

## ORIGINAL ARTICLE

## Functional Outcome of Percutaneous Ilio-sacral Screw Fixation for Posterior Pelvic Ring Injuries

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## ABSTRACT

## BACKGROUND

This study aimed to assess the functional outcomes of percutaneous ilio-sacral screw fixation in the treatment of posterior pelvic ring injuries.

## METHODS

A total of 34 (out of 42) adult patients treated with percutaneous ilio-sacral screw fixation for posterior pelvic ring injuries, with or without associated anterior ring injuries between January 2020 and December 2023, were included in this study. There were 35% females and 65% males, all of whom completed follow-up evaluation. Clinical and radiological follow-up assessments were performed at six months, and functional outcomes were evaluated using the Majeed Functional Score.

## RESULTS

The mean age of patients was 34.29 years  $\pm$  13.29. The average hospital length of stay was 22.88 days  $\pm$  18.63. Patients were categorized by Tile classification, with B3 injuries being the most common (26.47%), followed by C2 injuries (20.59%). Injury mechanisms included two-wheeler accidents (35.29%), pedestrian accidents (17.65%), and falls from height (14.71%). Functional outcomes assessed using the Majeed Functional Score showed excellent results in 79.41% of patients, good in 8.82%, fair in 8.82%, and poor in 2.94%. There was no incidence of neurological injury in this cohort.

## CONCLUSION

The findings suggest that, if executed correctly, percutaneous ilio-sacral screw fixation is a safe and effective method for managing posterior pelvic ring injuries. Most patients achieved excellent functional outcomes, aligning with previous research on this treatment modality.

## KEYWORDS

Majeed functional score, percutaneous ilio-sacral fixation, unstable posterior pelvic injuries

## INTRODUCTION

Posterior pelvic ring injuries are complex, often unstable, and difficult to manage effectively. Among these injuries, sacroiliac fractures are particularly severe and usually occur as a result of high-energy trauma, such as motor vehicle accidents or falls from significant heights.<sup>1</sup> The incidence of pelvic fractures is reported to range between 2% and 8% of all traumatic injuries,<sup>2</sup>

with a global mortality rate that can be as high as 33% in severe cases.<sup>3,4</sup> The sacroiliac joint plays a critical role in maintaining the stability of the posterior pelvic ring, as it is the primary structure responsible for supporting the body's weight. Any disruption to this joint can lead to significant instability in the pelvic ring, complicating recovery and treatment.<sup>5</sup>

The primary goal of surgical treatment for displaced and unstable pelvic ring fractures, including sacroiliac dislocations, is to restore anatomical alignment and provide stable fixation. This allows for early mobilization, which is crucial for improving patient outcomes and reducing complications associated with prolonged immobility.<sup>1</sup> Several surgical techniques are commonly used to address unstable pelvic fractures, including sacroiliac anterior

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plate fixation (SAPF), percutaneous sacroiliac screw internal fixation (PSCIF), and sacroiliac anterior papilionaceous plate (SAPP).<sup>6</sup> Among these, studies have demonstrated that PSCIF is more effective than SAPF in stabilizing unstable pelvic fractures, offering better outcomes for patients.<sup>7</sup>

In recent years, there has been an increasing emphasis on minimally invasive surgical techniques, which are favored for their ability to reduce blood loss, shorten surgical duration, and promote faster recovery times.<sup>8</sup> However, these techniques are not without risks; one of the potential complications of percutaneous screw fixation is screw malposition, which can lead to nerve or vascular injuries if not carefully managed.<sup>8,9</sup>

Assessing the outcomes of pelvic ring fractures is inherently challenging due to the variability in study designs, classification systems, and the frequent presence of multiple associated injuries in patients. This complexity underscores the importance of conducting focused research on the functional outcomes of percutaneous ilio-sacral screw fixation in cases of sacroiliac injuries.<sup>10</sup> Such studies are essential to better understand the efficacy, safety, and long-term benefits of this minimally invasive approach, ultimately improving patient care and recovery.

