Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2022 Feb 24; 10(B):1502-1508.
https://doi.org/10.3889/oamjms.2022.8422
eISSN: 1857-9655
Category: *B - Clinical Sciences*
Section: *Surgery*

Management and Outcome of Urogenital Trauma in Tertiary Hospital: The 8-Year's Experience in Indonesia

Yufi Aulia Azmi, Johan Renaldo*

Department of Urology, Universitas Airlangga Surabaya, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

Edited by: Branislav Filipović
Citation: Azmi YA, Renaldo J. Management and Outcome of Urogenital Trauma in Tertiary Hospital: The 8-Year's Experience in Indonesia. Open-Access Maced J Med Sci. 2022 Feb 24; 10(B):1502-1508. https://doi.org/10.3889/oamjms.2022.8422
Keywords: Urogenital trauma; Renal trauma; Profile; Retrospective study
***Correspondence:** Johan Renaldo, Department of Urology, Dr. Soetomo General Academic Hospital, Universitas Airlangga Surabaya, Surabaya, Indonesia. Tel.: +62818586110. E-mail: joeurologi@gmail.com
Received: 27-Dec-2021
Revised: 16-Jan-2022
Accepted: 14-Feb-2022

Funding: This research did not receive any financial support
Competing Interest: The authors have declared that no competing interest exists

Abstract

BACKGROUND: The current economy, technology, and civilization's development have indirectly increased the incidence of traffic accidents, and urogenital trauma occurs in 10–20% of trauma patients.

AIM: We decided to conduct this study to determine the incidence, severity, and outcome of urogenital trauma treatment at Dr. Soetomo General Hospital Surabaya.

MATERIALS AND METHODS: This study used an analytic observational study with a retrospective design. From 2013 to 2020, all medical record data of patients with urogenital trauma treated at Dr. Soetomo General Hospital Surabaya were collected and analyzed.

RESULTS: We collected 196 subjects with urogenital trauma who were treated for a period of 8 years. The most common type of trauma in urogenital trauma patients was kidney trauma, as many as 82 cases. Most of the cases were traffic accident cases, 184 patients and most of them with abdominal-pelvic trauma with 189 findings. Conservative management was most often performed, as many as 128 procedures. The outcome after receiving treatment was found to be that 27 patients died (13.8%) and 11 patients (6.5%) had a disability. Abdominal trauma was associated with external genitalia, urethra, and renal trauma ($p < 0.05$). External genitalia, urethra, bladder, and renal trauma were all associated with pelvic trauma ($p < 0.05$).

CONCLUSION: Most cases were caused by accidents, and the kidney was the most commonly involved organ. Cases of urogenital trauma are often associated with multiple trauma, especially abdominal trauma, so it is important to evaluate the urogenital tract when related to accidents involving the abdominal region.

Introduction

The current economy, technology, and civilization development had indirectly increased the incidence of traffic accidents and related accidents. Traumatic morbidity has become one of the most serious public health problems worldwide [1]. Disability caused by trauma has become one of the most serious public action problems in developed countries and countries with low total annual income. Urogenital trauma is involved in 10% of all cases of trauma in the United States [2].

In most reports, trauma related to the urogenital injury was found in approximately 10% of trauma patients in adults and < 3% of children with multiple/severe trauma to the lower abdomen or pelvis [3]. The kidneys were the most commonly affected organs in the urogenital system, whereas ureteral trauma was less common. Although urogenital trauma is rarely life-threatening, they could cause significant long-term morbidity such as impaired renal function, sexual dysfunction and urethral stricture [4].

Urogenital trauma occurs in 10–20% of trauma patients. Most of these traumas, with the exception of hilar disorders or renal rupture, are not immediately life-threatening. However, patients with urogenital trauma often present with potentially life-threatening injuries to other organs. In emergency cases, urological injury is often overlooked, due to inaccuracy in recognizing signs or symptoms. Failure to properly diagnose and treat urogenital trauma could result in significant short-term morbidity. Therefore, when evaluating trauma patients, doctors need to know the methods of diagnosis and identification related to trauma to the surgical area. Some of these key points include (1) fracture of the lumbar spine or lower ribs, (2) fracture of the pelvis, (3) pelvic pain or hematoma, (4) abnormal prostate (high-riding, unpalpable, or free-floating) on rectal examination (rectal), (5) blood in the urethral meatus, and (6) gross hematuria [5].

