TEN YEARS EXPERIENCE IN MANAGEMENT OF BLADDER TRAUMA AT TERTIARY HOSPITAL IN WEST JAVA INDONESIA

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ABSTRACT

Objective: *The aim of this study is to provide the characteristics, management, and outcome of bladder trauma at the center of trauma referral hospital in West Java, Indonesia.* ***Material & Methods:*** *This is a retrospective and descriptive study. The data of bladder trauma were collected from the medical records from January 2010 to December 2019. The data were presented using descriptive statistics in frequency and percentage.* ***Results:*** *Over a ten-year period, there were 1,174 cases of urogenital trauma, with 170 cases (14.48%) involving bladder injuries. The majority of the was 21-30 years old and were men (55.88%). The most common cause was blunt abdominal trauma (68.82%), which was caused by traffic accidents (91.45%). With 42.24% pelvic fracture as the most common associated injury. The most common type of bladder injury (45.88%) was bladder contusion. Iatrogenic trauma was the second leading causes (29.42%) with obstetrics and gynecology operations accounted for 84% of iatrogenic bladder trauma cases. The majority of bladder injuries were identified using a computed tomography (CT) scan. In 59.41% of cases, surgical intervention was required. The mortality rate was 2.94% during post-operative treatment due to coexisting or associated multiple injuries.* ***Conclusion:*** *We discovered that bladder trauma most commonly affects males of reproductive age with blunt abdominal trauma as the most common etiology and pelvic fractures as the most common associated injury. Surgical intervention often was required.*

Keywords: *Bladder injury, blunt abdominal trauma, iatrogenic bladder injury.*

ABSTRAK

Tujuan: *Tujuan dari penelitian ini adalah untuk memberikan karakteristik, manajemen, dan hasil dari trauma buli di pusat rujukan trauma rumah sakit di Jawa Barat, Indonesia.* ***Bahan & Cara:*** *Penelitian ini bersifat deskriptif retrospektif. Data trauma buli dikumpulkan dari rekam medis dari Januari 2010 sampai Desember 2019 dan disajikan menggunakan statistik deskriptif dalam frekuensi dan persentase.* ***Hasil:*** *Selama periode sepuluh tahun, terdapat 1.174 kasus trauma urogenital, dengan 170 kasus (14.48%) melibatkan cedera buli. Mayoritas berusia 21-30 tahun dan berjenis kelamin laki-laki (55.88%). Penyebab terbanyak adalah trauma tumpul abdomen (68.82%), yang disebabkan oleh kecelakaan lalu lintas (91.45%). Dengan 42.24% fraktur panggul sebagai cedera terkait yang paling umum. Jenis cedera buli yang paling umum (45.88%) adalah memar buli. Trauma iatrogenik adalah penyebab utama kedua (29.42%) dengan operasi kebidanan dan ginekologi menyumbang 84% dari kasus trauma buli iatrogenik. Mayoritas cedera kandung kemih diidentifikasi menggunakan computed tomography (CT) scan. Dalam 59.41% kasus, intervensi bedah diperlukan. Angka kematian adalah 2.94% selama perawatan pasca operasi karena cedera ganda yang hidup berdampingan atau terkait.* ***Simpulan:*** *Trauma buli paling sering mempengaruhi laki-laki usia reproduksi dengan trauma tumpul abdomen sebagai penyebab paling umum dan patah tulang panggul sebagai cedera terkait yang paling umum. Intervensi bedah sering diperlukan.*

Kata kunci: *Cedera buli, trauma tumpul abdomen, cedera buli iatrogenik*

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INTRODUCTION

Bladder trauma was mainly caused by blunt trauma, with smaller proportion of the cases attributed to penetrating trauma. Motor-vehicle accidents are the most prevalent cause of blunt trauma to the bladder while stab wounds or gunshot wounds are common causes for penetrating trauma to the bladder. High kinetic force to the abdomen may cause bladder rupture, particularly of the dome of the bladder (due to its relative structural weakness). Bladder injuries are often associated with concomitant pelvic fractures; nearly all cases (85-100%) of bladder trauma presented with

concurrent pelvic fracture. Extraperitoneal or intraperitoneal rupture may occur in such cases; strong association between rupture of peritoneum and morbidity and/or mortality was notably higher in cases of bladder trauma.[1] Cases of bladder rupture occur mostly as EP injuries in 70.1% of cases and as IP injuries in 29.5% of cases.[2]