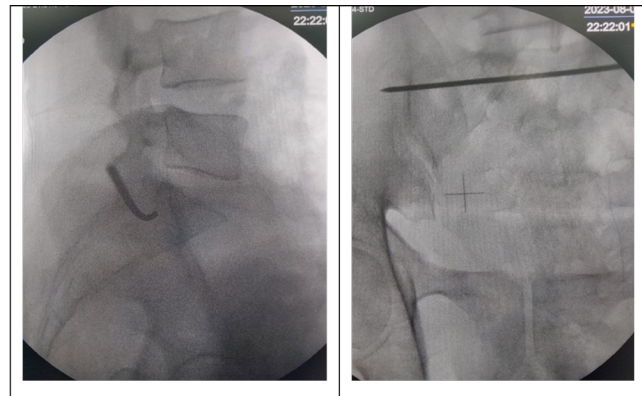
## METHODS

This prospective study was conducted in the Department of Orthopedics, B&B Hospital from January 2020 to December 2023, involving a total of 42 patients who were clinically diagnosed and radiologically confirmed with partially or completely unstable posterior pelvic ring injuries. However, the Majeed functional score could only be calculated for 34 patients, as eight patients were unreachable despite multiple attempts to contact them through various means. Ethical approval (B&BIRC-25-5) was obtained, and informed consent was taken from participants. Inclusion criteria comprised traumatic unstable posterior pelvic injuries classified by the Tile classification system, skeletally mature individuals, a minimum of six months of follow-up post-surgery, and willingness to provide written consent. Exclusion criteria included injuries requiring open reduction, skeletal immaturity, and concomitant lower limb fractures. Data were collected using an electronic pro forma and recorded in Microsoft Excel 2019, capturing variables such as age, gender, injury mechanism, fracture type, hospital stay, complications, and Majeed Functional Score (MFS). Continuous variables were presented as mean  $\pm$  standard deviation, while categorical data were shown as frequencies and percentages using appropriate statistical methods.

### SURGICAL TECHNIQUE

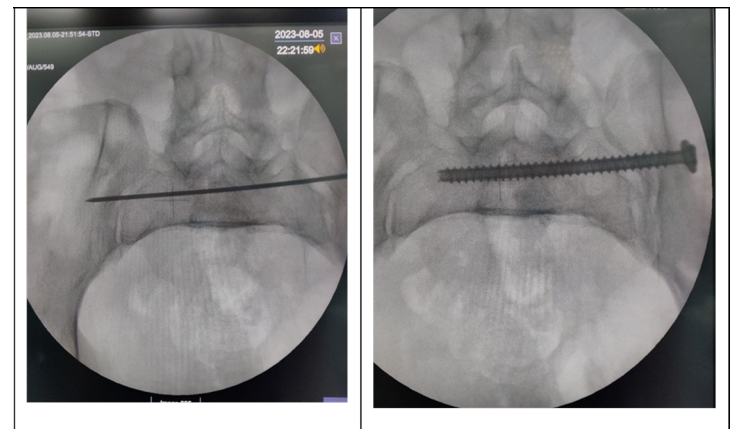
A small incision is made over or slightly lateral to the posterior superior iliac spine (PSIS), and blunt dissection is performed to minimize damage to surrounding tissues. Under fluoroscopic guidance, a guidewire is inserted through the ilium into the S1/S2 vertebral body. The proper trajectory is confirmed using inlet, outlet, and lateral views: the inlet view verifies anterior-posterior positioning, the outlet view ensures superior-inferior alignment, and the lateral view confirms depth and alignment within the sacral ala. The area is then drilled over the guidewire, carefully avoiding the spinal canal and neuroforamina. The

screw length is measured, and a cannulated screw is inserted over the guidewire, ensuring the screw head is flush with or slightly recessed into the ilium. Care is taken to prevent the screw from breaching the anterior sacral cortex or encroaching on neural structures.



Lateral View

Outlet view



Inlet View

Screw Placement

**Fig. 1: Different fluoroscopic views for sacroiliac screw fixation technique**

## RESULTS

The study included 34 participants, predominantly male (64.71%, n =22), with a mean age of 34.29 years ( $\pm 13.29$  SD). The average hospital stay was 22.88 days ( $\pm 18.63$  SD), reflecting varied recovery times. Road traffic accidents were the primary injury cause, with two-wheeler collisions (35.29%, n =12) leading, followed by pedestrian (17.65%, n =6) and four-wheeler incidents (14.71%, n =5). Falls (14.71%, n =5) and rarer causes (e.g., landslides, n =1) were also noted. Associated injuries were common (64.65%, n =23), with spinal (34.78%, n =8) and genitourinary (30.43%, n =7) injuries most frequent. Combined anterior and posterior fixation was performed in 29.41% (n =10) cases. Percutaneous sacroiliac screw fixation was used for all sacroiliac joint or sacral fractures, and anterior plate fixation was applied for anterior ring fractures involving the acetabulum or quadrilateral plate.

