

Research Article

Non-Surgical Strategies for High-Grade Renal Injury: A Retrospective Study in A Tertiary Care Centre

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A B S T R A C T

Introduction: Renal injuries account for 1% to 5% of all trauma-related injuries. Recently, the management of blunt renal trauma has increased the preference for non-operative treatment. This study evaluates outcomes of conservative (non-operative) management for high-grade blunt renal injuries at our medical centre.

Materials and Methods: This retrospective study analysed hospital records from the past 6 months, including all patients with blunt renal injuries. Patients were classified by the AAST injury grading system and categorised based on operative or non-operative management. We focused on assessing instances of “non-operative management failure,” complications, and the necessity for additional procedures. Descriptive analysis was conducted using Microsoft Excel software (version 2021).

Results: The study included 14 patients with an average age of 40.6 years. Eleven had Grade I–III injuries, two had Grade IV injuries, and one had a Grade V injury. All patients with Grade I–III injuries were successfully managed conservatively without requiring additional procedures. No immediate surgical explorations were performed. Among the two Grade IV injuries managed non-operatively, one required delayed exploration, while the Grade V injury did not necessitate intervention. Complications included urinary tract infection in one case, persistent haematuria in one case, urinoma in one case, and ileus in two cases. All complications were Clavien grade 1–2, with no mortalities.

Conclusion: Our findings support that when haemodynamically stable, conservative management is viable for high-grade (Grade IV and V) blunt renal injuries. The failure rate of non-operative management was one case for Grade IV injuries and none for Grade V injuries.

Keywords: High-Grade Renal Injury, Surgical Exploration, Conservative Management, Non-Operative Approach, Nephrectomy

Introduction

Renal injuries constitute a relatively small percentage, approximately 1%–5%, of all trauma cases, making them the third most commonly affected organ following abdominal trauma. The approach to managing renal injuries has undergone significant changes in recent decades, particularly with a growing preference for non-operative management, particularly in cases of lower-grade renal injuries. Renal trauma grading involves the use of appropriate imaging techniques to determine the extent of the injury. Various models have been proposed to stage and manage renal trauma based on injury severity. Tri-phasic CT imaging, owing to its widespread availability and detailed anatomical information, has largely replaced the less sensitive and less specific excretory urography or intravenous pyelography (IVP) for grading purposes.^{1–4} Advances in radiographic injury grading, improvements in haemodynamic monitoring, validated renal injury grading systems, and a deeper understanding of injury mechanisms have all contributed to the successful implementation of non-operative management strategies, even in cases of high-grade renal injuries (Grades IV and V).⁵

The assessment of trauma history and a thorough physical examination, including the patient’s haemodynamic status, when combined with imaging studies, offers substantial guidance for treatment decisions.⁶ This study’s primary objective is to determine the adequacy of conservative (non-operative) management for high-grade renal injuries.

Materials and Methods

This study was conducted at a single tertiary healthcare facility serving a semi-urban population in the vicinity of Chennai, Tamil Nadu, India. It was carried out retrospectively, and data were extracted from available hospital medical records following the necessary institutional approvals. The study encompassed all patients (14) who experienced renal trauma and sought medical attention at our centre between March 2023 and August 2023. Patients with penetrating renal injuries were excluded from the study, as they followed a distinct exploration-based institutional protocol. All patients with blunt renal injuries, whether diagnosed through radiological means or surgical intervention, were assessed and graded using the American Association for the Surgery of Trauma (AAST) 2018 renal injury grading system, with particular emphasis on grade IV and V injuries^{7,8} considered as high-grade cases in this investigation.

The AAST renal injury scale, which saw its latest update in 2018, stands as the predominant grading system for assessing renal trauma. The 2018 revision notably includes “vascular injury” (such as pseudoaneurysm and arteriovenous fistula) in the criteria used for imaging-based evaluation of visceral injuries.