Approximately 10% of patients with surgical trauma have urogenital involvement; 10–15% of trauma patients with abdominal injuries had urogenital involvement. As long as the trauma was identified, the mortality rate from upper urinary tract trauma was mainly due to other related injuries and the reported morbidity rate was around 26% [2].

The ideal management of patients with urogenital trauma requires comprehensive epidemiological

information which may vary in different populations and times [6]. The latest data about this trauma in our country, Indonesia is a prerequisite for improving services in the field of urology and traumatology in the future. Accordingly, this study aimed to describe the characteristics including incidence, severity, and outcome of urogenital trauma in patients admitted to the emergency department, including those with multiple trauma conditions.

Material and Methods

Study design

This study used an analytic observational study with a retrospective design. All medical record data of patients with urogenital trauma who were treated at Dr. Soetomo General Hospital Surabaya from 2013 to 2020 were collected and analyzed.

Study sample

The sample in this study was the medical records of all multitrauma patients accompanied by urogenital trauma at Dr. Soetomo in August 2013 to December. 2020. The sampling technique is total sampling. The data taken are the number of patients, gender, age, male to female ratio, diagnosis, location of trauma, other concomitant trauma, type of action, patient outcome.

The collected data are grouped and will be displayed descriptively in the form of tables and narratives.

Ethics committee approval

This study was approved by the ethics committee of Dr. Soetomo General Hospital Surabaya (protocol number 1934/KEPK/IV/2020).

Statistical analysis

From the collected data, categorical variables were compared by the Chi-squared test or Fisher's exact test. In all analyses, two-tailed $p < 0.05$ was taken to indicate statistical significance. All statistical analyses were performed using SPSS software version 24.0 (IBM Co., Armonk, NY, USA).

Results

Study subject demography

The total subjects of this study were 196 subjects, most of the patients with urogenital trauma who were treated at our institution for a period of 8 years, from 2013 to 2020, were male as many as 160 patients and female sex as many as 36 patients. The mean age of urogenital trauma patients was 35.3 years. With the highest incidence of urogenital trauma is the age of 18–28 years, 85 patients (Table 1).

Table 1: Patients' admission data

Variable	2013	2014	2015	2016	2017	2018	2019	2020	Total
Gender									
Male	5	26	30	8	20	20	42	9	160
Female	0	8	8	0	3	10	2	5	36
Total	5	34	38	8	23	30	44	14	196
Age									
18–28	3	14	12	3	11	12	22	8	85
29–39	2	8	10	1	4	9	9	1	44
40–50	0	6	10	2	4	5	7	3	37
51–61	0	4	5	1	2	2	4	1	19
> 61	0	2	1	1	2	2	2	1	11
Trauma type									
Renal	2	15	15	5	9	9	20	7	82
Bladder	4	12	14	0	10	9	9	0	58
Ureter	0	0	0	0	0	1	0	0	1
Urethra	0	8	9	4	9	8	6	2	46
Testis	0	3	4	1	2	3	10	5	28
Penis	0	0	2	0	1	5	2	3	13
Mechanism									
Accident	5	34	38	8	22	27	38	12	184
Fall	0	0	0	0	0	1	1	0	2
Sharp inj	0	0	0	0	0	2	3	0	5
Blunt inj	0	0	0	0	0	2	2	1	5
Other trauma									
Head-neck	2	11	7	0	0	1	1	4	26
Thorax	0	13	6	2	2	3	2	3	32
Pelv-abd	5	34	36	8	23	30	41	12	189
Upper Ext	2	17	8	3	4	9	18	4	65
Lower Ext	4	25	18	4	9	13	15	10	98

Types of urogenital trauma

In a period of 8 years, there were 196 urogenital trauma in adult patients who were received and treated at Dr. Soetomo General Hospital, Surabaya. Urogenital trauma including kidney trauma, ureteral trauma, bladder trauma, urethral trauma, penile, and testicular trauma cases. Where among them experienced trauma in more than one region. The most cases of urogenital trauma were in 2019, which were 44 cases in 1 year.