**Table 1: Baseline characteristics of included patients (N=34) including age, Mechanism of injury, length of hospital stay, side involved, associated injury, and other bony injury.**

Particular	Frequency	Percentage
<b>Gender</b>		
Female	12	35.29
Male	22	64.71
<b>Age</b>		
Mean	34.29(SD±13.29)	
<b>Length of Stay (Days)</b>		
Mean	22.88(SD±18.63)	
<b>Injury Mechanism</b>		
2-wheeler	12	35.29
3-wheeler	2	5.88
4-wheeler	5	14.71
6-wheeler	3	8.82
Fall from height	5	14.71
Other (landslide injury)	1	2.94
Pedestrian	6	17.65
<b>Associated Injury</b>		
No	11	35.35
Yes	23	64.65
<b>Types of Associated Injuries (Yes = 23)</b>		
Chest	3	13.04
Spine	8	34.78
Head	4	17.39
Abdomen	1	4.35
Genitourinary	7	30.43%
Combined anterior and posterior fixation	10	29.41%

**Table 2: Injury categorized according to the Tile classification**

Tile classification	Frequency	Percentage
A2	1	2.94%
A3	3	8.82%
B1	5	14.71%
B2	2	5.88%
B3	9	26.47%
C1	4	11.76%
C2	7	20.59%
C3	3	8.82%

Tile's classification revealed B3 as the most common fracture type (26.47%, n =9), followed by C2 (20.59%, n =7) and B1 (14.71%, n =5). Less frequent types included C1 (11.76%, n =4), A3 and C3 (8.82% each, n =3), B2 (5.88%, n =2), and A2 (2.94%, n =1). The high prevalence of B3 and C2 fractures indicates a predominance of complex and unstable pelvic injuries, likely linked to severe trauma mechanisms. This underscores the need for tailored surgical and rehabilitative approaches.

Most patients (79.41%) achieved excellent functional outcomes based on the Majeed Functional Score (MFS) at follow-up. Fair and good outcomes were each seen in 8.82% of patients, while 2.94% had poor recovery. For cases with associated injuries, the outcomes were similar: Excellent (73.91%), Fair (13.04%), Good (8.69%), and Poor (4.34%). In cases without associated injuries, results were better: Excellent (81.81%), fair (9.09%), good (9.09%), and no poor outcomes were observed. These findings indicate that the majority of patients attained favorable functional recovery.

## DISCUSSION

The management of posterior pelvic ring injuries continues to pose significant challenges in orthopedic trauma surgery, with percutaneous ilio-sacral screw fixation emerging as a preferred treatment method. Our study highlights the effectiveness of this technique, with 79.41% of patients achieving excellent results based on the Majeed Functional Score. These outcomes are comparable to those reported in similar studies, underscoring the reliability of this approach.

The mean age of our patient cohort was 34.29 years, which aligns with findings from other studies, such as Wang et al. (2020), who reported a mean age of 38.2 years, and Zhang et al. (2019), who documented a mean age of 36.7 years.<sup>11,12</sup> This demographic trend reflects the higher incidence of high-energy trauma, such as two-wheeler accidents (35.29%) and pedestrian accidents (17.65%), in younger, active populations. These mechanisms of injury were predominant in our study, consistent with patterns observed in other research.

In our patient series, Tile-type B3 injuries represented the predominant fracture pattern (26.47%), with C2 injuries comprising the second most frequent group (20.59%). This distribution corresponds with data from a Dutch cohort study that documented type B fractures in 39.3% of cases and type C fractures in 35.2% of patients.<sup>13</sup> The frequency of these severe pelvic disruptions emphasizes the necessity for robust fixation methods, particularly percutaneous ilio-sacral screw techniques when addressing complex pelvic ring injuries. This minimally invasive surgical approach demonstrates significant advantages by providing immediate stabilization while minimizing operative duration, reducing blood loss, and decreasing wound complications compared to traditional open procedures.

Our patients' average hospital stays of 22.88 days exceeded durations reported elsewhere, including 17.9 days for complex fractures in Taiwan<sup>14</sup> and a median of 9 days in Spain.<sup>15</sup> This disparity likely reflects differences in rehabilitation approaches, associated injuries, or institutional practices. Nevertheless, our cohort achieved remarkable functional outcomes, with 79.41% scoring excellent on the Majeed Functional Score significantly better than the 10.17% excellent outcomes reported in a developing



