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# Characteristics and Management of Renal Trauma: A 5-year experience in aTertiary Hospital in East Java,Indonesia

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**Abstract**— This was a descriptive study with a retrospective approach evaluating the medical record data of renal trauma patients for the past four years. A total of 84 renal trauma cases were obtained, consisting mostly of 5 to 20 years old (35.71%) male (86.9%) patients. The types were classified into blunt trauma (95.2%) mostly caused by motor vehicular accidents and penetrating trauma (4.8%). The severity was mostly dominated by grade I trauma (33.3%) followed by grade IV (23%) and III (19,2%). Anemia was the most prevalent complication (28.3%) and most patients had hematuria (82.1%). Most of the patients' hemodynamic status was stable (86.9%) and were treated conservatively (88.4%). Only 9 patients were surgically treated with a total of 11 procedures. The most common procedure performed was nephrectomy (36.3%); followed by renorraphy (27.7%), DJ stent insertion (9%), blood clot evacuation (9%), embolization (9%), and urinoma drainage (9%). The highest mortality rate was seen among patients with grade IV renal trauma (50%).Renal trauma in East Java was mostly found in men and was caused by MVA. Most hemodynamically stable patients were mostly treated conservatively and did not require a blood transfusion. Other co-existing organ injuries affected the patients' prognosis.

**Keywords**— Renal Trauma, Kidney Trauma, Renal Injury, Renal Trauma Management

## 1. Introduction

Research Approximately one to five percent of all trauma cases are renal traumas[1]. Even though kidneys are protected by lumbar muscles, vertebra, ribs, and visceral organs on the anterior side, they are the most often affected genitourinary organs in traumatic injuries[2]. Globally, there are around 200.000 cases each year[3]. It can be an isolated injury; however, most cases are concomitant with other injuries [4]. Based on the mechanism of injury, it is generally divided into blunt and penetrating injuries. Motor vehicle accidents (MVA)s are the major cause of blunt renal trauma in adults, followed by falls and sports injury. The etiologies are different compared to pediatric patients, in which the major cause for trauma is falling injuries and pedestrian accidents, followed by MVAs [5]. Penetrating injuries in renal are more severe and less predictable compared to the blunt counterpart. They are mostly caused by firearms and stab wounds [6]. As firearms are not commonplace among Indonesian civilians, gunshot injuries are less common to occur [7]. The characteristics of renal trauma in a particular region may differ from other areas as sociodemographic and geographic factors among many others may affect the common local etiologies of the trauma. Analyzing and identifying the characteristics of renal trauma are beneficial in developing specific strategies or guidelines unique to certain countries.

Currently, there are only two studies which reported the characteristics of renal trauma in Indonesia. The first study was conducted in a tertiary hospital in Bandung, West Java, whereas the second study was conducted in a tertiary hospital in Makassar, South Sulawesi [8, 9]. As Dr. Soetomo General-Academic hospital is considered as the top referral hospital for the eastern Indonesian region, evaluating the data for renal trauma in this center would provide significant epidemiological data for renal trauma in Indonesia[10]. Therefore, we aimed to evaluate the characteristics of renal trauma patients in Dr. Soetomo General-Academic hospital over the past five years.

## 2. Methods

Infinitesimal This is a descriptive study with a retrospective approach evaluating the medical record data of all patients with renal trauma due to various etiologies admitted to Dr. Soetomo General-Academic hospital from January 2015 until December 2019. The variables described were patient age, sex, mechanism of injury, level of hematuria, renal trauma grade based on the American Association for The Surgery of Trauma (AAST) renal injury scale[11], associated injuries, hematuria characteristics, hemodynamic status, management, transfusion requirement, complications, and mortality rate. The collected data was grouped and displayed descriptively in the form of tables and narratives. Patients with insufficient data were excluded. The ethical committee of the research and development center of Dr. Soetomo General-Academic hospital approved this study with the ethical number: 1136/KEPK/IV/2019.