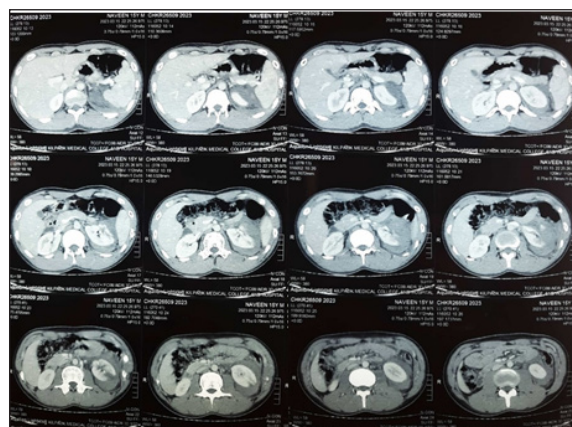


Figure 1. CECT–KUB Grade IV Renal Injury at the Time of Renal Trauma

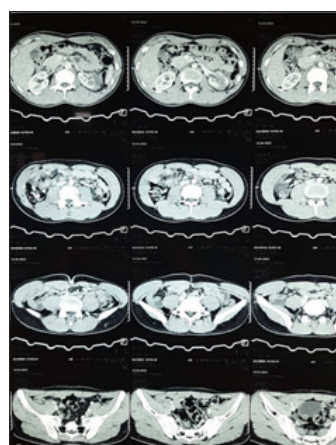


Figure 2. CECT–KUB One Month After Renal Trauma

Classification

Severity is assessed according to the depth of renal parenchymal damage and involvement of the urinary collecting system and renal vessels.

Table I. American Association for the Surgery of Trauma (AAST) 2018 Renal Injury Grading System⁹

Grade	Description
Grade I	Subcapsular haematoma and/ or contusion, without laceration
Grade II	Superficial laceration ≤ 1 cm depth not involving the collecting system (no evidence of urine extravasation) Perirenal haematoma confined within the perirenal fascia
Grade III	Laceration > 1 cm not involving the collecting system (no evidence of urine extravasation) vascular injury or active bleeding confined within the perirenal fascia

Grade IV	Laceration involving the collecting system with urinary extravasation Laceration of the renal pelvis and/ or complete ureteropelvic disruption vascular injury to segmental renal artery or vein Segmental infarctions without associated active bleeding (i.e. due to vessel thrombosis) active bleeding extending beyond the perirenal fascia (i.e. into the retroperitoneum or peritoneum)
Grade V	Shattered kidney avulsion of renal hilum or laceration of the main renal artery or vein: devascularisation of a kidney due to hilar injury devascularised kidney with active bleeding

upon the occurrence of an exploration within 24 hours from admission, allowing sufficient time for resuscitation and an evaluation of the patient's transient response. Conversely, patients who did not undergo exploration within this 24-hour timeframe were classified into the non-operative group. In our study, operative management encompassed various surgical interventions, such as nephrectomy. Non-operative cases included those managed through absolute bed rest, resuscitation involving fluid and blood transfusions, serial monitoring of haemoglobin levels, haematocrit, complete urine examination (CUE), prophylactic antibiotic administration, and rigorous monitoring of clinical parameters and vital signs.

Indications for operative management primarily revolved around haemodynamic instability at the time of presentation or the deterioration of the patient's condition despite conservative management efforts. Patients who presented with haemodynamic instability and showed no improvement with initial fluid resuscitation underwent immediate exploratory laparotomy. Furthermore, if a patient experienced clinical deterioration during the course of conservative/ non-operative management (e.g., a decrease in haematocrit levels or hypotension with persistent gross haematuria) and subsequently required exploratory laparotomy, this was deemed a failure of non-operative management. The evaluation of each management strategy's outcomes included assessing the necessity for exploration (either immediate or delayed), monitoring complications, and determining the requirement for additional interventions. During follow-up visits, various parameters were meticulously recorded, encompassing clinical history, blood pressure readings, local examinations, CUE, haematocrit levels, serum creatinine levels, and imaging (ultrasound/ CT), if conducted. This study was

Additional Points

- Advance one grade for multiple injuries up to grade III.
- "Vascular injury" (i.e. pseudoaneurysm or AV fistula) - appears as a focal collection of vascular contrast which decreases in attenuation on delayed images.
- "Active bleeding" - focal or diffuse collection of vascular contrast which increases in size or attenuation on a delayed phase.