Bladder trauma may be treated conservatively and operatively. The choice of treatment is individualized, with higher degree of bladder injury required surgical approach. In particular for IP bladder rupture, surgical intervention is required in almost all of the cases. Exploratory anatomy and suprapubic cystostomy are the few surgical treatment options available to patients with bladder trauma.[3] Outcomes of bladder trauma cases are strongly and significantly associated with the associated injuries.[4] In Indonesia, the incidence of traffic accidents is very high. There were 107.968 traffic accidents in 2018 with 29.083 fatalities. However, until now there was no study of trauma due to traffic accident, especially urogenital trauma.[5] The comprehensive data of urogenital trauma, including bladder trauma, in Indonesia, especially in West Java, has not been reported. Thus, the authors were interested in conducted this research. We present our ten experiences in managing bladder trauma at our center.

OBJECTIVE

The aim of this study is to provide the characteristics, management, and outcome of bladder trauma at the center of trauma referral hospital in West Java, Indonesia.

MATERIAL & METHODS

The study is a retrospective descriptive study performed from January 2010 to December 2019. Data were retrospectively collected from medical record of patients diagnosed with bladder trauma and treated in Department of Urology, Hasan Sadikin General Hospital, West Java - Bandung. The patient and clinical characteristics of the cases included: age, sex, cause of injury, type of injury, associated injury, patient management, and outcome of the management. The patients included in the study were patients agreeing to be treated in Hasan Sadikin General Hospital and presented with diagnostic confirmation of bladder trauma.

Types of bladder trauma were diagnosed by available radiographic imaging, preferably using CT scan. Diagnosis of bladder trauma type may be made preoperatively, intraoperatively, or postoperatively. Iatrogenic trauma is defined as trauma caused by medical procedures. Patients with suspected iatrogenic were classified according to surgical or medical procedures related to the bladder trauma.

The data were presented using descriptive statistics in frequency and percentage. Grading of bladder trauma utilized classification by the American Association for the Surgery of Trauma (AAST) grading. In patients managed with surgical treatment, time to treatment was defined as duration of symptoms starting from the cause of trauma to diagnosis of bladder trauma injury in the emergency department.

RESULTS

There were 1.174 cases of urogenital trauma admitted during the study period and 170 patients (14.48%) with bladder trauma. Most of the patients were male (95 patients; 55.88%) and aged between 21 and 30 years old (50 patients; 29.41%). The most prevalent cause of bladder trauma in our study population was blunt trauma in 116 patients (68.24%), followed by iatrogenic injury in 51 patients (30.00%) and penetrating trauma in 3 patients (1.76%). The most prevalent AAST grading of the bladder trauma in the study population was Grade 1 in 79 patients (46.47%), followed by grade 4 in 67 patients (39.41%); grade 5 in 12 patients (7.06%); and both grade 2 and grade 3 in 6 patients (3.53%). Higher proportion of intraperitoneal rupture was found in the study compared to extraperitoneal rupture cases (40.59% vs. 12.94%). The patients presented with bladder trauma were mainly treated with surgical approach (101 patients; 59.41%); only 4 out of 101 patients (9.36%) received delayed surgical treatment. Successful treatment outcomes were achieved in almost all of the patients (97.05%).

Blunt trauma is the most etiology found in cases of bladder trauma, account for 116 cases (68.24%), and often accompanied by associated injuries. The most associated injury that found in bladder trauma cases were pelvic fracture (n = 49, 42.24%). Otherwise, bladder trauma is occurred in all cases of pelvic trauma in this study. These associated injuries may occur in single patient with blunt trauma simultaneously. The majority

Table 1. Descriptive characteristics of the population.

