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UROLOGICAL COMPLICATIONS IN PELVIC FRACTURES: CORRELATION BETWEEN TYPES OF FRACTURES AND URINARY INJURIES

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ABSTRACT

Purpose: The aim of the study was to investigate radiological findings, specific pelvic fractures and urological injuries accompanying fractures of the pelvic region.

Material and Method: Patients with pelvic fracture who applied to the emergency department between January 2013 and December 2019 and were admitted to orthopedics and traumatology clinic were retrospectively screened. Pelvic fractures were typed according to Tile classification using the hospital's registration system. The present study include 62 patients with pelvic trauma (44 men, 18 women), who were consulted with the urology clinic upon their admission by the emergency department and then followed up by the urology clinic upon their hospitalization.

Results: The mean age of patients is 48 (7-90). 26 cases (47.6%) were in-vehicle traffic accident (IVTA), 14 cases (22.2%) extravehicular traffic accident (EVTA), 2 cases (1.6%) motorcycle accident, 16 cases (25.4%) fall down from height, 2 cases occupational accidents, and 2 cases accidents due to other causes. The most common pelvic fractures are Tile A2, B2 and B1. The most common accompanying finding in urogenital injuries is unexplained microhematuria (20.6%) and macrohematuria (22.2%). The most common types of pelvic fractures accompanied by urogenital injuries are Tile Types A2 and B2. There is a significant relation between types of pelvic fractures and urogenital injuries.

Conclusion: Pelvic ring injuries are injuries with high mortality and morbidity, which are often caused by high-energy injuries. Therefore, in order to minimize mortality and morbidity, a quick and aggressive approach is required for diagnosis and treatment in emergency services. Detection of the specific fracture pattern will also facilitate the detection of additional concomitant urological injury, which will create a chance for early intervention.

Introduction

Pelvic ring injuries are injuries with high mortality and morbidity, which are often caused by high-energy injuries. Pelvic fractures are the third most common cause of death caused by traffic accidents after central neurological system and chest injuries (1, 2). Pelvic fractures account for 3 -8% of all fractures (3). The presence of the bladder, urethra, uterus, vagina and prostate gland located under the pelvic brim increases the risk of injury to these urogenital organs. Therefore, a quick and aggressive approach is required for diagnosis and treatment in emergency services to minimize mortality and morbidity (4).

Urological injuries are observed in 10 -15% of the cases after trauma. In general, trauma, the most frequently injured organ is the kidney, and the least injured organ is the ureters (5). Urogenital injuries accompanied by pelvic ring fractures are bladder rupture (5-10%) and membranous urethra injuries in men (5-7). It is always important to exclude oliguria, anuria, and hematuria in bladder injury after pelvic trauma, as well as urethral injury in the presence of hemorrhage in the urethral meatus. Timely intervention in genitourinary injuries prevents or minimizes both deaths and complications such as impaired renal function, urinary incontinence and sexual dysfunction (8).

Most studies focused on mortality and morbidity of pelvic fractures, rather than concomitant genitourinary injuries. The present study is intended to investigate the general characteristics, radiological findings, specific pelvic fractures and urological injuries

accompanying these specific fractures in patients with pelvic fractures.

Material and Method

Patients with pelvic fracture who applied to Süleyman Demirel University Faculty of Medicine between January 2013 and December 2019 and were admitted to the orthopedics and traumatology clinic were retrospectively screened. Antero-posterior (AP) graphs and three-dimensional computed tomography (CT) scans of all pelvic fractures were examined on the hospital system. The pelvic fractures were grouped using the Tile Classification (Figure 1) (1).

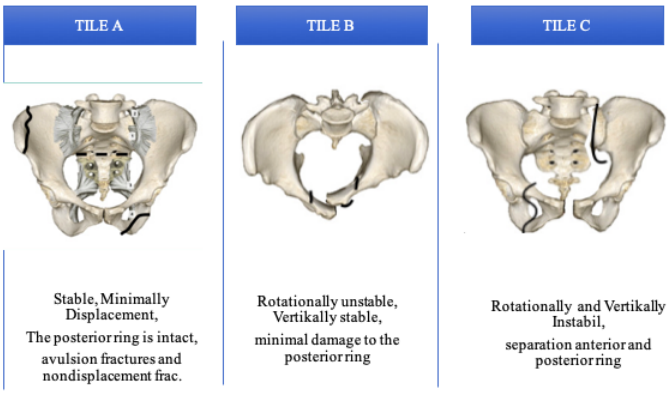

Figure 1. Tile classification in pelvic injuries is summarized schematically.