Our study followed the 2018 AAST grading (Table 1) (Figures 1 and 2).^{10,11} Figure 1 demonstrates a grade 4 renal injury which was managed conservatively and Figure 2 depicts CECT KUB - one month post-renal trauma. Patients were categorised into two groups based on their renal injury management approach: operative management and conservative/ non-operative management. The classification into the operative group was contingent

Table 2. Summary of Patients Categorised by Different Grades of Renal Trauma, Their Management Approach, and Respective Outcomes

Grade of Renal Injury	Number of Patients	Initial Non-Operative Management	Initial Operative Management	Failure of Non-Operative Management	Overall Operative Management
Grade I	3	3	0	0	0
Grade II	4	4	0	0	0
Grade III	4	4	0	0	0
Grade IV	2	1	0	1	1
Grade V	1	1	0	0	0
Total	14	14	0	1	1

conducted using a descriptive analysis approach, with data analysis performed using Microsoft Excel software (2021).

Results

The study encompassed a total of 14 participants, comprising 13 males and 1 female, aged between 20 and 50 years. Blunt trauma resulting in renal injury occurred through various mechanisms: motor vehicle crashes accounted for 11 cases, falls from height for 1 case, and assaults for 2 cases. Among the patients, 1 individual presented with both gross haematuria and shock (systolic blood pressure < 90 mmHg at presentation), 2 patients had gross haematuria alone, 8 patients exhibited microscopic haematuria, while the remaining 3 had neither haematuria nor shock. We analysed the injury grades and corresponding management strategies for all cases (Table 2).

In total, 11 cases were classified as Grade I to III injuries, all of which were managed conservatively. This involved follow-up ultrasound at 72 hours, continuous monitoring with complete urine examination (CUE), serum creatinine measurements, and serial haematocrit assessments. These patients were discharged after resolution of haematuria and/or clinical improvement, typically within 1 to 2 weeks.

Among the participants, 2 patients had Grade IV renal injuries, with one case undergoing delayed exploration and nephrectomy. Beyond the initial 24-hour period, one case classified as Grade IV underwent exploration due to worsening clinical indicators and haemodynamic instability. Complications observed included urinary tract infection (UTI) in 1 case, persistent haematuria in 1 case, urinoma in 1 case, and ileus in 2 cases. All complications were categorised as Clavien grade 1–2, and there were no recorded mortalities in either the operative or non-operative groups.

Discussion

The approach to treating blunt renal injuries has evolved significantly in recent decades, particularly regarding the management of more severe grades of renal trauma through non-operative means. In fact, non-operative management has emerged as the preferred approach even in cases of high-grade renal trauma. A meta-analysis conducted by Mingoli et al., which examined over 13,000 cases of renal trauma, revealed that non-operative management was the predominant strategy, employed in 82.4% of renal trauma cases, as opposed to the 17.3% of cases that underwent operative management.¹ While earlier studies, exemplified by Buckley et al., demonstrated the efficacy of non-operative management in grade IV renal injuries, recent research has indicated increased rates of renal preservation even in grade V injuries.¹² In our research, among the 3 cases of high-grade renal injury, conservative management yielded successful outcomes in 2 patients,