From the details of the table above, it can be seen that the most common type of trauma in urogenital trauma patients was kidney trauma as many as 82 cases, the second order was bladder trauma as many as 58 cases, and the third highest order was urethral trauma as many as 46 cases. Meanwhile, there were very few cases related to ureteral trauma, only one case was recorded.

Mechanism of trauma

Most of the cases were traffic accident cases, 184 patients, followed by sharp and blunt trauma in five cases, and caused by a fall in two patients.

Management of urogenital trauma patients

Urogenital trauma patients who were treated at RSUD Dr. Soetomo, Surabaya, after receiving emergency treatment, the patient will receive definitive

action. Conservative measures were most often performed, as many as 128 procedures, followed by open cystostomy 41 procedures.

In the study of kidney trauma in adult patients, there were 82 cases. Of all these cases, most of them performed conservative measures in a number of 77 cases, nephrectomy in three cases, and renorraphy in two cases. Ureteral trauma is quiet rare, in the study of urogenital trauma in adult patients, only one case of ureteral trauma was found out of 226 cases of urogenital trauma. In 1 case, the treatment was carried out with a conservative approach. There were 58 cases of bladder trauma from a total of 226 cases of urogenital trauma in this study. Most cases of bladder trauma (22 out of 58 cases) underwent conservative management. The remaining cases were treated with a surgical approach, of which 20 cases underwent bladder repair, and 16 cases underwent open cystostomy. In this study, 46 of 226 cases of urogenital trauma were found in urethral trauma. The majority of cases of urethral trauma underwent surgical management, which consisted of open cystostomy in 24 cases, and urethral repair in four cases. Conservative therapy was performed in 18 cases (Table 2).

The penis is an external genital organ that is quite at risk of being affected, in cases of trauma to the urogenital region. In this study, there were 13 cases of penile trauma. Most cases of penile trauma were treated conservatively (six cases). Surgical management was performed in seven other cases consisting of penile repair (four cases), open cystostomy (one case), penile stump reconstruction (one case), and primary suture (one case). Of the total 28 cases of testicular trauma, four cases were treated with conservative therapy. The rest were treated with primary suture (five cases), orchidectomy (seven cases), orchidopexy (seven cases), and testicular repair (five cases).

Patient outcome

The outcome of urogenital trauma patients who were treated at Dr. Soetomo General Hospital, Surabaya, after receiving treatment, it was found that 27 patients died (13.8%) and 169 patients (82.2%).

According to standardized terms, disabled persons refer to persons with physical or mental disabilities that affect or limit their activities of daily living and that may require special accommodations [7]. Most of the disabilities are caused by trauma including those caused by traffic accidents, falls, burns, and other acts of violence. In this study, there were 158 patients who lived (93.5%) without having a disability, and about 11 patients (6.5%) who have a disability. Appropriate trauma management will reduce the causes of disability and improved care and services will improve the lives of people living with trauma-related disabilities.

Table 2: Management applied to the patients

Management	Total
Renal	
Conservative	77
Nephrectomy	3
Renorraphy	2
Ureter	
Conservative	1
Bladder	
Conservative	22
Open cystostomy	16
Bladder repair	20
Urethra	
Conservative	18
Open cystostomy	24
Urethra repair	4
Penis	
Conservative	6
Open cystostomy	1
Primer suture	1
Penile stump	1
Penile repair	4
Testis	
Conservative	4
Primer suture	5
Orchidectomy	7
Orchidopexy	7
Testis repair	5

Other organ trauma

Based on the data obtained, all of the above urogenital trauma is accompanied by other organ trauma. One patient may experience more than one traumatized region. In this study, from 196 cases of urogenital trauma, 409 diagnoses of trauma were also obtained in other locations. Most of them with abdominal-pelvic trauma with 189 findings, while trauma to the lower extremity region with 98 findings, and upper extremities with 65 findings, and the rest with trauma to the thorax and head and neck region.

