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Original article

CHOOSING THE BEST TREATMENT FOR GRADE IV RENAL INJURIES THAT ARE ISOLATED AND NOT ISOLATED.

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Abstract

Objective:

The objective of this study was to review all grade IV renal injuries and report outcomes. It also sought to ascertain whether operative and selective non-operative management could result in high salvage rates and whether management and outcomes varied noticeably between cases of isolated grade IV renal injuries and those with concomitant multi-organ injuries.

Method:

The data of 50 grade IV kidney injuries that occurred at Department of Urology, Rajendra Institute of Medical Science, Ranchi was collected. These were split into two groups: those with isolated grade IV renal injuries (30) and those with accompanying nonrenal injuries (20), and both groups were analyzed with regard to the kind of renal injury, operative vs. nonoperative care, operational nephrectomy rate, and operational renal salvage rate.

Results:

35 of the 50 patients were operated on and 15 were not. 35 injuries were caused by penetrating trauma, 10 by blunt trauma, and 5 out of 50 (51%) were renal vascular injuries. Grade IV renal injuries requiring operational exploration that also had concurrent related injuries were healed at exploration with a 14% nephrectomy rate and an 82% salvage rate. With an average transfusion need of 8.5 units packed red blood cells, 15 (41%) of the 30 patients with isolated injuries required surgical exploration. One patient (10%) required a nephrectomy, two kidneys were postoperatively nonfunctional, and one mild complication was found. Only 10 patients needed transfusions (average 2.5 units), and 87% of the remaining 20 isolated grade IV renal injuries were handled nonoperatively.

Conclusion:

The primary reason for exploring and reconstructing the kidneys is persistent bleeding. Non-operative therapy should only be used in all cases of severe renal damage when patients are hemodynamically stable and have undergone full renal staging.

Keywords: kidney, salvage therapy, wounds and injuries, damage severity score, Submitted: 2023-04-21 Accepted: 2023-04-24

1. Introduction:

Renal trauma management has improved since the AAST Organ Injury Severity Score was created, leading to better results. Grades I to III are the most common kidney injuries, and they can

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be safely treated nonoperatively with high functional preservation [1]. High grade (IV/V) kidney injuries are controversial in that some advocate predominantly nonoperative treatment while others insist that surgical examination and repair are required [Figure 1; 2].

According to the AAST grading system, grade V is defined as numerous grade IV parenchymal lacerations necessitating renal exploration to stop a potentially fatal haemorrhage or a hemodynamically unstable renal vascular damage. The remaining grade IV renal injuries—more specifically, isolated grade IV renal injuries—need further explanation regarding the appropriateness of surgical vs nonsurgical treatment.

Based on the mechanism of damage, hemodynamic stability, radiographic staging, related nonrenal injuries, and clinical presentation, the selected management of 50 grade IV renal injuries was examined. We compared the outcomes between operational and nonoperative management. Operative vs. nonoperative management can only be chosen to produce the best results after thorough examination and staging.

2. Methods:

2.1. Study Design:

This was a retrospective study carried out for ten years at the Department of Urology, Rajendra Institute of Medical Science, Ranchi.

2.2. Methodology:

The etiology of the injury, hemodynamic stability, radiographic imaging (CT and/or single-shot excretory urogram), concomitant nonrenal injuries, and surgical versus nonsurgical therapy were among the factors evaluated. To decide between operational and nonoperative care based purely on grade IV renal injury, we separated these 50 injuries into isolated and non-isolated renal injuries. 51% or more of the injured renal unit's function was considered salvage. To evaluate renal function and healing, postoperative CT imaging or renal isotope scans were available in 51% of cases.

2.3. Sample Size:

50 samples were included in this study after assessing the inclusion criteria.

3. Results:

Penetrating and blunt renal trauma affected 35 and 15, respectively, of the 50 patients, while renal vascular damage affected 51% (36 of 50). Two-thirds of the 50 respondents (100) chose operational management. A timely renal investigation and effort at reconstruction were prompted by 82% of the operational cases with severe concurrent non-renal injuries that necessitated operative exploration. The majority of the kidneys (36 of 50) were salvaged at an 83% rate. The rate of operational nephrectomy was 14%, with 10 nephrectomies being performed as a last resort on patients who had sustained serious multi-organ injuries and required numerous blood transfusions. Five of the repaired kidneys showed less than 20% total renal function after surgery and did not meet the criteria for renal salvage. Three of these kidneys required vascular repairs (one arterial, one venous, and one mixed arterial and venous), and the information from two patients was unavailable for a thorough analysis.