whereas 1 patient necessitated operative intervention due to haemodynamic instability. The high rate of nephrectomy (100%) in the patients undergoing immediate exploration can be attributed to the motive of exploration being 'damage control' and not 'renal salvage'. Moreover, surgeons undertaking such emergency exploration are seldom trained in performing renal salvage procedures.¹² The existing body of literature reinforces the notion that conservative management is a viable approach for blunt renal injuries ranging from Grade I to III, particularly when there is no significant blood loss from the kidney, allowing for expectant treatment. Notably, there is an increasing number of reported successful cases of non-operative treatment for even Grade IV injuries and, in some instances, Grade V injuries. The available literature appears to endorse the consideration of conservative therapy, whenever feasible, for such patients. It should be noted, however, that Grade V vascular injuries will likely still necessitate prompt nephrectomy. The minimal occurrence of complications in our study underscores that conservative management is linked with low morbidity. In our investigation, none of the patients underwent immediate surgery, while one patient required delayed surgical intervention due to deteriorating clinical conditions and haemodynamic instability during the course of conservative management. Patients, especially those under conservative management, should receive thorough and vigilant follow-up for any potential complications, extending to a minimum of 3 months. It's worth noting that follow-up or "delayed" CT scans for patients undergoing conservative management are no longer recommended unless there is observable clinical deterioration or a reasonable suspicion of delayed complications, such as urinomas or vascular issues like arteriovenous fistulas or pseudoaneurysms. Intriguingly, among the cases undergoing immediate exploration, there were no instances of low-grade renal injuries (I–III), which raises the possibility of potential underreporting of renal injuries when other organ injuries were identified as the cause of haemodynamic instability during exploration. The absence of mortality in our study can be attributed to the nature of our facility, which primarily serves as a referral centre. Consequently, the majority of our patients were referrals, and only a limited number of direct admissions occurred. Patients who were fit or haemodynamically stable for transfer likely accounted for those who made it to our centre alive. However, it's important to acknowledge the limitations of our study, particularly its retrospective nature and the relatively small number of cases analysed. Ideally, a prospective randomised study would be optimal, but it is neither feasible nor ethical in the context of acute life-threatening situations, as seen in this study. Consequently, retrospective systematic reviews currently serve as the gold standard for evaluating the feasibility of conservative/

non-operative management of renal trauma.¹³⁻¹⁵

Conclusion

Immediate laparotomy remains the primary approach in managing trauma patients exhibiting haemodynamic instability despite adequate resuscitation efforts. In cases where stability is achieved, contrast-enhanced CT imaging stands as the preferred diagnostic and grading tool for renal injuries. Subsequent management decisions can then be guided by the patient's clinical condition, often commencing with a cautious "wait and see" strategy.

Our study's results demonstrate that even in patients with Grade IV and V injuries, conservative management can be a feasible option if the patient remains haemodynamically stable. This is underscored by our findings, where non-operative management failed in only 1 case of Grade IV and none of the Grade V injuries.