Table 3 shows that urological trauma is associated with abdominal and pelvic trauma. External genitalia, urethra, and renal trauma were associated with abdominal trauma respectively ($p < 0.05$). In addition, external genitalia, urethra, bladder, and renal trauma were associated with pelvic trauma respectively ($p < 0.05$). However, this study found that ureter and bladder trauma were not associated with abdominal trauma ($p > 0.05$) while ureteral trauma was not associated with pelvic trauma ($p > 0.05$) (Table 4).

Table 3: Patients therapy outcome

Variable	Total (%)
Outcome	
Death	27 (13.8)
Survive	169 (82.2)
Disability	
Non-disable	158 (93.5)
Disable	11 (6.5)

Discussion

Demographically, most of the adult patients with urogenital trauma who were treated at Dr. Soetomo General Hospital Surabaya in a period of 8 years (2013–2020), 160 patients were male, and the remaining 36 patients were female, with a ratio of

Table 4: The association of urological trauma and abdominal and pelvic trauma

Trauma	Abdomen			Pelvis		
	n	%	p-value	n	%	p-value
External genitalia	13	6.6	0.012[a]	26	13.3	0.017a
Urethra	14	7.1	0.000[a]	40	20.4	0.000[a]
Ureter	0	0.0	0.423[b]	1	0.5	1.000[b]
Bladder	34	17.3	0.859[a]	42	21.4	0.009[a]
Renal	68	34.7	0.000[a]	25	12.8	0.000[a]

[a]Chi-squared test. [b]Fisher exact test.

4:1. This finding is almost the same as a study from the same center in 2010–2012, where there were 221 male patients (85.6%) and 37 female patients (14.4%), with a male ratio compared to women by 6:1 [8]. Research in developed countries such as Ireland, also shows a higher proportion of incidence in men, but with a ratio of 2.1:1 [9]. The EAU guidelines also state that urogenital trauma is more common in the male population, with a male: female ratio of 3:1 [10]. The high incidence of urogenital trauma in males is related to the anatomical structure, and males in many populations participate more frequently in physical sports, violent and combat events, and traffic accidents [11].

The mean age of urogenital trauma patients in Dr. Soetomo General Hospital is 35.3 years old. Meanwhile, the highest incidence of urogenital trauma is the age of 18–28 years. Previous research at the same center in 2010–2012 showed similar results, namely, the highest incidence of urogenital trauma was aged 20–29 years. Comparison with the characteristics of urogenital trauma patients in other developing countries, comparable to those in this study, with an average age of 20–30 years of urogenital trauma patients, or the productive age group [2].

Most of the cases in our study were traffic accidents (184 cases), blunt trauma and sharp trauma with five cases each. In the research of Dr. Soetomo Hospital in 2010–2012 it was also stated that the most common cause of urogenital trauma was traffic accidents 204 patients (79.1%), 3 patients (1.2%) due to falls from a height, and two patients (0.7%) due to sports trauma [8]. This finding is also in line with research in the United States, traffic accidents account for at least 44.6% of trauma events but due to the freedom of sharp weapons/fire in America, it is the most common cause of sharp trauma [12]. Most traffic accidents, which are the main cause of urogenital trauma, generally involve middle age, while pedestrian accidents involve elderly patients [3].

Urogenital trauma in adult patients treated at Dr. Soetomo Hospital Surabaya during 2013–2020, including cases including kidney trauma, ureteral trauma, bladder trauma, urethral trauma, and external genital trauma consisting of penile trauma and testicular trauma. The most common types of trauma in adult patients who experienced urogenital trauma were kidney trauma as many as 82 cases. When compared with global, the incidence of renal trauma accounts for 5% of all trauma patients, and is the largest contributor to genitourinary trauma, especially those associated with blunt abdominal trauma (80–90%) [13]. Because of its protected location within the bony pelvis, trauma to the bladder is less common than to the kidney but is still quite risky with either blunt or penetrating trauma. The majority of bladder ruptures without pelvic fractures occur after a hard blow to the abdomen in people with a full bladder. This condition often results in intraperitoneal blowout injury to the bladder dome [14]. The incidence of urethral trauma is rare in major trauma, but almost always accompanies pelvic fractures in about 82%. About 90% of these cases attack male patients because of the urethra's longer anatomy than in women [15]. Men are 5 times more likely to experience urethral trauma than women, which is due to the longer length and less mobility of the male urethra [16].