The present study included 62 patients who were consulted with the urology clinic upon their admission by the emergency service and then followed by the urology clinic upon their hospitalization. The inclusion criterion included patients with pelvic fracture that were admitted by the service for follow-up and also followed up by the urology clinic. Those with head and thoracic trauma, low-energy injuries, those without pathological pelvic fractures, urogenital injuries, as well as those not consulted with the urology clinic were excluded from the study. The institutional ethics committee's approval was obtained prior to retrospective assessment.

Data analysis was conducted using the "SPSS v23.0" package program. Descriptive statistics were shown in the form of mean ± standard deviation or medians (minimum-maximum) for continuous variables, while nominal variables were presented as case number and percentages (%).

Histogram and the "One-Sample Kolmogorov-Smirnov Test" were used to determine whether the continuous variables were distributed normally. $p>0.05$ was considered as the normal distribution. The difference between normally-distributed variables among the independent variables was assessed using "Independent Samples T test" while the difference between the non-normally-distributed variables was assessed with "Mann-Whitney U test". The correlation between nominal variables was assessed using "Pearson's chi-square test" and "Fisher's exact test". The value $p<0.05$ was considered significant.

Results

The mean age of the patients that included 44 male (69.8%) and 18 female (30.2%) is 48 (7-90 years). In terms of injury mechanisms, 26 cases (47.6%) were in-vehicle traffic accident (IVTA), 14 cases (22.2%), extravehicular traffic accident (EVTA), 2 cases (1.6%) motorcycle accident, 16 cases (25.4%) fall from height, 2 cases occupational accidents, and 2 cases accidents due to other causes (Table 1). The most common pelvic fractures are Tile A2, B2 and B1. As for the urogenital injuries seen, unexplained microhematuria (20.6%) and macrohematuria (22.2%) are the most common concomitant findings. The most common types of pelvic fractures accompanied by urogenital injuries are Tile Type A2 and B2 (Table 2). There is a significant correlation between types of pelvic fracture and urogenital injuries ($p=0.018$). Concomitant urogenital injuries do not differ by gender ($p=0.092$). There was no significant correlation between trauma mechanisms and concomitant urological injuries ($p=0.086$). 24 (38.7%) of the cases had additional orthopedic injuries, 7 (11.3%) of whom also had multiple limb fractures. The most common concomitant limb fractures are femoral fractures (neck, subtrochanteric and diaphysis) in 11 cases (17.5%). 40 of the pelvic fractures were followed up conservatively, and 22 were treated surgically (open reduction and internal fixation, external fixation).

Table 1. Demographic templates of patients and other accompanying orthopedic injuries

	n=62
Age (mean)	48(7-90)
Sex (M/F)	44 E/18 K
Fracture mechanism	**n(%)**
IVTA	26 (47,6)
EVTA	14 (22,2)
Motor accident	2 (1,6)
Fall down	16 (25,4)
Occupational acc.	2 (1,6)
Other	2 (1,6)
Other accompanying orthopedic fractures	24 (38,7)
Upper extremity fractures	6 (9,5)
Lower extremity fract.	15 (23,9)
Toracalumbar spine frac.	3 (4,8)
At least two fracture	7 (11,3)

Discussion

Pelvic fractures are direct or indirect outcomes of anteroposterior compression, lateral compression, vertical scissor, or combination of these three depending on the incoming direction of high-energy force. These injuries lead to high morbidity and are often accompanied by injuries of the bladder and urethra. Some subtypes of pelvic fractures poses higher risk of injury to the genitourinary system (9). The present study is therefore focused exactly on this. The real bone pelvis is surrounded by the pubic arc and symphysis pubis in the anterior, by the iliac fossa in the lateral, by the sacrum and the sacroiliac joint in the posterior. Injuries in the pelvic bone ring that are not accompanied by posterior sacroiliac joints do not disturb stability. In vertical type of instable fractures that affect the posterior ring, urogenital organs are at risk. The best example to it is fractures of bilateral pubic rami, accompanied by separation of the

