,^[11] Another significant mode of renal injuries in the study was fall from height. This mechanism was commonly found in age group <20 yrs. In the present study only 43.90 % (18 out of 41) of patients with renal injuries had evidence of haematuria. All patients presenting with haematuria were in Grade III, IV & V injuries. But when only grade IV and V

injuries were considered; 15 out of 27 (55.56%) patients presented with haematuria. In our study 65.85% of cases were high grades.

Shock defined by a systolic blood pressure of less than 90 mm Hg at the time of admission was present in 8 out of 41 patients (19.51%). On subgroup analysis, 3 out of 10 (30%) patients with Grade V renal injuries and 3 out of 17 (17.64%) patients with Grade IV renal injuries presented with shock at admission.

A high proportion of patients presenting with hypotension is due to increase no of patients presenting with high-grade injuries.

Out of 8 patients presenting with hypotension; 3 patients had penetrating injuries who required renal exploration. Of which 1 patient underwent nephrectomy and in other two patients renal salvage procedure was done. And all other 5 patients had presence of concomitant life threatening other visceral injuries for which the patient underwent intervention. Of all patients presenting with hypotension, mortality was 25% (2 out of 8). In our series it was noted that, patients presenting with haematuria and hypotension had increased probability of high-grade injuries and a higher rate of intervention. In the present study, ultrasonography was able to identify 37 out of 41 renal injuries showing a sensitivity of 90.24%. However, the exact characterization and grading of renal injuries was not possible with this modality. CT with intravenous contrast is the most comprehensive diagnostic tool available for the evaluation of the victim of blunt abdominal trauma. The trend toward greater non-operative management of traumatic abdominal injuries can be attributed in large part to successful staging of injuries by CT. In the present series, contrast enhanced CT scan was 100% sensitive in identifying renal injuries and no significant injury was missed. Also, the exact

grading of the injuries was possible in all 41 patients. In our series, 37 out of 41 patients (90.24%) were managed successfully with conservative management and minimally invasive procedures. Out of 41, four patients (9.76%) needed surgical intervention in the form of renorrhaphy or nephrectomy and another 7 (17.07%) patients required drainage in form of DJ stent insertion or PCN insertion.

All low-grade injuries (Grade I, II, and III) were managed conservatively. 88.22% (15 out of 17) of grade IV injuries were managed with minimal invasive procedure and observation whereas 80% of grade V injuries were managed conservatively. The need for surgical intervention escalates with higher grades of renal injury and penetrating injuries. The intervention rate in the high-grade (grade IV and V) renal injuries was about 40.74% (11 out of 27) and 29.27% (12 out of 41) overall. The overall nephrectomy rate in this study was around 4.87% (2 out of 41). No patient needed delayed nephrectomy.

Overall mortality rate in our study was 2.44% (1 out of 41). Both nephrectomy and mortality occurred in Grade V injuries. Venkata ranga et al,^[14] reported a Complication rate of 36.73% during the follow-up period of 6 months duration. UTI in 16.33% of patients was the most frequent complication followed by persistent haematuria in 6.12% and hypertension in 6.12% patients. Normal contrast uptake and excretion was noted in 20% (2 out of 10) patients, Partial loss of function was noted in 30% (3 out of 10) of patients and complete loss in 20% (2 out of 10) of patients with Grade V injuries. All the patients who had loss of function were from grade V injuries. Whereas Van der wilden et al,^[17] in their study of 206 patients reported that 76.2% of their patients with a grade IV or grade V injuries preserved renal function. Due to lack of long follow up. So, we were not able to comment on long-term complications such as hypertension or development of CKD in future life span.

Table 3: Comparison of Success of Conservative Management

S.No	Grade	Our study	Narendra et al ¹⁶	Soumish et al ¹⁸	Cecila et al ¹⁹	Sarang et al ⁹
1	I	100%	66.67%	85.7%	NA	85.71%
2	II	100%	96.87%	100%	NA	73.33%
3	III	100%	92%	90%	NA	75.67%
4	IV	88.22%	76.32%	66.66%	89%	59.25%
5	V	80%	80%	33.33%	52%	0%

CONCLUSION

At the end of study, we conclude that during initial evaluation there should be high level of suspicion of renal trauma in young patients' population presenting with hematuria or bruise over loin particularly following blunt abdominal injuries. Though ultrasonography FAST is a useful screening tool in trauma ward during initial evaluation of trauma patients. However, Contrast enhance CT imaging is needed as the most comprehensive diagnostic tool for exact characterization and grading of renal injuries and to select appropriate managements option. All low grade and most high-grade renal injuries can be managed conservatively with minimal invasive procedures. In selected Grade V Injuries if managed conservatively, avoids the need of nephrectomy. Surgical interventions in the form of renorrhaphy or nephrectomy is advisable in hemodynamically unstable patients to salvage the kidney or life. Further Long-term follow-up is needed to see long term complications such as hypertension, reduction in the renal split function.

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