A perinephric abscess (2), wound/urinary tract infection (3), and persistent flank/abdominal pain (4) were additional postoperative problems. The 15 nonoperative cases had 4 ureteral stent placement complications (2 adults and 2 kids for non-resolving large urinomas), 2 wound infection complications, and 2 child death complications that were unrelated to the renal damage. The nonoperative group did not require any postponed renal investigation.

15 of 50 patients (27%) experienced isolated grade IV kidney damage (table 1). In 55% and 43% of patients, respectively, blunt and penetrating trauma occurred. The majority of surgical cases involved a penetrating wound. 15 (41%) underwent surgical investigation, with a 10% nephrectomy rate and an overall renal salvage rate of 82% (two kidneys were postoperatively nonfunctional).

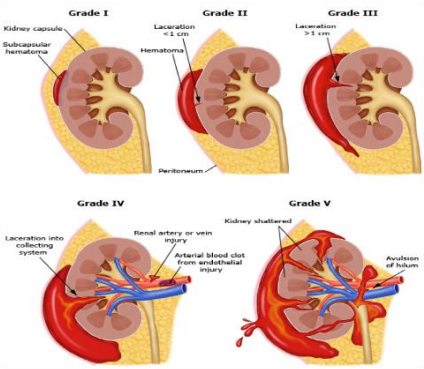

Figure 1: **Renal Trauma**

Table 1: **Renal injuries of an isolated grade IV**

CRITERIA	**OPERATIVE**	**NON-OPERATIVE**
No. Blunt	4	11
No. penetrating stab/ gunshot wounds	10/3 [13]	4/2 [1]
Av/median transfusion units	8.0/7.8	2.5
No. nephrectomy	1	1
No. renal function less than 20%	2	2
The average stay at the hospital	11.7	11.8
Salvage rate (%)	82%	87%

Both nephrectomies were performed as a result of stab wounds that required 3,000 and 4,000 ml of blood transfusions. With a renal salvage rate of 88%, the remaining 57% of isolated grade IV renal injuries were treated non-operatively. Of these 22 patients, 2 had main artery thrombosis in 2 and post-segmental artery embolization in 1, both of which resulted in less than 20% total renal function remaining in the injured kidney.

The average transfusion required for surgical cases in the isolated grade IV renal damage group was 8.0 units prbc (median 7.8) and 2.5 units for nonoperative cases ($p < 0.001$). The isolated renal surgery and nonoperative groups' respective median hospital stays were 11.7 and 11.8 days, respectively.

4. Discussion:

In big metropolitan trauma centres, the incidence of renal trauma has been observed to range from 2% to 3% [3]. Most of these wounds are mild and merely need observation. Today, urological trauma education and treatment include a strong integration of renal injury screening and staging [4]. Management can be chosen if a case has been adequately staged based on the clinical presentation, hemodynamic stability, mechanism of injury, and radiographic imaging [5]. With very few exceptions, grades I to III renal damage can be treated nonoperatively, according to the literature [6].

We think that grade V kidney damage automatically signify a hemodynamically unstable condition necessitating prompt operational examination. As a result, treating grade IV renal damage is controversial. The treating physician must be able to manage the case surgically or, alternatively, to provide prudent nonoperative therapy in order to achieve the best results. The patient should ideally receive care from a skilled trauma or urological surgeon at a facility set up to deliver

high-level acute care with a variety of treatment modalities.

According to the AAST renal injury grading scale, 50 grade IV renal injuries were treated in the previous year. Grade IV renal injuries frequently co-occur with additional serious related injuries that necessitate rapid operational exploration (76% in this series) [6], obviating the need for preoperative CT staging and necessitating renal exploration, intraoperative staging, and care.

accompanying damage, the patient's stability, and the surgeon's expertise all play a role in determining how the patient is treated in this situation. In order to avert the unacceptable high 40% to 60% nephrectomy rate in recent reports [7–10], a skilled urologist or trauma surgeon with immediate vascular control and renal reconstructive procedures should be involved.

We had a 14% operative nephrectomy rate in this series, which we believe is directly related to our involvement in the patient's operative care. The best course of action in a damage control scenario if the patient is unsteady and has suffered a serious renal injury may be an urgent nephrectomy. When rapid exploration is not necessary but a serious renal injury has already occurred, there is debate regarding how to address grade IV renal injuries. We concentrated on isolated grade IV injuries whose management was determined solely by these in order to evaluate this condition.

Out of our 50 grade IV renal injuries, 26 solely damaged the kidney; 41% of these injuries were investigated; the remaining 59% were handled without surgery (table 1). With an average transfusion need of 8.0 units prbc, persistent bleeding needing repeated blood transfusions led to renal exploration in the majority of the operating group. Our recommendations for intervention include hemodynamic instability resulting in clinical decompensation, quickly growing renal hematoma, prolonged hemodynamic instability despite 2 units prbc, and severe hypotension and shock. In hemodynamically stable patients requiring numerous blood transfusions, angioembolization can be a desirable substitute for renal exploration. Ureteropelvic junction injury, a substantial amount of devitalized renal tissue, an inadequate staging, or insufficient observational resources are other relevant criteria for renal exploration.