Characteristics	Frequency (n)	Percentage (%)
Sex		
Male	95	55.88
Female	75	44.12
Age group		
<10 years old	6	3.53
11 – 20 years old	28	16.47
21 – 30 years old	50	29.41
31 – 40 years old	38	22.35
40 – 50 years old	28	16.47
51 – 60 years old	11	6.47
>60 years old	9	5.29
Etiology		
Blunt trauma	116	68.24
Penetrating trauma	3	1.76
Iatrogenic trauma	51	30.00
Grading (AAST)		
Grade 1	79	46.47
Grade 2	6	3.53
Grade 3	6	3.53
Grade 4	67	39.41
Grade 5	12	7.06
Management		
Conservative	69	40.59
Surgery	101	59.41

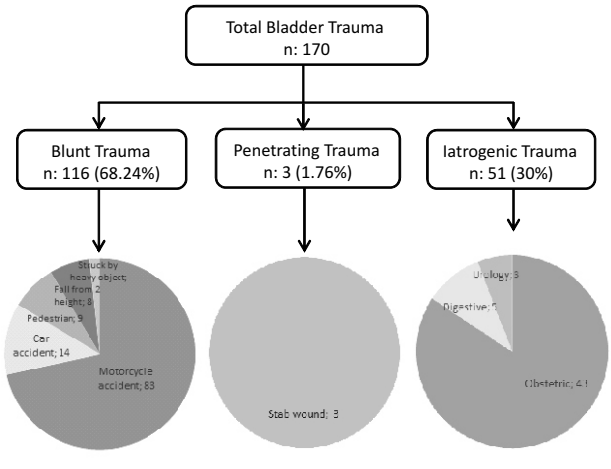

Figure 1. Summary of etiology and mechanism of bladder trauma

mechanism of blunt trauma was a result of motorcycle accident (n = 83, 71.55%), followed by car accident (n = 14, 12.07%), pedestrian (n = 9, 7.76%), fall from height (n = 8, 6.90%), and struck by heavy object (n = 2, 1.72%).

Table 2. Bladder associated injury in blunt trauma

Associated injury	Amount of cases (n)	Percentage (%)
Pelvic fracture	49	42.24
Extremity (Bone)	37	31.90
Urethral injury	15	12.93
Head injury	15	12.93
Kidney injury	9	7.76
Lung injury	8	6.90
External genitalia	7	6.03
Spleen	6	5.17
Liver	2	1.72
Ureter	1	0.86
Other (Hollow viscus, perineum, rectum, vagina)	17	14.66

Table 3. Mechanism of bladder trauma caused by blunt trauma

Mechanism	Amount of cases (n)	Percentage (%)
Motorcycle accident	83	71.55
Car accident	14	12.07
Pedestrian	9	7.76
Fall from height	8	6.90
Struck by heavy object	2	1.72

Penetrating trauma accounted for 3 cases (1.76%) of bladder trauma. All penetrating trauma mechanism was a stab wound. Intraperitoneal bladder rupture was occurred in 2 cases and bladder contusion in 1 case.

Iatrogenic bladder trauma accounted for 51 cases (30.00%) of bladder trauma in our study. The most common of iatrogenic injuries in the cases occur after obstetrical procedures (n = 43; 84.32%), followed by after digestive surgical procedure (n = 5, 9.80%), and urological surgical procedures (n = 3, 5.88%), respectively.

Table 4. Surgical procedures and iatrogenic bladder trauma

Surgical procedures	Frequency (n)	Percentage (%)
Obstetric	43	84.32
Digestive	5	9.80
Urologic	3	5.88

Several mechanisms of injury may be associated with the type of bladder trauma. Bladder contusions were the most prevalent type of bladder

Table 5. Type and etiology of bladder trauma

Type of bladder injury	N (%)	Etiology of trauma		
		Blunt	Iatrogenic	Penetrating
Contusion	79 (46.47)	76	2	1
Intraperitoneal rupture	69 (40.59)	28	39	2
Extraperitoneal rupture	22 (12.94)	12	10	0
Involved bladder neck injury	12 (7.06)	8	4	0

injury occurring in 79 patients (46.47%). Intraperitoneal bladder rupture is more frequent than extraperitoneal bladder rupture with 69 cases (40.59%) and 22 cases (12.94%), respectively. Bladder neck involvement occurred in 12 cases (7.06%) of bladder trauma in this study.