Urogenital trauma patients who were treated at Dr. Soetomo, Surabaya, after receiving emergency treatment, the patient will receive definitive management [17]. The decisive approaches were a conservative management in 128 patients, an open cystostomy in 42 cases, and bladder repair in 20 cases. The vast majority of existing data supports successful conservative management trials, even in stable people with high-grade renal injury. Conservative management normally involves bed rest, analgesics, hemodynamic monitoring, serial laboratory testing, and, if the situation deteriorates, reimaging [17]. In a study at Dr. Soetomo Hospital in 2010–2012, most of the urogenital trauma was managed with the principle of non-operative management, namely, 111 cases (96.5%) and operative management as many as four cases (3.5%). The details of the operative management of kidney trauma patients are nephrectomy in two cases (1.7%), renoraphy in one case (0.87%), and partial nephrectomy in one case (0.87%). In other research centers in developed countries also prioritize conservative management by 72.58%, in a 10-year study [1].

In this study, urogenital trauma patients who were treated at Dr. Soetomo, Surabaya, most of the patients (82.2%) managed to survive in the emergency and definitive treatment settings, or about 13.7% of the subjects died. This figure is still higher than previous similar studies which stated that mortality related to urogenital trauma was 5% [2] and 2.3% [18].

In our study, it was found that 169 patients lived without having a disability, only about 11 patients had a disability. Disability due to trauma has become a serious public health problem, especially in developing countries, due to its economic and social burden. The rate of urogenital trauma that causes disability is 2.5 times the mortality rate due to related trauma [6]. There are insufficient data regarding the epidemiological findings and types of disability associated with genitourinary trauma in different populations. However, the association between trauma and disability in the form of urethral stricture was found in 9.6–36.1% in

cases with straddle injuries, and 5–25% in cases of urethral trauma associated with pelvic fractures [19].

Based on the data obtained, all of the above urogenital traumas are accompanied by other organ trauma. One patient may experience more than one traumatized region. In this study, out of 196 patients who had urogenital trauma, 409 were diagnosed with trauma in other locations. Most of them with abdominal-pelvic trauma with 189 findings, while trauma to the lower extremity region with 98 findings, and upper extremities with 65 findings, and the rest with trauma to the thorax and head and neck region. The results of this study are in accordance with the research of Dr. Soetomo Hospital in 2010–2012 where the most comorbid trauma in urogenital trauma patients was anoperineal trauma as many as 103 cases (39.9%), the second order was abdominal trauma as many as 64 cases (24.8%) [8]. Globally also mentions that some urogenital trauma rarely stand-alone but there are accompanying trauma. As in renal trauma, most of them accompanies blunt abdominal trauma by 80-90% [13]. Ureteral trauma is often iatrogenic due to hysterectomy by 54% [20] while scrotal trauma is often associated with the incidence of pelvic fractures by 82% [15].

Renal trauma was associated with abdominal and pelvic trauma. The majority of renal trauma patients with moderate to major renal trauma will have had a CT scan performed soon after presentation [17]. However, in hospitals, especially in developing countries, that have not had any imaging, a history of rapid deceleration injuries and/or significant associated injuries could help make the decision to refer a patient to a trauma center [21]. Renal trauma is the result of the kidney and/or hilar structures being directly crushed. Less commonly, sudden deceleration may also result in an avulsion injury affecting the vascular structures of the hilum or the ureteropelvic junction (UPJ). In the case of high-velocity bullets or fragments, they have the potential for the greatest parenchymal destruction and are most often associated with multiple organ injuries [21]. However, in Indonesia, high-velocity bullets are rare due to the government's ban on owning firearms [22].

Bladder trauma was associated with pelvic trauma only. These findings were in accordance with the previous research associating bladder injuries with pelvic fractures [16]. Injuries to the bladder are often connected with pelvic fractures [23]. The anterolateral bladder wall is torn at the base of the bladder (at its fascial attachments), or the opposite side undergoes a contrecoup. The risk of bladder damage was greatest when the pelvic circle was displaced more than 1 cm, when the pubic symphysis diastasis was more than 1 cm, and when the pubic rami were fractured [16]. A sharp bone fragment may reach the bladder directly [24]. As a result of a pelvic blow, the intravesical pressure of a swollen bladder quickly rises, resulting in intraperitoneal bladder damage. The bladder dome is the bladder's most vulnerable area [24]. Penetration injuries, the most of which are the result of gunshot wounds, are very uncommon in all countries, including Indonesia [25].