Significantly fewer renal investigations were necessary for isolated grade IV renal injuries (41% vs. 76% of the nonisolated grade IV renal database, $p < 0.001$). This is not surprising considering that the majority of grade IV renal injuries require operational examination and reconstruction together with accompanying nonrenal damage. Exploration rates for penetrating and blunt trauma were 73% and 92%, respectively, and 16% and 51% for blunt trauma, respectively, and they substantially varied between groups with and without isolated grade IV renal injury. Only a third of stab wounds needed to be examined, compared to all bullet wounds to the kidney. The remaining penetrating grade IV kidney injuries were managed non operatively thanks to CT staging. For the group under observation, there was no need for delayed renal examination.

Blood transfusion needs were a significant predictor of renal surgical exploration in the isolated renal trauma group ($p < 0.001$), with 88 percent of patients exploring receiving an average of 8.0 units prbc. Only 47% of patients in the nonoperative isolated renal group had blood transfusions, with each patient receiving an average of 2.5 units prbc. This validates chronic bleeding as our primary justification for investigation. The average hospital stay for the groups with operational and nonoperative isolated renal damage was 11.7 and 11.8 days, respectively. The optimisation of patient care and outcome with selected management was further highlighted by comparable renal salvage rates (82% and 87%).

As previously mentioned, in 4 hemodynamically stable patients who had chronic bleeding from a segmental arterial damage, arterial embolisation was employed as an alternative to surgical investigation. Three individuals had follow-up renal functional data available, and all three demonstrated a functional renal unit (21%, 21%, and 42%). Only 2 patients, however, had a functional capacity that exceeded 20% of total renal function. Operative exploration was needed to treat

more severe vascular injuries in order to stop life-threatening bleeding. A careful consideration of nephrectomy should be made at exploration if a main arterial injury is discovered that will require significant reconstruction with little chance of success at even the most experienced trauma centers because data have emerged showing that venous repairs significantly outperform arterial repairs [11,12].

The majority of grade IV renal injuries that have been correctly staged by CT imaging and are hemodynamically stable can be treated non operatively. The care of the renal injury must be successful, and delayed consequences must be avoided, by ongoing evaluation. A CT is advised after 48 hours, or sooner if the clinical status changes. A urinoma may require ureteral stenting and/or percutaneous drainage, whereas an increasing hematoma may call for delayed surgical investigation [13]. The treating physician must make sure that the kidney damage is getting well if nonoperative therapy is chosen. If progress is not noticed, the necessary intervention should be carried out to promote renal repair. A prolonged post-injury course that necessitates multiple imaging studies, substantial radiation exposure, additional procedures, and a protracted recovery often results from failure to recognise a severe renal injury that should be surgically managed. This places a significant burden on the patient and hospital system. In some cases, the kidney loses function and may need a delayed nephrectomy for long-term treatment.

In some patients, the nonoperative care of grade IV isolated and nonisolated renal injuries that are hemodynamically stable is crucial to the successful management of severe renal injuries. This is especially true for isolated grade IV renal injuries in which just the renal injury is explored during surgery. In this series, 57% of patients versus 22% in the nonisolated renal group were handled expectantly. An increasing corpus of research on effective nonoperative care of selective grade IV renal injuries shows that the renal salvage rate for isolated and nonisolated renal injuries was identical at 87%.

5. Limitation:

It is a retrospective analysis of prospectively gathered data based on a review of medical records and charts assembled in a trauma database from a single institution. Additionally, we are unable to comment on long-term renal function or the prevalence of late problems due to the dearth of follow-up imaging investigations that are prevalent in this population (51% in our sample with only 31% having quantitative recorded functional data). Direct comparison of management approaches and results might be made possible by a prospective multi-institution study, which would also eliminate the single-institution bias.

6. Conclusion:

The treating physician needs to be proficient in a variety of interventional and management techniques in order to best address grade IV renal injury, both isolated and non-isolated. Due to their connection with other nonrenal injuries needing operational exploration, the majority of nonisolated renal injuries will necessitate renal exploration and reconstruction. The majority of isolated grade IV renal injuries, however, can be successfully treated without surgery when there is prolonged bleeding, which is the primary trigger for renal exploration. Grade IV renal injuries should be managed selectively to improve patient care and increase the likelihood that the kidneys will survive.

7. List of abbreviations:

AAST- American Association for the Surgery of Trauma
CT- computerized tomography
PRBC-packed red blood cells

8. Conflict of Interest:

The authors state that they have no conflicts of interest.

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