Bladder injuries were diagnosed most frequently with CT scan with delay cystography in patient in stable condition. Otherwise, bladder injury was diagnosed at surgery if patient in unstable condition. All patient in this study was underwent Focused Assessment with Sonography in Trauma (FAST).

Traumatic bladder injury was managed either surgically or by conservative with catheter drainage. There were 101 cases (59.41%) of bladder trauma in this study required surgical treatment. All cases of Intraperitoneal bladder rupture (n = 69, 40.59%), contusion with associated injury that indicated to perform open surgery and involving of bladder neck trauma (n=32, 18.82%) were required open surgical treatment. Conservative treatments were applied in 69 cases (40.59%). Extraperitoneal bladder rupture with no involved bladder neck trauma and no other indication of surgical treatment (n = 22, 12.94%), and bladder contusion without any indication for surgical treatment (n = 47, 27.64%) were manage by conservative treatment.

Twelve patients (7.06%) were found to have an involvement of bladder neck injury. There were 8 patients with extaperitoneal bladder rupture due to blunt trauma and 4 patients with intraperitoneal bladder rupture due to iatrogenic bladder trauma in obstetric surgery. All of these cases need surgical treatment.

No laparoscopic repairs were performed. In intraperitoneal bladder rupture, we performed bladder repair in 3 layers, whereas in extraperitoneal bladder rupture in two layers. Absorbable suture was the used in all cases. All patient undergoing bladder repairs were left with a urethral catheter and a suprapubic catheter. Peri-vesical drain also inserted in addition to catheter drainage.

The mean catheter time across all patients was 14 days. Patients who underwent operative repair and had a post cystogram, there were no leaks were identified. There were no recorded complications from patients who did not have post-operative cystogram and who managed with conservative treatment. Five patients (2.94%) died during post-operative treatment due to coexisting causes or associated multiple injuries.

DISCUSSION

Bladder trauma was occurred more frequent in male (75%) than female. Our study also has similarities in which the incidence of bladder trauma is more common in male (55.88%) than in female. Productive age (21-40 years) becomes the most age who experience of bladder trauma, this is due to the high level of mobilization in this age range.[6] Bladder injuries identified from National Trauma Data Bank (NTDB) were mostly male (75%) and younger than 40 years old (57%).[6-7] Blunt trauma is the main cause of bladder trauma, accounting up to 60 to 85% of all bladder trauma and the majority due to motor vehicle accidents, especially motorcycles (71.55%) in our study; smaller percentage of bladder trauma occur due to penetrating injury, which accounted for 15 to 51% of all bladder traumas.[1,6]

According to our study, blunt trauma becomes the most etiology of bladder trauma with 68.24% of all cases. Pelvic injury is the most associated injury that was occurred in 42.24% blunt trauma with bladder injury in this study. Otherwise, bladder trauma is occurred in all cases of pelvic trauma in this study. Whereas, Cases of penetrating trauma is mainly caused by gunshot or stab wounds.[8] We found that stab wound occur in all of penetrating trauma in our study. This may be due to the ownership of firearms in Indonesia only permitted in a limited circle, thus gunshot wounds are very rarely found in Indonesia. Characteristics in our case are relatively identical to previous studies conducted regarding bladder trauma.

Cases of bladder trauma mainly presented with gross hematuria and associated injuries, such as pelvic fracture. Further evaluation utilizing cystogram and CT cystography may be required. High kinetic force presented as the main etiology of traumatic injury to the bladder may IP (Intraperitoneal) or EP (Extraperitoneal) rupture of the bladder. Often, these cases require extensive surgical management.[9] Bladder injuries are readily diagnosed with CT cystogram and with history taking. In rare cases, however, delayed treatment due to delayed diagnosis may occur. Particularly in cases of spontaneous bladder rupture, treatment may be delayed due to lack of symptoms in the first few days after the occurrence of trauma to the bladder.[10] In our study, there were 4 patients with delayed treatment presenting with diagnosis of bladder injury. All cases were caused by iatrogenic trauma after the patient underwent gynecological surgery. The patient sent home 3 day after surgery and returned to emergency department with lower abdominal pain and difficult to urinate.

