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Functional outcomes and sexual dysfunction after surgically treated pelvic fractures

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Abstract

Background: *Pelvic ring fractures constitute 3–8% of all fractures of the skeletal system and are usually due to high-energy trauma in young and often sexually active individuals.*

Methods: *A cross-sectional retrospective study was conducted in a two level trauma center. 45 patients who were operated between January 2017 and January 2020 for pelvic fractures were included. Patients were evaluated according to age, gender, trauma mechanism, fracture classification, accompanying injury, surgical technique, functional outcomes and sexual dysfunction. Functional outcomes were assessed with Female Sexual Functioning Index-6, International Index of Erectile Function-5 and Majeed's score. The pelvic fractures were classified using Young and Burgess's and Tile classification.*

Results: *Average of age was 50.2±13.8 (range 28-70) years old and follow-up time was 38.06±18.05 (range 24-72) months. 19 (54.2%) male patients were included. Most of the patients had a "fair" Majeed Score (45.7%). Antero-posterior compression fractures had the worst Majeed's score with a mean of 61.8±8.8 and lateral compression had the best outcome average with 69.8±11.7 (p=0.041).*

There were no significant difference between fracture type in terms of Female Sexual Functioning Index-6 and International Index of Erectile Function-5 scores, but the antero-posterior compression fracture had the worst outcome values with a mean of 18.5±2.12 (p=0.928) and 13.3±5.6 (p=0.743), respectively.

Conclusions: *This study suggests that antero-posterior compression mechanism is associated with the worst clinical outcomes. Therefore, pelvic fractures, especially antero-posterior compression types should have a multidisciplinary evaluation with gynecology, urology, and psychiatry departments to increase the treatment success.*

Keywords: Pelvic fractures, Surgical treatment, Pelvic injury mechanism, Sexual dysfunction

INTRODUCTION

Pelvic ring fractures constitute 3–8% of all fractures of the skeletal system and are usually due to high-energy trauma in young and often sexually active individuals [1].

Improved multidisciplinary care for pelvic fracture patients has not only led to higher survival rates, but also to more survivors with persistent disabilities. Sexual dysfunction is a disability with severe life quality impact [2].

Treatment of complex pelvic fractures consists of bleeding management, hemodynamic restoration, pelvic ring stabilization, quick diagnosis and surgery. During the early phase, external fixation is used for temporary pelvic stabilization. And when the patient's hemodynamic state stabilizes, definitive internal fixation surgery is performed, usually in 5-7 days [3].

Pelvic ring injuries may lead to genitourinary injury (GUI) through direct or indirect trauma, those are the most typical complications of fractures that disrupt the integrity of the pelvic ring [4]. Symphysis diastasis is the most important risk factor for GUI related to pelvic injuries [5]. Urologic injuries were detected in about 22% of patients with rupture of the symphysis [6].

Patients with pelvic fracture were shown to have a higher incidence of sexual dysfunction and worst clinical outcomes compared to patients without pelvic fracture [7]. Pelvic fractures and associated GUI may cause sexual dysfunction in both genders, especially in men with erectile dysfunction (ED) and women with dyspareunia [8].

MATERIALS AND METHODS

All patients with traumatic pelvic fracture treated surgically at our institution between January 2017 and January 2020 were considered for enrollment (n=54). Exclusion criteria were persistent spinal cord or brain injury, younger than 18 years and older than 70 years, open fracture, missing files or films and previous GUI. Patients were followed for at least 24 months. 45 patients with inclusion criteria were included in the study.

Patients were evaluated according to age, gender, trauma mechanism, fracture classification, additional system injury, surgical technique, functional outcomes and sexual dysfunction. Patients were evaluated by preoperative pelvic radiography and computed tomography (CT).

Relationship between pelvic fracture and clinical outcomes was our most concern so we used different classifications of pelvic fracture including Young-Burgess classification [9] and Tile system [10].

Functional outcomes were assessed with the Female Sexual Functioning Index-6 (FSFI6), The International Index of Erectile Function-5 (IIEF5) and Majeed's Pelvic Scale (MPS). To prevent observer bias, all examinations and interviews were performed by the same person.

FSFI-6 is a 6-item type scale that evaluates female sexual function in six topics: desire, arousal, lubrication, orgasm, satiety and pain. The scale reflects the sexual function of women in the last month. Each title on this scale is scored between 0 and 5. Total score range is between 0 (minimum score) and 30 (maximum score). A higher score indicates better function. FSFI score ≤ 19 is defined as female sexual dysfunction [11].

