

# Clinical results in the posterior pelvic injuries which are treated with percutaneous cannulated screw

Zafer Sen<sup>1</sup>, Alper Kurtoglu<sup>2</sup>, Halil Ekrem Akkurt<sup>3</sup>, Halim Yılmaz<sup>4</sup>, Ilker Cöven<sup>5</sup>

<sup>1</sup> Orthopedics and Traumatology Department, Health Sciences University Konya Training and Research Hospital, Konya, Turkey

<sup>2</sup> Orthopedics and Traumatology Department, Sakarya University Training and Research Hospital, Sakarya, Turkey

<sup>3</sup> Physical Therapy and Rehabilitation, Health Sciences University Konya Training and Research Hospital, Konya, Turkey

<sup>4</sup> Physical Therapy and Rehabilitation, Health Sciences University Konya Training and Research Hospital, Konya, Turkey

<sup>5</sup> Neurosurgery, Health Sciences University Konya Training and Research Hospital, Konya, Turkey

**Abstract.** *Study Objectives:* The sacrum is an important structure that provides approximately 70% of the body weight to be transmitted to the pelvic ring. Sacral fractures and associated sacroiliac joint injuries may occur with high-energy injuries in young people and low-energy trauma due to osteoporosis in elderly patients. *Methods:* 21 patients who underwent posterior pelvic ring injury between 2012 and 2020 at the Health Sciences University Konya Training and Research Hospital were studied. Percutaneous Sacroiliac Screwing (PSS) technique was used as the operation technique. Patients who had bilateral posterior ring injury and were operated on were studied. *Results:* There was no significant difference between demographical characteristics (age, gender) and the fracture type, and POS also ( $p>0.05$ ). However, the weight of the patients in “fair” class was found significantly higher ( $p=0.026$ ). Besides, the operation time was significantly lower in “excellent” and “good” POS classes ( $p=0.017$ ). *Conclusions:* In the study performed by Chen et al., the exposure of scopy was found to be 22.1 shots 5. In our study, it was found to be 25.04 shots on average although the method was bilateral PSS. Although PSS has a learning curve, it is an easy-to-apply technique. Although bilateral PSS was used in our study, the duration was found to be 22 minutes. It can be concluded that PSS is a minimally invasive technique with a high learning curve and performing bilateral PSS through the same guide shortens the surgical time and reduces the exposure of scopy.

**Keywords:** Posterior pelvic ring injuries, PSV technique, Pelvic Outcome Score

## Introduction

The sacrum is an important structure that provides approximately 70% of the body weight to be transmitted to the pelvic ring (1,2). Sacral fractures and associated sacroiliac joint injuries may occur with high-energy injuries in young people and low-energy trauma due to osteoporosis in elderly patients (2). Anterior pelvic ring injuries are usually accompanied by posterior pelvic ring injuries. Anterior pelvic ring injuries are performed by direct imaging methods and

physical examination. However, in this way, posterior pelvic ring injuries may not be diagnosed. During the physical examination, no neurological symptom is present at a rate of 75% (3,4). For this reason, diagnosis can be difficult (5,6).

Different surgical methods have been described in posterior pelvic ring injuries(7-9). These are internal fixation with anterior and posterior approach plate screw system, transiliac rod method, percutaneous iliosacral cannulated screw (10,11). The percutaneous sacroiliac screwing (PSS) method has increased

its popularity with the development of standard imaging methods in impaired posterior pelvic ring injuries (12,13). By this method, unstable pelvic injuries can be treated with minimal morbidity, but can also lead to serious complications (14,15). Surgical experience is one of the most important factors. It is used in the surgical treatment of posterior pelvic ring injuries, spinal plane distortion, unstable fractures, non-union problems after conservative treatment (16). Internal fixation selection is recommended for surgical treatment of unstable pelvic fractures (17,18).

In this study, it was aimed to shorten the surgical time by screwing up both screws on the right and left side with the same guide in cases with unstable bilateral percutaneous iliosacral screws. Moreover, it was aimed to reduce the complication rate, evaluate our case results, reduce the exposure to radiation, and discuss the results with the literature.

## Materials and Methods

The ethics approval was obtained from the Ethics Committee for Non-Medicinal and Medical Device Researches with the decision dated 17th of April 2020 and No: 2020/2424. In a Training and Research Hospital, 25 patients with pelvic injury between September 2012 and December 2019 were retrospectively analyzed. The files of patients were scanned, and pre-op and post-op direct graphs and tomography images were evaluated. A total of 21 cases with a posterior pelvic injury, no pre-op neurological deficit, at least a 6-month follow-up, and bilateral iliosacral screws were included in the study. Four cases were excluded since two patients had pre-op neurological deficits, and two patients had no 6-month follow-up from the study.