Ureteral trauma was not associated with abdominal and pelvic trauma. Due to its small size, motility, and close proximity to the vertebrae, bony pelvis, and muscles, ureter trauma is rare. Our results show that iatrogenic trauma, not abdominal or pelvic trauma, mostly causes ureter trauma [17]. Iatrogenic ureter trauma occurs when laparoscopic or endoscopic surgery is overlooked during laparotomy. Moreover, the distribution of the location of external ureteral injuries varies across studies [16]. However, over the past two decades, the incidence of urological iatrogenic trauma has decreased in developed countries [17].

Urethral trauma was associated with abdominal and pelvic trauma. Our finding inline with the previous study that in cases with associated pelvic trauma and abdomen trauma, especially in posterior uretral trauma [26], [27]. Ten percent of men who sustain a pelvic fracture may also present with a concomitant urethral injury, so a high index of suspicion is required. In the posterior urethra, the injury is most commonly from pelvic fractures (motor vehicle collisions, industrial accidents) and iatrogenic injuries (prostatectomy or TURP) which causes a distraction injury where the membranous urethra is pulled off of the prostate at the apex, resulting in a pelvic fracture urethral distraction defect or "PFUDD" [27]. Blunt posterior urethral injuries are almost exclusively related to pelvic fractures and the risk increases with fracture configuration severity [15]. These injuries are referred to as pelvic fracture urethral injuries and are mainly caused by MVAs [28], [29].

External genitalia trauma, including penile and scrotum trauma, was associated with abdominal and pelvic trauma. Urological trauma is often linked to serious injury in multiple trauma patients [17]. Blunt abdominal and pelvic trauma (high energy trauma) are the two most common causes of kidney, ureter, and bladder trauma [25]. However, there are epidemiological differences in urological trauma among low-, middle-, and high-income countries, including Indonesia. Pelvic fractures are uncommon, accounting for 3–8% of all fractures, but account for 25% of polytrauma [30]. Concern should be raised about concomitant urologic trauma in polytraumatized patients with pelvic and/or abdominal trauma, especially in motor vehicle accidents and falls from considerable heights [25], [31], [32]. When polytraumatized patients are admitted without typical clinical signs, medical history is vital. The mechanism of injury supports the suspicion of urologic trauma and vice versa. Therefore, caution should be exercised in the treatment of any pelvic fracture or abdominal trauma [33]. Patients' mortality and morbidity are decreasing as urologists understand more about polytrauma, which reduces mortality by 25% and duration of stay by 4 days [17].

However, this research has some limitations. Longer follow-up could produce actual data and become an adequate source of reference. In addition, it is necessary to improve and optimize the recording and documentation related to patient's management at Dr. Soetomo recalled that some patients were excluded from this study due to incomplete medical record data.

Conclusion

From the data collected regarding urogenital trauma, it was found that most cases were caused by accidents with the organ most often involved was the kidney. In addition, cases of urogenital trauma are often associated with multiple traumas, especially in the abdominal region, so it is important to evaluate the urogenital tract when related to accidents involving the abdominal region.