## 3. Results

NumerousA total of 84 renal trauma cases were obtained based on the medical record data from January 2015 to December 2019. The patients' characteristics in this study is shown in table 1. Most of the admitted patients were adolescent male (86.9%) aged 5 to 20 years old (35.71%) with an average of 31.41 years old. The types of traumas were classified into blunt trauma (95.2%) and penetrating trauma (4.8%). The blunt trauma cases were mostly caused by motor vehicular accidents (MVA)s (78.5%) and a small proportion of cases was due to violence (2.3%). All penetrating trauma cases were caused by stabbing incidents (4.8%). The severity of the trauma was mostly dominated by the grade I trauma (33.3%) followed by grade IV (23%) and III (19,2%). Consistent to the anatomical location of kidney, abdominal injuries were the most frequent (43.62%). As most of the patients did not suffer from any short-term or long-term complications (38.9%), they mostly did not require any transfusions (72,6%). However, anemia was the most prevalent complication (28.3%) as heavy bleeding still occurred in several cases. Table 2 displayed the clinical profile and management of renal trauma cases in the hospital over the past 5 years. Almost all patients had hematuria (82.1%), of which mostly were presented with micro hematuria (47.5%). Interestingly, two grade IV renal trauma patients and three grade V patients did not show any signs of hematuria. Most of the patients' hemodynamic status were stable (86.9%). The patients with unstable hemodynamic status were mostly due to non-kidney-related intraabdominal organs bleedings, such as: spleen, liver, and colon rupture. Hemodynamic instability due to kidney-related injuries occurred in 2 patients with grade V renal trauma due to blunt trauma and 3 patients with grade III, IV, and V due to penetrating injuries. Most of the patients were treated conservatively (88.4%). Only 9 patients were surgically treated with a total of 11 procedures as some patients underwent two procedures. The most common procedure performed was nephrectomy (36.3%); followed by renorraphy (27.7%), DJ stent insertion (9%), blood clot evacuation (9%), embolization (9%), and urinoma drainage (9%). The highest mortality rate was seen among patients with grade IV renal trauma, in which 50% of the patients did not survive. On the contrary, 81.8% of patients with grade V renal trauma survived.

**Table 1.** Basic Characteristics of Renal Trauma Patients in Dr. Soetomo General-Academic Hospital from 2015-2019

| | Number of Cases (n) | Percentage of Cases (%) |
|---|---|---|
| **Age (years old)** | | |
| 5-20 | 30 | 35,71 |
| 21 - 30 | 18 | 21,43 |
| 31 – 40 | 11 | 13,10 |
| 41 – 50 | 10 | 11,90 |
| 51 – 60 | 12 | 14,29 |
| > 60 | 3 | 3,57 |
| **Sex** | | |
| Male | 73 | 86,9 |
| Female | 11 | 13,1 |
| **Trauma Type** | | |
| Blunt Trauma | 80 | 95.2 |
| Penetrating Trauma | 4 | 4,8 |
| **Etiology** | | |
| Motor Vehicular Accident | 66 | 78,5 |
| Fall | 4 | 4,8 |
| Single accident | 8 | 9,6 |
| Violence (blowing) | 2 | 2,3 |
| Stabbing | 4 | 4,8 |
| **AAST Grade** | | |
| I | 26 | 33,3 |
| II | 8 | 10,2 |
| III | 15 | 19,2 |
| IV | 18 | 23 |
| V | 11 | 14,3 |
| **Associated Injuries** | | |
| Head and neck | 7 | 7,45 |
| Thoracal | 16 | 17,02 |
| Abdominal | 41 | 43,62 |
| Pelvic | 11 | 11,70 |
| Upper extremity | 12 | 12,77 |
| Lower extremity | 7 | 7,45 |
| **Complications** | | |
| Anemia | 24 | 28,3 |
| UTI | 18 | 21,2 |
| Sepsis | 6 | 7 |
| Urinoma | 3 | 3,5 |
| Clot Retention | 1 | 1,1 |
| No complications | 33 | 38,9 |
| **Transfusion Requirement** | | |
| Transfusion | 20 | 27.3 |
| No Transfusion | 53 | 72.6 |

**Table 2.** Clinical Profile and Management of Renal Trauma Patients in Dr. Soetomo General-Academic Hospital from 2015-2019

| AAST Grade | Hematuria | | | Hemodynamic Status | | Management | Procedure | | | | | | | Mortality | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | None | Microscopic | Gross | Stable | Unstable | Conservative | Surgery | Renorraphy | Nephrectomy | DJ Stent | Clot Evacuation | Embolization | Urinoma Drainage | Survive | Death |
| I | 6 (23% | 15 (57,7%) | 5 (19,3%) | 26 (35.6%) | 3 (3.57%) | 26 (30.95%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 (80.7%) | 5 (19,3%) |
| II | 1 (11,1%) | 5 (62,5%) | 2 (22,2%) | 8 (11%) | 3 (3.57%) | 8 (9.52%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 (75 %) | 2 (25 %) |
| III | 2 (13,4%) | 7 (46,6%) | 6 (40%) | 14 (19.2%) | 1 (1.19% | 14 (16.67%) | 1 (1.19%) | 1 (11.11%) | 0 | 0 | 0 | 0 | 0 | 10 (66 %) | 5 (34 %) |
| IV | 2 (11,1%) | 5 (27,8%) | 11 (61,1%) | 17 (23.3%) | 1 (1.19%) | 16 (19.05%) | 2 (2.38%) | 1 (11.11%) | 1 (11.11%) | 0 | 0 | 0 | 0 | 9 (50 %) | 9 (50 %) |
| V | 3 (27,2%) | 5 (45,5%) | 3 (27,2%) | 8 (10.9%) | 3 (3.57%) | 5 (5.95%) | 6 (7.14%) | 1 (11.11%) | 3 (33.33%) | 1 (9%) | 1 (9%) | 1 (9%) | 1 (9%) | 9 (81,8%) | 2(19,2%) |