We used a validated Portuguese version of the scale [12].
IIEF-5 is administered as a sensitive screening tool for the presence and severity of ED with clinical evaluation. IIEF-5 evaluates orgasm function, sexual desire, sexual intercourse and general satisfaction. The score is the sum of the responses given to five items, with a maximum of 25. If the total score is below 21, it indicates ED. ED is classified into five categories based on the scores: severe (5–7), moderate (8–11), mild-to-moderate (12–16), mild (17–21) and no ED (22–25) [13].

We used a validated Portuguese version of the scale [14].

MPS was used to assess functional outcomes associated with pelvic pain, along with a variety of other activities such as sitting, walking and sexual intercourse. Functional assessment consists of six multiple choice questions whose answers are a continuation. The total score of the answers given to the questions varies between 0 and 100. The final score corresponds to 85–100 is excellent, 70–84 is good, 55–69 is fair and < 55 is bad result [15].

SPSS 20.0 for Windows (IBM Corp, Armonk, NY) was used for the statistical analysis. The ANOVA test was used to compare more than two independent variables with no normal distribution. Comparison of two variables that were independent and normal distribution fit was done by Student's t test. Chi-square (or Fisher's exact test at appropriate locations) was used to examine the relationship between categorical variables. Due to multiple testing, an alpha level correction (Bonferroni) was conducted, setting the level of significance to $p<0.05$. In the following the results are displayed as mean ± standard deviation (range).

RESULTS

Patient age was 50.2 ± 13.8 (range 28-70) years. 25 (55%) male patients were included. Follow-up time was 38.6 ± 8.5 (range 24-48) months. Most common cause of injury was motor vehicle crash in 16 patients (34.3%), pedestrian accident in 14 (25.7%) and followed by fall from height (>8 meters) in 10 (22.9%) (Table 1).

Table 1: Frequency of descriptive characteristics of patients

	Mean ± SD	**(min–max)**
Age (years)	50.2 ± 13.8	(28-70)
Follow-up (months)	38.6 ± 8.5	(24-48)
	N	%
Gender		
Female	20	45.8
Male	25	54.2
Trauma mechanism		
Motor vehicle crash	16	35.5
Pedestrian accident	14	31.1
Fall from height (> 5 meters)	10	22.4
Simple fall	3	6.6

Others	2	4.4
Young-Burgess classification		
APC	17	37.8
LC	14	31.1
VS	14	31.1
Tile Classification		
A	-	-
B	28	62.2
C	17	37.8
Pelvic ring injury		
Isolated pelvic ring	34	75.5
Combined with acetabulum	7	15.5
Accompanying injury		
No	8	17.7
Spine	2	4.4
Upper extremity	3	6.6
Lower extremity	15	33.3
2 anatomical areas	6	13.3
3 or more anatomical areas	1	2.2
Damage control surgery		
Yes	20	44.4
No	25	55.6
Surgical approach		
Pfannenstiel	22	48.8
Ilioinguinal	8	17.7
Modified Stoppa	10	22.2
Posterior sacrum	5	11.1
External fixation	4	8.8
Kocker Langenbeck	2	4.4
Symphysial plate fixation		
Yes	25	55.5
No	20	44.4

According to Tile classification, the most common fracture pattern was type B fracture, occurring in 28 patients (62.2%). Another 17 patients (37.8%) sustained a type C fracture and none had type A fracture.

17 patients (37.8%) sustained an APC fracture, 14 patients (31.1%) a LC fracture and 14 patients (31.1%) had a VS fracture. 7 patients had a concomitant fracture of the acetabulum (15.5%) and 22 patients (48.8%) had a sacral fracture.

8 patients (17.7%) sustained isolated pelvic trauma. Traumatic lower extremity injury was the most frequent concomitant injury (42.9%).

We performed damage control surgery in 20 patients (44.4%), of those 10 patients were treated with supra-acetabular external-fixation (EF), 7 with iliac wings EF and 3 with C-Clamp stabilization. Definitive fracture care was performed between 8 and 10 days after the injury.

The most common surgical approaches were the anterior approach through Pfannenstiel incision in 22 patients (48.8%), followed by ilioinguinal approach in 8 patients (17.7%) and modified Stoppa approach in 10 patients (22.2%).

There was significant difference comparing MPS by gender, female had better results with a mean of 70.06 ± 13.05 ($p<0.05$).

The MPS showed significant difference between the fracture type according to Young-Burgess classification ($p = 0.041$). The mean MPS score is higher in LC and VS than in APC, indicating that functional outcomes are worse in APC injuries (Table 2).