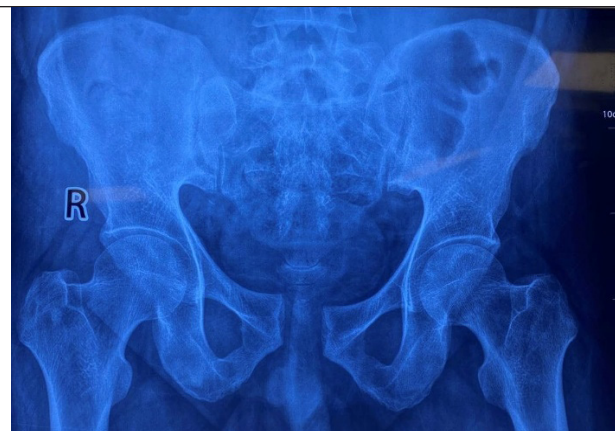


Fig. 2a: Pubic diastasis with left sacroiliac joint disruption

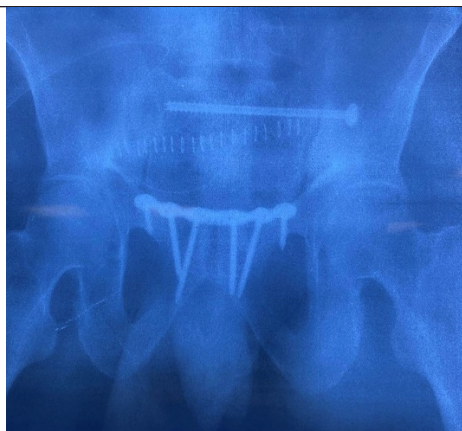


Fig. 2b: Post-operative pelvic outlet view radiograph

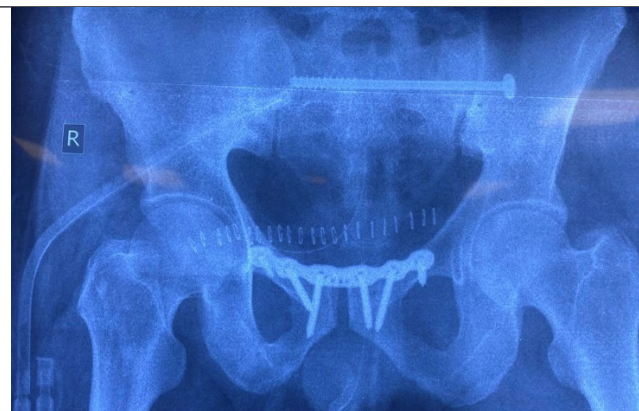


Fig. 2c: Post-operative pelvic antero-posterior view radiograph



Fig. 2d: Post-operative pelvic inlet view radiograph



Fig. 2e: Post-operative CT scan left sacroiliac joint fusion



Fig. 2f: Sitting cross-legged.



Fig. 2g: Squatting.



Fig. 2h: Single leg standing

**Table 3: Clinical outcomes assessed using the Majeed Functional score (MFS) at the follow-up**

MFS of all cases			MFS with associated injuries		MFS without associated injuries	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<b>Excellent</b>	27	79.41%	17	73.91%	9	81.81%
<b>Fair</b>	3	8.82%	3	13.04%	1	9.09%
<b>Good</b>	3	8.82%	2	8.69%	1	9.09%
<b>Poor</b>	1	2.94%	1	4.34%	0	0

country study.<sup>16</sup> We attribute these superior results to careful patient selection, surgical precision, structured rehabilitation, and early mobilization protocols. These findings highlight how comprehensive perioperative care substantially influences recovery following pelvic fractures, despite longer hospitalization periods.

Our research demonstrated a minimal complication rate, with just 2.94% of patients experiencing unfavorable results. This compares advantageously to findings from a five-year follow-up investigation of 194 pelvic fracture surgeries, which reported a 25% unplanned reoperation rate. The lower complication rate in our study may be due to the use of advanced imaging techniques and strict adherence to surgical principles during the procedure.<sup>17</sup>

Overall, 88.23% of our patients achieved good to excellent outcomes, further validating the effectiveness of percutaneous ilio-sacral screw fixation. Similar success rates have been reported by one study which reports 83.32% results using the Majeed scoring system, while other reports an impressive 75% excellent to good outcomes in their cases.<sup>18,19</sup> These consistent findings across multiple studies reinforce the reliability of this technique for managing posterior pelvic ring injuries.

A limitation of our study is the relatively short follow-up period compared to some long-term studies in the literature. Future research should focus on evaluating long-term outcomes and potential late complications associated with this fixation technique.

## CONCLUSION

The study demonstrates that percutaneous ilio-sacral screw fixation is associated with excellent functional outcomes for most posterior pelvic ring injuries. The majority of patients (79.41%) achieved excellent results based on the Majeed Functional Score, indicating significant recovery and restoration of pelvic function. This minimally invasive technique appears to be highly effective in stabilizing pelvic fractures, particularly in cases involving Tile B3 and C2 injuries, which were the most common in this cohort. These findings suggest that this method is a reliable and effective treatment option for pelvic fractures with sacroiliac injury.

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