### Classification

Posterior pelvic injuries were classified according to the Tile classification. Therefore;

Type A: Stable pelvic ring injuries

A1: Innominate bone avulsions

A2: Stable iliac wing fracture or stable minimally separated pelvic ring fracture

A3: Sacrum and coccyx transverse fracture

Type B: Partial stable injuries (rotational instability, vertical stability)

B1: Open book type injuries

B2: Lateral compression injuries

B3: Bilateral type B injuries

Type C: Unstable injuries (rotational and vertical unstable)

C1: Unilateral

C2: Bilateral type B, unilateral type C

C3: Bilateral type C injuries

### Imaging

11 of our cases (52.3%) were Tile B3, and 10 of our cases (47.7%) were of type Tile C2. The pre-op and post-op pelvic anteroposterior, inlet & outlet graphs, and pelvic computed tomography of the patient groups were examined through the imaging system. Patients' age, gender, operation time, number of scopy shots (exposure time with 1 sec exposure time), and postoperative complications were recorded.

### Pelvic Outcome Score (POS) Evaluation

The patients were given a partial weight bearing one day after surgery, and full weight bearing after eight weeks. In the post-op 3rd month, the patients were evaluated with Pelvic Outcome Score (POS). POS value is calculated by combining radiological and clinical scores. A total of 7 points can be obtained from the scale. 7 points are evaluated as excellent results, 6 points as good results, 5-4 points as fair results, 3-2 points as poor results, 1 point as very poor results (1,19). For the fixation of the percutaneous posterior sacroiliac, 6.5 mm washer cannulated screws and a 60 cm screw-through guide were used.

### Statistical Analyses

The statistical analyses were performed by SPSS (IBM Inc, Chicago, IL, USA) with version 20.0. The descriptive statistics were presented as mean±SD (min-max) and frequency (percentage). Mann-Whitney U test was used for fracture type groups and the Kruskal-Wallis test was used for POS levels to compare the age, operation time, scopy shots, and weight. Monte



**Figure 1.** Intraop percutaneous bilateral iliosacral screwing



**Figure 2.** Intraop PSS scopy imaging



**Figure 3.** Direct graphy of post-op PSS



**Figure 4.** CT image of post-op PSS

Carlo Exact Chi-square test was used to evaluate the relationship between fixing material, gender, and POS.  $p < 0.05$  was considered statistically significant

## Results

A total of 21 patients who underwent surgery because of posterior pelvic ring injury were enrolled in the study (Table 1). The percutaneous sacroiliac screwing technique (PSS) was used as the operation technique. During the operation, a 6.5 mm washer cannulated screw was placed on the S1 vertebra. The screws were placed on the right and left sides with the same guide.

The mean age of the patients was  $48.4 \pm 19.3$  (17.0-82.0), and 52.3% of the cases were male ( $n=11$ ). The mean weight of the patients was  $79.52 \pm 8, 40$  kg. Percutaneous internal fixation was performed in all cases by the posterior sacroiliac (PSS) technique. Of the PSS cases, 52.3% ( $n=11$ ) was Tile B3 and 47.7%

( $n=10$ ) was Tile C2. The mean follow-up time of the patients was 13 months (9.0-96.0), the mean duration of the operation was 22 minutes (15.0-29.0), and the mean number of scopy shots was  $\sim 25$  (18.0-40.0) (Figure 1). In PSS cases, POS was observed in 8 cases (38.09%) as excellent, in 6 cases (28.57%) as good, in 5 cases (23.80%) as fair and in 2 cases (9.52%) as fair (Figure 2-4). There was no significant difference between demographical characteristics (age, gender) and the fracture type, and POS also ( $p > 0.05$ ). However, the weight of the patients in "fair" class was found significantly higher ( $p=0,026$ ). Besides, the operation time was significantly lower in "excellent" and "good" POS classes ( $p=0.017$ ) (Table 2).

The mean number of scopy shots in patients of Type B3 was  $26.0 \pm 7.11$  and  $24.0 \pm 4.52$  in Type C2 (0.457). In one of the follow-up cases, relaxation occurred in the weight-bearing phase. The POS value of this patient was poor class, but the revision was not considered in the patient who did not show any weakness in the sacroiliac joint and was clinically relieved.