Table 2: Evaluation of gender, trauma characteristics, and fracture types in terms of the functional scores

	MPS Mean ± SD Median (min–max)	P	FSFI6 Mean ± SD Median (min–max)	p	IIEF5 Mean ± SD Median (min–max)	p
Gender						
Male	61.26 ± 10.8 62 (31-76)	0.037[s]	-	-	13.88 ± 6.17 15 (5-29)	-
Female	70.06 ± 13.05 69 (52-96)		21.71 ± 4.76 20 (17-30)		-	
Trauma mechanism						
Motor vehicle crash	60.2 ± 13.3 61.5 (31-76)	0.061[a]	17	0.28[a]	13.2 ± 5.4 15 (5-23)	0.54[a]
Pedestrian accident	64.1 ± 8 64 (52-80)		18.3 ± 1.5 18 (17-20)		18.3 ± 9.7 16 (10-29)	
Fall from height	74.88 ± 12.3 72 (60-96)		24.4 ± 5.4 25 (18-30)		13	
Simple fall	57.67 ± 5.5 58 (52-63)		21		-	
Young-Burgess classification						
APC	61.8 ± 8.8 68 (52-90)	**0.041[a]**	18.5 ± 2.1 18.5 (17-20)	0.25[a]	13.3 ± 5.6 15 (5-23)	0.31[a]
LC	69.8 ± 11.7 68 (52-90)		23 ± 4.2 20.5 (18-29)		16.7 ± 2.9 15 (15-20)	
VS	64.9 ± 16.3 64 (31-96)		22.5 ± 6 20 (17-30)		14.4 ± 8.9 13 (6-29)	
Tile Classification						
A	-	0.094[a]	-	0.28[a]	-	0.34[a]
B	64.9 ± 10.9 (46-90)		20.7±3.9 (17-29)		14.2±5.1 (5-23)	
C	66.2 ± 16.5 (31-96)		23.6±5.9 (18-30)		14.4±8.9 (6-29)	
Surgical approach						
Pfannenstiel	61.8 ± 9 (46-80)	0.07[a]	19 ± 1.4 (18-20)	0.287[a]	15.3 ± 7.1 (5-29)	0.17[a]
Ilioinguinal	67.1 ± 12.6 (52-90)		21 ± 5.4 (17-29)		14.5 ± 7.8 (9-20)	
Modified Stoppa	65.6 ± 5.7 (59-74)		21 ± 3.6 (18-25)		11 ± 5.7 (7-15)	
Posterior sacrum	79.4 ± 12.4 (63-96)		27 ± 5.2 (21-30)		-	
Kocker Langenbeck	55 ± 4.2 (52-58)		19 ± 2.8 (17-21)		-	
External fixation	59.5 ± 20 (31-75)		-		12.7 ± 5.9 (6-17)	
Symphysial plate fixation						
Yes	63.2 ± 7.6 (52-80)	0.36[s]	18.3 ± 1.5 (17-20)	**0.03[s]**	15.8 ± 5.8 (9-29)	0.15[s]
No	66.9 ± 15.3 (31-96)		22.6 ± 4.9 (17-30)		11.3 ± 6.2 (5-20)	

Statistically significant parameters are in bold

FSFI6 female sexual function index, IIEF5 International index of erectile function-5, MPS modified Majeed's pelvic outcomes grading scale, APC anteroposterior compression, LC lateral compression and VS vertical shear.

a One way ANOVA test, sStudent t test

When the Majeed score was “fair” or “poor”, APC injuries are more common. When the Majeed score was “excelent”, LC injuries were more prevalent (p=0.043) (Table 3).

Table 3: Evaluation of fracture types in term of clinical outcomes subdomains.

	MPS (n, %)				p
	Excellent	Good	Fair	Poor	
Young-Burgess classification					
APC	-	3 (6.6%)	8 (17.7%)	6 (13.3%)	0.043
LC	4 (8.8%)	4 (6.6%)	5 (11.1%)	1 (2.2%)	
VS	1 (2.2%)	4 (8.8%)	6 (8.8%)	3 (4.4%)	
Total	11.2%	24.4%	42.2%	22.2%	

Statistically significant parameters are in bold
MPS modified Majeed’s pelvic outcomes grading scale, APC anteroposterior compression, LC lateral compression and VS vertical shear.

The Majeed score didn’t differ according to Tile classification (p=0.094) (Table 4).

Table 4: Evaluation of fracture types in term of sexual dysfunction subdomains.

	FSFI6 (n, %)		p	IIEF5 (n, %)		p
	Sexual dysfunction	No Sexual dysfunction				
Fracture classification						
APC	2 (7.1%)	3 (7.1%)	1	4 (50%)	8 (6.3%)	0.985
LC	2 (14.3%)	4 (28.6%)		2 (12.4%)	-	
VS	3 (21.4%)	3 (21.4%)		4 (25%)	1 (6.3%)	
Total	42.8%	57.1%		87.4%	12.6%	

FSFI6 female sexual function index, IIEF5 International index of erectile function, APC anteroposterior compression, LC lateral compression and VS vertical shear.