Table 2. Urogenital Injuries and Pelvic Fractures by Tile Classification

	Urogenital Injuries (n)								**Total %**
Tile Classification	**Blunt Kidney Trauma Grade I-II**	**Blunt Kidney Trauma Grade III-IV**	**Macro-hematuria**	**Mikro-hematuria**	**Bladder rupture**	**Scrotal edema**	**Neurogenic bladder**	**Uretral Injury**	
A1	1	-	1	-	-	-	-	-	2 (3,2)
A2	3	-	6	1	-	4	2	-	16 (25,8)
A3	-	-	-	-	1	-	2	-	3 (4,8)
B1	-	2	2	4	1	-	-	-	9 (14,6)
B2	-	4	2	7	1	3	-	1	18 (29)
B3	-	-	1	1	1	-	-	1	4 (6,5)
C1	2	2	2	-	-	1	-	-	7 (11,3)
C2	-	-	-	-	2	1	-	-	3 (4,8)
Total	6	8	14	13	6	9	4	2	62 (100)
p score (<.05)	**0.29**	**0.25**	**0.79**	**0.07**	**0.41**	**0.76**	**0.14**	**0.14**	

posterior sacroiliac joint and Malgaigne's fractures or Tile Type 2B fractures accompanied by fractures of the sacrum (10). Kidney injuries account for approximately 5% of all traumas and 90% of these injuries are blunt trauma. Isolated kidney injuries are rare and often accompany multiple traumas (11). Kidney traumas are rated according to the classification of AAST (American Association for the Surgery of Trauma). Blunt kidney traumas are followed conservatively as between Grade 1-4, while patients with Grade 5 kidney trauma require diagnostic surgery and often nephrectomy due to hemodynamic instability. Penetrating kidney injuries are treated surgically, except for selective patients (12). In the present study, grade I-II renal lacerations were observed in A1, A2 and C1 fractures, while grade III-IV lacerations were observed in B1, B2 and C1 fractures. We can say that the severity of laceration in the kidney increases as a result of the lateral compression forces and vertical forces with increased intensity that are seen concomitantly with the anteroposterior compression forces. In our study, a patient with grade IV kidney laceration was treated through repair while the rest of the patients included herein were treated conservatively.

Bladder traumas can be classified radiologically or clinically (13). The clinical classification made by the American Association for the Surgery of Trauma (AAST) categorizes 5 stages (14). But this classification can be roughly divided into intraperitoneal injuries, extraperitoneal injuries and injuries of both. Blunt trauma accounts for 50 -85% of bladder injuries (15, 16). Pelvic fracture is observed in 70% of blunt bladder traumas, while 3 -26% of pelvic fractures are accompanied by bladder trauma, depending on the severity of the pelvic fracture (17, 18). Extraperitoneal bladder injuries occur 3-4 times more often than intraperitoneal injuries, and pelvic fractures often accompany extraperitoneal injuries (19, 20). Conservative approaches are preferred in extraperitoneal bladder injuries. Urethral or suprapubic bladder drainage is intended to be achieved. Although it may vary depending on clinical experience, cystography can be taken after an average of 10-14 days and the catheter can be removed after making sure that the bladder integrity is intact (15, 21, 22). Intraperitoneal bladder ruptures occur when there is a sudden increase in the intra-bladder pressure that is secondary to the increase in intra-abdominal pressure as a result of the high-energy blows to the lower abdomen or the pelvis especially when the bladder is full. Often, the dome part that is covered by peritoneum and where the bladder is in its most mobile and weakest state is ruptured, which results in urine extravasation into the peritoneum. Intraperitoneal bladder rupture is less common in pelvic fractures, but surgical exploration is required for such injuries (17). In our study, bladder rupture was observed particularly in Tile B and C fractures, and these cases were treated conservatively.