References

1. Zou Q, Fu Q. Diagnosis and treatment of acute urogenital and genitalia tract traumas: 10-year clinical experience. Pak J Med Sci. 2015;31(4):925-9. https://doi.org/10.12669/pjms.314.6116
   PMid:26430431
2. Salimi J, Nikoobakht MR, Khaji A. Epidemiology of urogenital trauma in Iran: Results of the Iranian national trauma project. Urol J. 2006;3(3):171-4. https://doi.org/10.22037/uj.v3i3.191
   PMid:17559035
3. Javanmard B, Fallah-karkan M, Razzaghi M, Djafari AA, Ghiasy S, Lotfi B, *et al*. Characteristics of traumatic urogenital injuries in emergency department; a 10-year cross-sectional study. Arch Acad Emerg Med. 2019;7:e63. https://doi.org/10.22037/aaem.v7i1.455
   PMid:31875217
4. Mirzazadeh M, Fallahkarkan M, Hosseini J. Penile fracture epidemiology, diagnosis and management in Iran: A narrative review. Transl Androl Urol. 2017;6(2):158-66. https://doi.org/10.21037/tau.2016.12.03
   PMid:28540222
5. Minczak BM. Current Diagnosis and Treatment: Emergency Medicine. 7th ed. New York, USA: LANGE; 2009.
6. Sarvestani AS, Zamiri M, Sabouri M. Prognostic factors for fournier's gangrene; a 10-year experience in Southeastern Iran. Bull Emerg Trauma. 2013;1(3):116-22.
   PMid:27162838
7. Disabled Persons MeSH NCBI. https://www.ncbi.nlm.nih.gov/mesh/68006233 [Last accessed on 2022 Jan 31].
8. Himawan B, Hardjowijoto S, Djatisoesanto W. Trauma Urogenital di RSUD Dr.Soetomo Surabaya/FKUA Periode tahun 2010-2012. Indonesia: Universitas Airlangga; 2013.
9. Bhatt NR, Merchant R, Davis NF, Leonard M, O'Daly BJ, Manecksha RP, *et al*. Incidence and immediate management of genitourinary injuries in pelvic and acetabular trauma: A 10-year retrospective study. BJU Int. 2018;122:126-32. https://doi.org/10.1111/bju.14161
   PMid:29417734
10. Djakovic N, Plas E, Lynch T, Mor Y, Santucci RA, Serafetinidis E, *et al*. Guidelines on urological trauma. Update. 2009;47(1):1-15. https://doi.org/10.1016/j.eururo.2004.07.028
    PMid:15582243
11. Lynch TH, Martínez-Piñeiro L, Plas E, Serafetinides E, Türkeri L, Santucci RA, *et al*. EAU guidelines on urological trauma. Eur Urol. 2005;47(1):1-15. https://doi.org/10.1016/j.eururo.2004.07.028
    PMid:15582243
12. Grigorian A, Livingston JK, Schubl SD, Hasjim BJ, Mayers D, Kuncir E, *et al*. National analysis of testicular and scrotal trauma in the USA. Res Reports Urol. 2018;10:51-6.
    PMid:30128306
13. Zabkowski T, Skiba R, Saracyn M, Zieliński H. Analysis of renal trauma in adult patients: A 6-year own experiences of Trauma Center. Urol J. 2015;12(4):2276-9. https://doi.org/10.22037/uj.v12i4.2725
    PMid:26341772
14. Tezval H, Tezval M, von Klot C, Herrmann TR, Dresing K, Jonas U, *et al*. Urinary tract injuries in patients with multiple trauma. World J Urol. 2007;25(2):177-84. https://doi.org/10.1007/s00345-007-0154-y
    PMid:17351781
15. Battaloglu E, Figuero M, Moran C, Lecky F, Porter K. Urethral injury in major trauma. Injury. 2019;50:1053-7. https://doi.org/10.1016/j.injury.2019.02.016
16. McGeady JB, Breyer BN. Current epidemiology of genitourinary trauma. Urol Clin North Am. 2013;40(3):323-34.
    PMid:23905930
17. Kitrey ND, Djakovic N, Hallscheidt P, Kuehhas FE, Lumen N, Serafetinidis E, *et al*. EAU Guidelines on Urological Trauma. European Association of Urology; 2021.
18. Sözen S, Celik S, Akpinar C, Güven FM, Yel C, Kavalci C, *et al*. Analysis of the patients admitted to emergency department due to urogenital trauma and investigation of factors that affect mortality. J Acute Dis. 2017;6:70-3. https://doi.org/10.12980/jad.6.2017jadweb-2016-0066
19. Simhan J, Ramirez D, Hudak SJ, Morey AF. Bladder neck contracture. Transl Androl Urol. 2014;3(2):214-20. https://doi.org/10.3978/j.issn.2223-4683.2014.04.07
    PMid:26816768
20. Engelsgjerd J, LaGrange C. Ureteral Injury. Treasure Island, FL: StatPearls Publication; 2019.
21. Zeckey C, Winkelmann M, Macke C, Mommsen P, Tezval H, Peterson AC, *et al*. Urogenital Trauma. In: Urology at a Glance. Berlin, Heidelberg: Springer; 2014. p. 311-34.
22. International Firearm Injury Prevention and Policy. Guns in Indonesia Firearms, Gun Law and Gun Control; 2020. Available from: https://www.gunpolicy.org/firearms/region/indonesia [Last accessed on 2021 Nov 06].
23. Matlock KA, Tyroch AH, Kronfol ZN, McLean SF, Pirela-Cruz MA. Blunt traumatic bladder rupture: A 10-year perspective. Am Surg. 2013;79(6):589-93. https://doi.org/10.1177/000313481307900619
    PMid:23711268
24. Figler B, Hoffler CE, Reisman W, Carney KJ, Moore T, Feliciano D, *et al*. Multi-disciplinary update on pelvic fracture associated bladder and urethral injuries. Injury. 2012;43(8):1242-9. https://doi.org/10.1016/j.injury.2012.03.031
    PMid:22592152
25. Syarif, Palinrungi AM, Kholis K, Palinrungi MA, Syahrir S, Sunggiardi R, *et al*. Renal trauma: A 5-year retrospective