There was no significant difference between fracture type in terms of FSFI6 and IIEF5 scores but the APC fracture had the worst outcome values with a mean of 18.5±2.1 (p = 0.25) and 13.3±5.6 (p = 0.31), respectively.

FSFI6 was significant worst when we did symphyseal plate fixation with a mean of 18.3 comparing to 22.6 (p<0.05). However there was no significant difference in terms of Majeed (p=0.361) and IIEF5 score (p=0.157).

DISCUSSION

Pelvic fractures are still among the most devastating musculoskeletal injuries being associated with high mortality and morbidity, despite advances in knowledge regarding underlying pathophysiology and enhancements in the surgical techniques[6].

The mortality rate, even for uncomplicated cases, remain among the highest for any musculoskeletal injury and complications following treatment have been found to occur frequently, often resulting in inferior outcomes[16]. Long-term outcomes of pelvic fractures are related to the severity of bone injuries, the effectiveness of treatment, and the presence of accompanying visceral or neurological trauma[1].

The functional outcome in majority was good to fair (74.2%). Females had better outcome as compared to male counterparts. This may be attributed to exposure of female patients of our study to low energy injury, as 3 out of 19 female patients sustained pelvic fracture due to a simple fall.

In correlation analysis there was association between fracture pattern and functional outcome. APC injuries had the worst clinical outcomes.

In a systematic review, sexual dysfunction was reported to be 35.9% (range 14–72%) in males and 39.6% (31–66%) in females [9]. Unfortunately, the fact that sexual problems are often overlooked by traumatologists and patients usually prefer not to explain their sexual problems [18].

Sexual dysfunction should be assessed separately for both genders because of the important anatomic differences and evaluation methods between male and female. The use of a questionnaire, such as IIEF5 in men and FSFI6 in women, may facilitate the assessment of severity of sexual dysfunction[11], [12], [14].

The time to evaluate sexual function after pelvic fracture is another area of inconsistency in the current literature. Patients should be referred for specialized sexual evaluation and treatment if the sexual dysfunction does not recover spontaneously in 12 months after injury[18].

According to the Young and Burgess classification based on the

injury mechanism, the riskiest injury for bladder rupture is APC, and the riskiest injury for urethral rupture are APC and LC. In the same study, there were relatively high rates of post-traumatic sexual dysfunction (47% in males; 24% in females) and urinary dysfunction (41% in males; 33% in females) in pelvic fracture patients without GUI.

According to Metze, 61% of men with pelvic fracture had some form of erectile dysfunction. Symphyseal distraction or rupture has a higher ED risk than compression. Damage to the posterior portion of the pelvic ring is associated with a permanent problem, possibly due to pelvic plexus injury [19].

In the present study, ED was present in eight (57.1%) patients with APC fracture and in four (28.6%) patients with VS fractures. However it was never seen in LC fracture. Those results didn´t have significant relationship (p=0.743).

ED after pelvic trauma may have different underlying causes like neurogenic causes where the traumatic force may not lead to complete rupture, but tear and damage the cavernosal nerves, vascular causes, reduced penile inflow (arterial damage), increased penile outflow (veno-occlusive dysfunction) and AV-fistulas have been described in ED patients after pelvic fracture[20] [21].

The prevalence of sexual dysfunction in women in the general population is between 5% and 24%. In our study, sexual dysfunction was 42.9% (n= 6). Possible causes of sexual dysfunction include APC injury, symphysis plate fixation and soft-tissue damage around the perineum, as well as neurological or vascular injury during fracture or surgery [22]. In our study, one woman (16.6%) with sexual dysfunction had APC injury and two patients (66.6%) had symphysial plate fixation.

The present study has limitations such as retrospective design, small sample size, heterogeneous injury and treatment spectrum and lack of control group (non-pelvic injury). In addition, the other limitations in this study are no pre-traumatic assessment of sexual function and the associated injuries that may affect chronic pelvic pain or sexual dysfunction. The use of validated questionnaires and having at least 24 months follow-up to observe spontaneous recovery are the strengths of our work.

CONCLUSION

This study establishes that APC is associated with the worst clinical outcomes and suggests that is most common cause of sexual dysfunction in men and VS in women. Orthopedic surgeons should offer solutions not only for orthopedic problems but also for all recoveries. Therefore, when treating pelvic fractures, especially patients with APC and VS injuries should be multidisciplinary evaluated.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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