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Conflict of Interest: None

References

- Mingoli A, La Torre M, Migliori E, Cirillo B, Zambon M, Sapienza P, Brachini G. Operative and nonoperative management for renal trauma: comparison of outcomes. A systematic review and meta-analysis. *Ther Clin Risk Manag*. 2017;13:1127-38. [PubMed] [Google Scholar]
- Veeratterapillay R, Fuge O, Haslam P, Harding C, Thorpe A. Renal trauma. *J Clin Urol*. 2017;10:379-90. [Google Scholar]
- Wright JL, Nathens AB, Rivara FP, Wessells H. Renal and extrarenal predictors of nephrectomy from the national trauma data bank. *J Urol*. 2006;175(3 Pt 1):970-5. [PubMed] [Google Scholar]
- Bariol SV, Stewart GD, Smith RD, McKeown DW, Tolley DA. An analysis of urinary tract trauma in Scotland: impact on management and resource needs. *Surgeon*. 2005;3(1):27-30. [PubMed] [Google Scholar]
- Wessells H, Suh D, Porter JR, Rivara F, MacKenzie EJ, Jurkovich GJ, Nathens AB. Renal injury and operative management in the United States: results of a population-based study. *J Trauma*. 2003;54(3):423-30. [PubMed] [Google Scholar]
- Paparel P, N'diaye AM, Laumon B, Caillot JL, Perrin PA, Ruffion A. The epidemiology of trauma of the genitourinary system after traffic accidents: analysis of a register of over 43,000 victims. *BJU Int*. 2006;97(2):338-41. [PubMed] [Google Scholar]
- Santucci RA, McAninch JW, Safir M, Mario LA, Segal MR. Validation of the American Association for the Surgery of Trauma organ injury severity scale for the kidney. *J Trauma*. 2001;50(2):195-200. [PubMed] [Google Scholar]
- Shariat SF, Roehrborn CG, Karakiewicz PI, Dhimi G, Stage KH. Evidence-based validation of the predictive value of the American Association for the Surgery of Trauma kidney injury scale. *J Trauma*. 2007;62(4):933-9. [PubMed] [Google Scholar]
- Kumar NA, Chaitanya SV, Pinni S, Sharma AY, Sharma T, Goyal N [Internet]. Role of conservative management in high grade renal injuries: our experience at a tertiary care centre; 2020 [cited 2023 Dec 24]. Available from: <https://pesquisa.bvsalud.org/portal/resource/pt/sea-202876?lang=en> [Google Scholar]
- Moore EE, Shackford SR, Pachter HL, McAninch JW, Browner BD, Champion HR, Flint LM, Gennarelli TA, Malangoni MA, Ramenofsky ML, Trafton PG. Organ injury scaling: spleen, liver, and kidney. *J Trauma*. 1989;29(12):1664-6. [PubMed] [Google Scholar]
- Kozar RA, Crandall M, Shanmuganathan K, Zarzaur BL, Coburn M, Cribari C, Kaups K, Schuster K, Tominaga GT, AAST Patient Assessment Committee. Organ injury scaling 2018 update: spleen, liver, and kidney. *J Trauma Acute Care Surg*. 2018;85(6):1119-22. [PubMed] [Google Scholar]
- Buckley JC, McAninch JW. Selective management of isolated and nonisolated grade IV renal injuries. *J Urol*. 2006;176(6 Pt 1):2498-502. [PubMed] [Google Scholar]
- Shoobridge JJ, Corcoran NM, Martin KA, Koukounaras J, Royce PL, Bultitude MF. Contemporary management of renal trauma. *Rev Urol*. 2011;13(2):65-72. [PubMed] [Google Scholar]
- Sujenthiran A, Elshout PJ, Veskimae E, MacLennan S, Yuan Y, Serafetinidis E, Sharma DM, Kitrey ND, Djakovic N, Lumen N, Kuehhas FE. Is nonoperative management the best first-line option for high-grade renal trauma? A systematic review. *Eur Urol Focus*. 2019;5(2):290-300. [PubMed] [Google Scholar]
- Keihani S, Rogers DM, Putbren BE, Anderson RE, Stoddard GJ, Nirula R, Luo-Owen X, Mukherjee K, Morris BJ, Majercik S, Piotrowski J, Dodgion CM, Schwartz I, Elliott SP, DeSoucy ES, Zakaluzny S, Sherwood BG, Erickson BA, Baradaran N, Breyer BN, Fick CN, Smith BP, Okafor BU, Askari R, Miller BD, Santucci RA, Carrick MM, Allen L, Norwood S, Hewitt T, Burks FN, Heilbrun ME, Gross JA, Myers JB; in conjunction with the Trauma and Urologic Reconstruction Network of Surgeons. The American Association for the surgery of trauma renal injury grading scale: implications of the 2018 revisions for injury reclassification and predicting bleeding interventions. *J Trauma Acute Care Surg*. 2020;88(3):357-65. [PubMed] [Google Scholar]