Bladder and other urinary organs are located in a relatively protected location. Thus, isolated bladder injuries without associated injuries and/or pelvic fractures are rare; nearly all (83 - 95%) of bladder injuries were diagnosed with concurrent pelvic fracture. In terms of pattern of rupture, a rough estimate of "60-30-10" rule may be found in bladder injuries, with 60% of bladder ruptures being extraperitoneal, 30% intraperitoneal, and 10% combined.[11-12] Intraperitoneal bladder ruptures often require extensive repair with average size of bladder ruptures reaching up to 6 cm. Conversely, extraperitoneal bladder rupture without complications may be treated with urinary catheter drainage. Repair of the bladder is the staple of management in cases with complications and/or severe bladder rupture that required surgical exploration.[9] Associated injuries found in the study were also concurrent with previous studies; more than half of the patients presented to the emergency room with other injuries besides bladder trauma. Rupture rates were different in this study; higher rates of intraperitoneal rupture compared to retroperitoneal rupture were found in this study. This is due to the high incidence of iatrogenic bladder trauma. Almost all iatrogenic bladder injury becomes intraperitoneal rupture.

Iatrogenic bladder trauma may cause further complications and requirement of repeat surgery to manage the conditions. Leaks from the bladder laceration occurring during the previous medical procedure may be difficult to diagnose. An estimated prevalence for iatrogenic bladder injury was measured at 0.15%. Greater rates of injury are found in open surgeries and several types of surgeries. In a study by Cohen et al, largest incidence of iatrogenic bladder trauma was found in patients with previous history of general surgery, reaching 0.35% for patients with previous open colorectal surgery. Overall, incidence rate of iatrogenic bladder injury was 0.11%. Significantly higher rates iatrogenic bladder injury occurred on open surgeries ($p < 0.001$), with 69.3% of all iatrogenic bladder injury in the same study occurred after open surgeries.[13] Obstetric and gynecologic procedures amount for more than half of all iatrogenic bladder trauma compared to other surgical specialties, with rates varying from 0.05 to 0.66%.[14-15] In our study, Obstetric-related procedures accounted the highest amount of iatrogenic bladder injuries with 84.32%. This was consistent with findings in other studies. Almost all cases were consulted intra-operatively to urology department. Higher amount of surgical procedures performed in this study (59.41%) was related to the amount of ruptures and associated injuries with concurrent bladder trauma. In this study there were 5 (2.94%) mortality cases, but the cause of death was due to associated injury or coexisting multiple trauma of the patient, not because of their the bladder trauma.

A cystogram is often needed in assessing the results of postoperative bladder trauma. A routine cystogram is performed after repair of extraperitoneal bladder disruption and complex intraperitoneal bladder disruption. In those patients undergoing repair of a simple intraperitoneal bladder disruption, however, routine follow-up cystograms did not affect clinical management. Cystogram examination is also sometimes used as a reference for clinicians to determine the optimal time in removing the urine chateter.[16-17] The duration of use of a urinary catheter in patients with bladder trauma remains controversial, usually in 10-14 days. However, no references are cited. Similarly, the use of cystograms to evaluate bladder trauma usually performed in 7-10 days after surgery.[16,18,19] At Hasan Sadikin Hospital, there is still no complete data on the use of cystograms to evaluate cases of bladder trauma. This is because the patient is usually discharged and will be evaluated at the urology clinic. If patients have a result of post-operative cystogram, it's usually done in 2 weeks

post-operative treatment. Therefore, this can be a material for further research on the use of cystograms in evaluating cases of bladder trauma in our hospital.

This study was limited by its retrospective design and insufficiency of some data within the registry. Despite the limitations that we have, the large number of samples and long of periods in this study make our study more objective and reliable. Therefore, our study has clinical importance to contribute meaningful perspectives for several stakeholders.

CONCLUSION

Bladder trauma cases, at trauma center hospital in west java, were mostly occurred in male and in productive age group. Blunt abdominal trauma was the most prevalent mechanism of injury leading to bladder trauma; abdominal trauma was mainly caused by traffic accident. Associated injuries with bladder trauma were very commonly found, particularly pelvic injuries. Iatrogenic bladder trauma may occur in some medical procedures. Obstetrics and gynecology procedure was the most prevalence in iatrogenic bladder trauma. Most cases of bladder trauma in this study require surgical treatment.