### *4. Discussion*

Among all genitourinary organs, kidneys are the most vulnerable despite their relatively protected retroperitoneal position[12]. Even though studies regarding renal trauma characteristics have been published in the past, currently as of the writing of this study, there are only 2 studies reporting the characteristics of renal trauma in Indonesia. Incidence reports of trauma cases in particular regions are beneficial as they vary depending on the geographic area of the world [13]. The first study reported findings from Bandung, West Java, whereas the second study reported findings from Makassar, South Sulawesi [8, 9]. East Java is the second largest province in Indonesia with a wide variety of socio-demographic backgrounds representative of the country [14]. Thus, conducting the study in Surabaya, the capital city of East Java would reflect the demographic characteristics of the Indonesian population. Moreover, Dr. Soetomo Hospital is the largest tertiary general hospital in East Java, which is considered as the top referral hospital for eastern Indonesia region[10].

In this study, we discovered that the majority of patients were male (86.9%). These results are similar to previously published studies from different centers around the world[3, 5, 15]. It is possible that the incidence is higher among male due to the familial culture of our country, in which the father usually serves as the head of the family. Thus, men are usually associated with a relatively more dominant daily activity compared to women [16]. This finding is closely related to MVAs (78.5%) as the major etiology of blunt trauma in this study. MVAs could potentially cause renal trauma due to rapid deceleration and acceleration forces. Deceleration forces may cause rupture or thrombosis of major kidney structures, whereas acceleration forces may create collision with its surrounding structures such as spinal vertebrae and ribs causing parenchymal and vascular injuries[12]. Motorcycles are the primary mode of transportation for the majority of men in Indonesia [17]. Most patients in this study were male aged 5 to 20 years old followed by 21 to 30 years old. Young adults are more prone to MVAs due to relatively lower emotional control compared to older demographics. Thus, some of them often disregard safety precautions in driving[18, 19]. Penetrating injuries were less common among the patients (4.8%) and were due to stabbing injuries. Most penetrating kidney trauma from other centers around the world are caused by firearm. Penetrating trauma due to gunshot injuries is more frequently found in Brazil [6]. In Indonesia, gunshot injuries are less common since most civilians are not allowed to carry firearms [7].

The degree of severity in this study is most commonly dominated by grade I renal trauma (33.3%) which is similar to an epidemiological systematic review by Voelzke& Leddy evaluating 10.935 patients with renal trauma[5]. Evaluating other intraabdominal organs is necessary as 80-90% of renal trauma cases have other organ injuries possibly requiring surgical exploration [20]. In genitourinary trauma patients, there are two principal clinical signs that physicians should be aware of, hematuria and hemodynamic status. Hematuria is frequently found in renal trauma cases with different varying degrees of severity. Macro-hematuria is usually related to major renal injuries; however, the severity of hematuria and renal trauma grade are not associated [21]. This is reflected in the results of this study, in which two grade IV renal trauma patients and one grade V patients did not show any signs of hematuria, while five grade I renal trauma patients were present with gross hematuria (19.3%). Among the cases, gross hematuria was only found in 34.6% of patients, whereas microhematuria was found in 48% of patients. These findings differ heavily with the results of the study by Maarouf et al who reported gross hematuria in 94.2% of all patients included in their study[19]. A large majority of the patients were hemodynamically stable (86.9%). Hemodynamic status is affected not only by the severity of the renal trauma, but also the involvement of both intra and extra-abdominal organ injuries [22]. These significant findings are related to the presence of anemia among the patients, in which most of the patients in this study were presented with anemia (55.26%).