review in single institution. Afr J Urol. 2020;26:61. https://doi.org/10.1186/s12301-020-00073-2

26. Cinman NM, Mcaninch JW, Porten SP, Myers JB, Blaschko SD, Bagga HS, *et al*. Gunshot wounds to the lower urinary tract: A single-institution experience. J Trauma Acute Care Surg. 2013;74(3):725-30. https://doi.org/10.1097/TA.0b013e31827e1658

    PMid:23425728

27. Mihalik JE, Smith RS, Toevs CC, Putnam AT, Foster JE. The use of contrast-enhanced ultrasound for the evaluation of solid abdominal organ injury in patients with blunt abdominal trauma. J Trauma Acute Care Surg. 2012;73(5):1100-5. https://doi.org/10.1097/TA.0b013e31825a74b5

    PMid:22832765

28. Latini JM, McAninch JW, Brandes SB, Chung JY. Rosenstein D (2014) SIU/ICUD consultation on urethral strictures: Epidemiology, etiology, anatomy, and nomenclature of urethral stenoses, strictures, and pelvic fracture urethral disruption injuries. Urology. 2014;83(Suppl 3):1-7. https://doi.org/10.1016/j.urology.2013.09.009

    PMid:24210733

29. Barratt RC, Bernard J, Mundy AR, Greenwell TJ. Pelvic fracture urethral injury in males-mechanisms of injury, management options and outcomes. Transl Androl. 2018;7(Suppl 1):S29-62. https://doi.org/10.21037/tau.2017.12.35

    PMid:29644168

30. Summerton DJ, Kitrey ND, Lumen N, Serafetinidis E, Djakovic N. EAU guidelines on iatrogenic trauma. Eur Urol. 2012;62(4):628-39. https://doi.org/10.1016/j.eururo.2012.05.058

    PMid:22717550

31. Mukherjee K, Barman MK, Maitra T, Biswas A, Venugopal PN. Epidemiology and management of urogenital trauma: The 7-years experience at west bengal, india bio-cultural adptation view project whole genome sequencing of indian population view project epidemiology and management of urogenital trauma: The 7-years experience at west Bengal, India. Int J Public Health Manag. 2014;1:66-9.

32. Čapka D, Klézl P, Fric M, Grill R. Urogenital injury in polytrauma patients: A five-year epidemiological study. Acta Chir Orthop Traumatol Cech. 2021;88(4):307-12.

    PMid:34534061

33. Serafetinides E, Kitrey ND, Djakovic N, Kuehhas FE, Lumen N, Sharma DM, *et al*. Review of the current management of upper urinary tract injuries by the EAU trauma guidelines panel. Eur Urol. 2015;67(5):930-6. https://doi.org/10.1016/j.eururo.2014.12.034

    PMid:25578621