Urethral injuries in pelvic fractures are often accompanied by fractures of the pubic arc. Its incidence ranges from 1.6% to 25% (24). Since the urethra in men is longer and mobile, injuries are observed 5 times more often than in women (18). Typically, patients experience bleeding in the urethral meatus. In these patients, retrograde urethrogram is needed to check urethral integrity. If urethrography does not present with any opaque matter transmitted to the bladder and if its complete extravasation is observed, complete rupture is suspected while incomplete rupture is suspected if there is a filling into the bladder (23, 24). Injuries of the urethra can be divided into anterior and posterior injuries. Posterior injuries are often associated with blunt trauma and pelvic fractures. They have a high incidence particularly in inferior pubic ramus fractures and Malgaigne fractures (23). Anterior urethral injuries are usually seen as horseback riding or after kicking into the perineum. Complete injuries often occur as a result of separation of the posterior urethra from the bulbomembranous junction (18). Treatment is divided into intervention in the early and late period. Both options have advantages and advantages in terms of recurrent urethral stricture, sexual dysfunction and

incontinence (25, 26). In our study, only two patients had urethral injuries. These patients were treated endoscopically at an early stage. It was found that recurrent urethral stenosis developed similar to the literature in their 3-year follow-up and their stenosis was treated endoscopically.

Microscopic or macroscopic hematuria may be the first sign in all fracture patterns. In our study, we found micro- and macroscopic hematuria without urogenital organ injury in 27 cases. Macroscopic hematuria is observed more in Type A fractures, whereas microscopic hematuria is observed in Type B fractures. The trauma occurrence mechanism is also effective in this. Depending on the mechanism of blunt trauma, the foci of bleeding formed due to damage to the urogenital endothelium of any localization may not be detected by using the existing imaging methods. Büyükcam et al. reported that hematuria and kidney trauma are correlated, regardless of the severity of the kidney injury (8). Presence of gross hematuria during post-traumatic urination or catheter drainage of the bladder is often observed in bladder rupture. It is necessary to evaluate it with retrograde cystosgraphy or CT. Bladder bleeding from bladder perforation is very rarely life-threatening. The critical thing is that urine, which is extravassed from the bladder, poses a risk of infection (6).

In our study, 4 out of 63 patients developed neurogenous bladder in acute period. In the follow-up of these cases, overactive bladder symptoms that appeared in the period after the spinal shock phase were treated with anticholinergic agents. After stabilization of sacral and vertebral fractures in transient neurogenous bladder patients, considerable improvement was observed within 6 months -1 year after the decompression of the nerves innervate the bladder.

Our study was carried out retrospectively through the hospital registration system. Consultations and recorded images in the current system were used. The patient findings recorded during their hospital stay were used. We do not know about the comorbid diseases of the patients. The limitations of the present study include that the evaluation herein is focused solely on trauma, and that it does not cover complications or additional injuries due to medium- and long-term pelvic fractures and urological injuries.

Conclusion

Urinary system injuries are often observed in patients admitted with pelvic trauma. Because mortality and morbidity risks of these patients are high, the correct assessment and follow-up of such patients with pelvic trauma help diminish possible complications. While microscopic or macroscopic hematuria can be the first urinary manifestation, there may not exist an underlying organ injury in most cases. The main conclusion from the present study is that the urinary tract injury accompanying pelvic fractures varies depending on the type of fracture rather than the mechanism of injury occurrence.

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References

1. Tile M. Pelvic ring fractures: should they be fixed?. J Bone Joint Surg Br. 1988;70:1-12.

2. Dalinka MK, Arger P, Coleman B. CT in pelvic trauma. Orthop Clin North Am. 1985;16:471-80.

3. Tscherne H, Regel G, Pape HC, Pohlemann T, Krettek C. Internal fixation of multiple fractures in patients with polytrauma. Clin Orthop Relat Res. 1998;347:62-78.

4. Alost T, Waldrop RD. Profile of geriatric pelvic fractures presenting to the emergency department. Am J Emerg Med. 1997;15:576-8.

5. Güloğlu R, Kocataş A, Asoğlu O, Alış H, Arıcı C, Türel Ö. Urologic injuries. Ulus Travma Acil Cerrahi Derg. 1996;2:43-6.

6. Dalal AK, Sinha TP, Mohanty D. Pelvic Fractures and Urogenital Injuries. Journal of Orthopaedics, Traumatology and Rehabilitation. 2014;7:29-32.