Most patients' hemoglobin (Hb) levels decrease to around 8 to 10 g/dL (34.21%) and less than 8 g/dL (21.05%). Deepak et al reported similar findings, in which the hb levels of the renal trauma patients ranged from 8.9 to 10.5 g/dL [23]. The high number of patients of anemia does not reflect the number of patients requiring transfusion as only 27.3% of patients underwent blood transfusion with an average of 2 bags. The main indication for transfusion in the patients were hemodynamic instability, significant intraoperative blood loss, or a significant reduction in hb concentration during the recovery period. The transfusion requirements in this study were much lower than a similar study in a tertiary hospital in Nepal, in which blood transfusion was performed in 25 out of 34 patients [24]. Urinary tract infection (UTI) followed as the second most prevalent complication among the cases (21.2%). Urinoma is less prevalent as it was only present in 3 patients. On the contrary, urinoma formation is the most common complication among the patients in the study by Syarif et al [9]. Extravasation could resolve spontaneously in 80% of cases without any interventions unless there is a continuous leak or urine collection [20].

In this study, most patients were treated conservatively with bedrest, fluid, and antibiotics (88.6%). Even though the role of antibiotics in renal trauma has not been elucidated, broad spectrum intravenous antibiotics have displayed benefits when there is damage to the collecting system and urinary leakage [25]. In a study by Long et al, 5% of patients with grade IV renal trauma who were not given prophylactic antibiotics eventually need nephrectomy due to urosepsis [26]. Antibiotics could potentially reduce the incidence of UTI and perinephric abscess to 5% [27]. Another study also proposed that 17% of renal trauma patients who did not response to antibiotics were more likely to develop urinoma which subsequently progressed to sepsis[28].

Surgical interventions were only performed in a small number of patients (11.3%) with severe renal trauma grade IV and V or in lower grades accompanied with unstable hemodynamic status and or signs of peritonitis. Bjurlin et al reported that out of 19.572 renal trauma patients, only 16.6% were treated surgically. They also reported the most commonly performed surgery was nephrectomy followed by partial nephrectomy and renorraphy[6]. In this study, the most commonly performed surgery was also nephrectomy (36.3%) followed by renorraphy (27.7%). Surgical interventions are more commonly performed in penetrating renal injuries. However, in 88% of cases where the wound is located posteriorly leading to anterior axillary line, a non-operative approach can be chosen. Stab wounds resulting in grade III injuries or higher are unpredictable and have a higher rate of delayed complications if treated conservatively[29]. Surgical exploration is mandatory for cases of renal trauma with hemodynamic instability unresponsive to aggressive resuscitation, regardless of the mechanism of injury. A pulsatile or pervasive perineal hematoma identified during exploratory laparotomy is another indication for renal exploration [30].

The AAST classification for renal trauma grade was created to predict morbidity and mortality in renal trauma. In this study, the highest mortality rate was among patients with grade IV trauma (50%), while there were only 2 grade V patients who died (19.2%). The difference in mortality rate between grades compared to previous studies is due to the simultaneous presence of other organ injuries, especially in multiple trauma cases which affects the prognosis and management of each patient[9]. Moreover, the small sample size of grade V renal trauma patients in this study may have a biased effect regarding the mortality rate results.

## 5. Conclusion

Renal trauma in Dr. Soetomo General-Academic hospital were mostly found in men and were caused by MVA. The majority of hemodynamically stable patients were mostly treated conservatively and did not require blood transfusion. Other co-existing organ injuries affected the patients' prognosis, which may cause a disassociation between renal trauma grade and mortality rate.