REFERENCES

1. Mahat Y, Leong JY, Chung PH. A contemporary review of adult bladder trauma. Journal of injury & violence research. 2019; 11(2): 101-6.
2. Barnard J, Overholt T, Hajiran A, Crigger C, Jessop M, Knight J, et al. Traumatic Bladder Ruptures: A Ten-Year Review at a Level 1 Trauma Center. Adv Urol. 2019; 2019: 2614586.
3. Nathwani P, Shamsukha D, Joshi NS, Joseph S, Pujari N. Prospective Study of Urinary Bladder Injury. International Journal of Scientific Study. 2016; 4(5): 157-63.
4. Urry RJ, Clarke DL, Bruce JL, Laing GL. The incidence, spectrum and outcomes of traumatic bladder injuries within the Pietermaritzburg Metropolitan Trauma Service. Injury. 2016; 47(5): 1057-63.
5. Transportation DGoL. Perhubungan Darat Dalam Angka 2018. In: Directorate General of Land Transportation Ministry of Transportation RoI, editor. 2018.
6. McGeady JB, Breyer BN. Current epidemiology of genitourinary trauma. The Urologic clinics of North America. 2014; 40(3): 323-34.
7. McGeady JB, Breyer BN. Current epidemiology of genitourinary trauma. Urol Clin North Am. 2013; 40(3): 323-34.
8. Zaid UB, Bayne DB, Harris CR, Alwaal A, McAninch JW, Breyer BN. Penetrating Trauma to the Ureter, Bladder, and Urethra. Current Trauma Reports. 2015; 1(2): 119-24.
9. Stein DM, Santucci RA. An update on urotrauma. Current opinion in urology. 2015; 25(4): 323-30.
10. Qiao P, Tian D, Bao Q. Delayed diagnosis of spontaneous bladder rupture: a rare case report. BMC Womens Health. 2018; 18(1): 124-.
11. Johnsen NV, Dmochowski RR, Young JB, Guillamondegui OD. Epidemiology of Blunt Lower Urinary Tract Trauma With and Without Pelvic Fracture. Urology. 2017; 102: 234-9.
12. Corriere JN, Jr., Sandler CM. Management of the ruptured bladder: seven years of experience with 111 cases. The Journal of trauma. 1986; 26(9): 830-3.
13. Cohen AJ, Packiam VT, Nottingham CU, Pariser JJ, Faris SF, Bales GT. Iatrogenic Bladder Injury: National Analysis of 30-Day Outcomes. Urology. 2016; 97: 250-6.
14. Glaser LM, Milad MP. Bowel and Bladder Injury Repair and Follow-up After Gynecologic Surgery. Obstetrics and gynecology. 2019; 133(2): 313-22.
15. Karim MI, & Adi, K. Characteristic of Iatrogenic Bladder trauma patient in Hasan Sadikin general hospital from January 2013 - January 2018. Indonesian Journal of Urology. 2020; 27(2): 180-5.
16. Inaba K, McKenney M, Munera F, de Moya M, Lopez PP, Schulman CI, et al. Cystogram follow-up in the management of traumatic bladder disruption. J Trauma. 2006; 60(1): 23-8.
17. Inaba K, Okoye OT, Browder T, Best C, Branco BC, Teixeira PG, et al. Prospective evaluation of the utility of routine postoperative cystogram after traumatic bladder injury. The journal of trauma and acute care surgery. 2013; 75(6): 1019-23.
18. Allen F. Morey MD F, Jay Simhan MD, FACS. Genital and Lower Urinary Tract Trauma : Bladder Injury. In: Alan W. Partin M, PhD, Roger R. Dmochowski, MD, MMHC, FACS, Louis R. Kavoussi, MD, MBA, Craig A. Peters, MD, editor. Campbell-Walsh-Wein Urology. Twelfth Edition ed. Philadelphia, PA: Elsevier; 2020. p. 14024-31.
19. N.D. Kitrey (Chair) ND, P. Hallscheidt, F.E. Kuehhas, N. Lumen, E. Serafetinidis, D.M. Sharma. European Association of Urology Guidelines Netherlands2020. Available from: http://uroweb.org/guidelines/compilations-of-all-guidelines/.