7. Cooperberg MR, McAninch JW, Alsikafi NF, Elliott SP. Urethral reconstruction for traumatic posterior urethral disruption: Outcomes of a 25-year experience. J Urol. 2007;178:2006-10.

8. Buyukcam F, Sen J, Akpinar S, Zengin Y, Calik M, Odabas O. Evaluation of urogenital injuries in patients with trauma in the emergency department. Ulus Travma Acil Cerrahi Derg. 2012;18:133-40.

9. Bjurlin MA, Fantus RJ, Mellett MM, Goble SM. Genitourinary injuries in pelvic fracture morbidity and mortality using the National Trauma Data Bank. J Trauma. 2009;67:1033-9.

10. Koraitim MM, Marzouk ME, Atta MA, Orabi SS. Risk factors and mechanism of urethral injury in pelvic fractures. Br J Urol. 1996;77:876-80.

11. Yildirim C, Yuksel OH, Akan S, Urkmez A, Verit A. Lower pole renal cut injury due to the iliac wing fracture: A rare case report. Arch Ital Urol Androl. 2015;87:179-80.

12. Moore EE, Shackford SR, Pachter HL, McAninch JW, Browner BD, Champion HAT, et al. Organ Injury Scaling: Spleen, Liver, and Kidney. J Trauma. 1989;29:1664-6.

13. Haroon SA, Rahimi H, Merritt A, Baghdanian A, Baghdanian A, LeBedis CA. Computed tomography (CT) in the evaluation of bladder and ureteral trauma: indications, technique, and diagnosis. Abdom Radiol (NY). 2019;44:3962-77.

14. Kong JP, Bultitude MF, Royce P, Gruen RL, Cato A, Corcoran NM. Lower urinary tract injuries following blunt trauma: a review of contemporary management. Rev Urol. 2011;13:119-30.

15. Guttmann I, Kerr HA. Blunt bladder injury. Clin Sports Med. 2013;32:239-46.

16. Pereira BMT, Campos CCC, Calderan TRA, Reis LO, Fraga GP. Bladder injuries after external trauma: 20 years experience report in a population-based cross-sectional view. World J Urol 2013;31:913-7.

17. 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.

18. McGeady JB, Breyer BN. Current epidemiology of genitourinary trauma. Urol Clin North Am. 2013;40:323-34.

19. Anderson RE, Keihani S, Moses RA, Nocera AP, Selph JP, Castillejo Becerra CM, et al. Current Management of Extraperitoneal Bladder Injuries: Results from the Multi-Institutional Genito-Urinary Trauma Study (MiGUTS). J Urol. 2020:101097JU0000000000001075.

20. Lee MJ, Wright A, Cline M, Mazza MB, Alves T, Chong S. Pelvic Fractures and Associated Genitourinary and Vascular Injuries: A Multisystem Review of Pelvic Trauma. AJR Am J Roentgenol. 2019;213:1297-306.

21. Deibert CM, Spencer BA. The association between operative repair of bladder injury and improved survival: results from the National Trauma Data Bank. J Urol. 2011;186:151-5.

22. Matlock KA, Tyroch AH, Kronfol ZN, McLean SF, Pirela-Cruz MA. Blunt traumatic bladder rupture: a 10-year perspective. Am Surg. 2013;79:589-93.

23. Barratt RC, Bernard J, Mundy AR, Greenwell TJ. Pelvic fracture urethral injury in males-mechanisms of injury, management options and outcomes. Transl Androl Urol. 2018;7(Suppl 1):S29-S62.

24. Mundy AR, Andrich DE. Urethral trauma. Part I: introduction, history, anatomy, pathology, assessment and emergency management. BJU Int. 2011;108:310-27.

25. Zou Q, Zhou S, Zhang K, Yang R, Fu Q. The Immediate Management of Pelvic Fracture Urethral Injury-Endoscopic Realignment or Cystostomy? J Urol. 2017;198:869-74.

26. Horiguchi A, Shinchi M, Masunaga A, Okubo K, Kawamura K, Ojima K, et al. Primary Realignment for Pelvic Fracture Urethral Injury Is Associated With Prolonged Time to Urethroplasty and Increased Stenosis Complexity. Urology. 2017;108:184-9.