## 6. References

[1] McGeady JB, Breyer BN. Current epidemiology of genitourinary trauma. *Urol Clin North Am* 2013; 40: 323.
[2] Mingoli A, La Torre M, Migliori E, et al. Operative and nonoperative management for renal trauma: comparison of outcomes. A systematic review and meta-analysis. *Ther Clin Risk Manag* 2017; 13: 1127.
[3] Mangaiyarkarasi S, Thiruvasagamani B, Subhakanesh SK, et al. Epidemiological Analysis of Trauma Patients with Renal Injuries.
[4] van der Wilden GM, Velmahos GC, D'Andrea KJ, et al. Successful nonoperative management of the most severe blunt renal injuries: a multicenter study of the research consortium of New England Centers for Trauma. *JAMA Surg* 2013; 148: 924–931.
[5] Voelzke BB, Leddy L. The epidemiology of renal trauma. *Transl Androl Urol* 2014; 3: 143.
[6] Bjurlin MA, Jeng EI, Goble SM, et al. Comparison of nonoperative management with renorrhaphy and nephrectomy in penetrating renal injuries. *J Trauma Acute Care Surg* 2011; 71: 554–558.
[7] Karp A. *Estimating global civilian-held firearms numbers*. Small Arms Survey Ginebra, Suiza, 2018.
[8] Karim I, Adi K. FIVE YEARS CHARACTERISTIC OF KIDNEY TRAUMA IN TERTIARY HOSPITAL IN WEST JAVA FROM 2013-2017. *Indones J Urol*; 26. Epub ahead of print 15 January 2019. DOI: 10.32421/juri.v26i2.455.
[9] Palinrungi AM, Kholis K, Palinrungi MA, et al. Renal trauma: a 5-year retrospective review in single institution. *African J Urol* 2020; 26: 1–6.
[10] Widarta GD, Laksana MAC, Sulistyono A, et al. Deteksi Dini Risiko Ibu Hamil dengan Kartu Skor Poedji Rochjati dan Pencegahan Faktor Empat Terlambat. *Maj Obstet Ginekol* 2015; 23: 28–32.
[11] Chiron P, Hornez E, Boddaert G, et al. Grade IV renal trauma management. A revision of the AAST renal injury grading scale is mandatory. *Eur J Trauma Emerg Surg* 2016; 42: 237–241.
[12] Erlich T, Kitrey ND. Renal trauma: the current best practice. *Ther Adv Urol* 2018; 10: 295–303.
[13] Guareschi BLV, Stahlschmidt CMM, Becker K, et al. Epidemiological analysis of polytrauma patients with kidney injuries in a university hospital. *Rev Col Bras Cir* 2015; 42: 382–385.
[14] Kloping YP, Muharram FR, Reswari AM. Validity and reliability of the Indonesian version of the International Index of Erectile Function. *J Clin Urol* 2021; 14: 95–99.
[15] Khan AR, Fatima N, Anwar K. Pattern and management of renal injuries at Pakistan Institute of Medical Sciences. *J Coll Physicians Surg Pak* 2010; 20: 194–197.
[16] Chouhan JD, Winer AG, Johnson C, et al. Contemporary evaluation and management of renal trauma. *Can J Urol* 2016; 23: 8191–8197.
[17] Khairani AF, Azka AN, Faried A, et al. CHARACTERISTICS OF MOTOR VEHICLE ACCIDENT PATIENTS PRESENTING TO A NATIONAL REFERRAL HOSPITAL IN WEST JAVA, INDONESIA. *Southeast Asian J Trop Med Public Health* 2018; 49: 887–893.
[18] Patel P, Duttaroy D, Kacheriwala S. Management of renal injuries in blunt abdominal trauma. *J Res Med Dent Sci* 2014; 2: 38–42.
[19] Maarouf AM, Ahmed AF, Shalaby E, et al. Factors predicting the outcome of non-operative management of high-grade blunt renal trauma. *African J Urol* 2015; 21: 44–51.
[20] Rajendra BN, Sharma V, Basavaraj MK, et al. Grade V renal injury-Short and long term outcome. *Open J Trauma* 2017; 1: 20–25.
[21] Coccolini F, Moore EE, Kluger Y, et al. Kidney and uro-trauma: WSES-AAST guidelines. *World J Emerg Surg* 2019; 14: 54.

[22] Lanchon C, Fiard G, Arnoux V, et al. High grade blunt renal trauma: predictors of surgery and long-term outcomes of conservative management. A prospective single center study. *J Urol* 2016; 195: 106–111.
[23] Deepak J, Khanday ZS, Bagdi RK, et al. Three cases of blunt renal trauma in children. *Sri ramachandra* 2007; 62.
[24] S P. Management of Blunt Renal Trauma: An Experience from Tertiary Hospital. *JOJ Urol Nephrol*; 5. Epub ahead of print 16 January 2018. DOI: 10.19080/JOJUN.2018.05.555671.
[25] Shoobridge JJ, Corcoran NM, Martin KA, et al. Contemporary management of renal trauma. *Rev Urol* 2011; 13: 65.
[26] Long J, Fiard G, Descotes J, et al. High-grade renal injury: non-operative management of urinary extravasation and prediction of long-term outcomes. *BJU Int* 2013; 111: E249-55.
[27] Al-Qudah HS, Santucci RA. Complications of renal trauma. *Urol Clin* 2006; 33: 41–53.
[28] Wells H, Somani BK. Current Management of Renal Trauma. *J Emerg Med Trauma Surg Care*; 2.
[29] Kitrey ND, Djakovic N, Gonsalves M, et al. Urological trauma. *EAU Guidel Eur Assoc Urol*.
[30] Burns J, Brown M, Assi ZI, et al. Five-year retrospective review of blunt renal injuries at a level I trauma center. *Am Surg* 2017; 83: 148–156.