**Table 1.** Characteristics of the patients according to fracture types

Features	Categories	Tile B3	Tile C2	Total	<i>p</i>
		n (%)	n (%)	n (%)	
Gender	Male	5 (45.5)	6 (60.0)	11 (52.4)	0.515
	Female	6 (54.5)	4 (40.0)	10 (47.6)	
POS	Poor	1 (9.1)	1 (10.0)	2 (9.5)	0.202
	Fair	1 (9.1)	4 (40.0)	5 (23.8)	
	Good	4 (36.4)	3 (30.0)	7 (33.3)	
	Excellent	5 (45.5)	2 (20.0)	7 (33.3)	
Post-op Complications	None	9 (81.8)	10 (100)	19 (90.5)	0.167
	Yes	2 (18.2)	0 (0.0)	2 (9.5)	
Additional problem	None	10 (90.9)	10 (100.0)	20 (95.2)	0.340
	Yes	1 (9.1)	0 (0.0)	1 (4.8)	
<b>Mean±SD</b>					
Age	year	43.45±17.14	54.00±20.98	48.48±19.34	0.221
Operation time	min	21.91±4.01	22.10±4.48	22.00±4.13	0.919
Scopy shots	number	26.00±7.11	24.00±4.52	25.05±5.96	0.457
Weight	kg	78.18±7.85	81.00±9.15	79.52±8.40	0.457

**Table 2.** Demographical and clinical characteristics of the patients according to the fracture types

Categories	Age	Weight	Operation time	Scopy shots
	Mean±SD			
Poor	56.00±29.69	75.00±7.07	24.50±4.95	27.50±6.54
Fair	58.40±12.34	87.80±5.58	25.80±3.70	29.40±7.12
Good	54.43±15.41	80.43±6.07	22.14±3.07	25.14±6.04
Excellent	33.29±18.71	74.00±8.30	18.43±2.29	22.00±4.16
<i>p</i>	0.071	0.026*	0.017*	0.254

Two patients had complications as loosen screws and infection in the rectum in the post-op period. The POS classes were not related to fracture types ( $p=0.202$ ).

## Discussion

Internal fixation is used in the treatment of Tile type C2 unstable fractures. Plaque screw system, PSS, iliosacral bar methods can be used as internal fixation (1). Today, according to the studies, it is a widely preferred technique because it is more stable than the plate screw and iliosacral bar method in terms of PSS

stability (20-23). Both the surgeon's and the patient's scopy exposure is high at the beginning due to the PSS learning curve. Moreover, the PSS method can damage vascular and neurological structures (19, 24).

In the study performed by Chen et al., the exposure of scopy was found to be 22.1 shots (5). In our study, it was found to be 25.04 shots on average although the method was bilateral PSS. Lindhahl and Hirvansolo reported that 6% of patients had a reduction loss and 2% of them had malposition after PSS operation in their study (25). In our study, only one case had a reduction loss in screw (4.7%). However, there were no observed joint changes, and the case was

not revised as he/she did not provide any additional clinical findings. In the studies, it was reported that compared to anterior plating, percutaneous unilateral sacroiliac screwing is less interventional (26), PSS gives more reliable results in unstable pelvic fractures (27) and this technique can be used to conduct a successful process (28). In addition, in some recent studies, sacroiliac screwing with the help of TiRobot is the minimally invasive method with reliable, suitable, and meaningful results (29). It has been stated that it gives better results in terms of quality of life (30).

Although PSS has a learning curve, it is an easy-to-apply technique (19). In a study by Chen et al., PSS operation time was found to be 58.2 minutes (5). Although bilateral PSS was used in our study, the duration was found to be 22 minutes. In a study by Kılınç, functional scores of posterior screw fixation and posterior plate screw fixation were found similar (1).

## Conclusions

The union of post-op PSS and post-op functional results was similar to the results of the internal fixation of the posterior plate screw system. Although it was not observed in our study, in the literature, it is stated that there is a serious risk of neurological and vascular injury with posterior screw fixation. It can be concluded that PSS is a minimally invasive technique with a high learning curve and performing bilateral PSS through the same guide shortens the surgical time and reduces the exposure of scopy.

## Conflicts of Interest

The authors declare that there is no conflict of interest in this manuscript.

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Correspondence:

Zafer Şen

Orthopedics and Traumatology Department, Health Sciences University Konya Training and Research Hospital, Konya, Turkey

E-mail: zafersenkny@gmail.com