

## ANTERIOR PELVIC PLATE OSTEOSYNTHESIS AND PERCUTANEOUS SACROILIAC JOINT SCREW FIXATION IN OPEN-BOOK PELVIS FRACTURE.

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### ABSTRACT

**INTRODUCTION:** Osteofixation using the Plate-Screw system is currently regarded as the gold standard for open-book pelvic fractures; it provides stable fixation and also permitting early mobilization and rehabilitation. **OBJECTIVE:** To determine the outcome of anterior plate osteosynthesis and percutaneous sacroiliac screw fixation for open-book pelvic fracture. **METHODOLOGY:** This retrospective and cross-sectional study was performed at the Department of Orthopaedic, Dr KM Pfau Civil Hospital, Karachi, Pakistan from January 2017 to December 2019. In this study, we reviewed the medical record of all skeletally mature patients who underwent surgical treatment for open-book pelvis fracture (Tile B and Young-Burgess APC II). Patients with open fracture, or associated with acetabular fractures, concomitant spinal injuries, and those definitively managed with external pelvic fixator were excluded. The functional outcome was evaluated according to Majeed scoring system. Immediate postoperative and follow-up radiographs at minimum 6-month were reviewed for evidence of screw loosening and implant failure. **RESULTS:** A total of 19 patients; 4(21.1%) females and 15(78.9) males with a mean age of  $38.47 \pm 10$  years were included. Five patients (26.3%) underwent combined anterior plate fixation and posterior sacroiliac (SI) joint screw fixation. 14 patients (73.7%) underwent only anterior symphyseal plate fixation. Trauma due to road traffic accidents was the most frequent cause and was observed in 13 (68.4%) cases. Partial screws back-out was noted in 1 patient. According to Majeed functional scoring system averaged 77.94 (50–96); 04(21.1%) patients achieved excellent while 11(57.9%) patients had good outcome. 03 (15.7%) patients showed a fair outcome while 1 (5.3%) had poor functional outcome. **CONCLUSION:** We concluded that anterior plating and a supplemental posterior fixation is a safe and effective method for the stabilization of anterior pelvic ring fracture. It produces a low rate of complication and provides stable fixation to enable early mobilization.

**KEYWORD:** Anterior Plate, Sacroiliac Screw, Open-Book, Pelvic Fracture

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### INTRODUCTION

Traumatic injury to the pelvis causes significant mortality and morbidity, all over the world, and often the result of high-energy trauma such as traffic-related accidents or a fall from significant height<sup>1</sup>. Epidemiologic studies show that open book Pelvic fractures are rare and represent approximately 13% to 16% of all pelvic fractures and 1.5% to 3% of all skeletal fractures<sup>1-3</sup>. The goal of treatment in these open-book pelvic fractures is to provide stable fracture reduction and fixation to allow early patient mobilization. There are several publications claiming that proper prompt fixation of these pelvic fractures provides the highest chances of good function<sup>4-7</sup>. These injuries if inadequately managed or neglected may lead to chronic pain at the sacroiliac joint, gait abnormalities, pelvic obliquity, sitting discomfort and disturbance of sexual, bladder or sphincter function<sup>8, 9</sup>. There are several surgical procedures used to perform fracture stabilization, such as external fixation, tension band wiring, plate fixation, cannulated

screw fixation, and so on. Osteofixation using the Plate-Screw system is currently regarded as the gold standard; it provides stable fixation and also permitting early mobilization and rehabilitation while avoiding the complications and problems associated with either external fixation or tension band wiring<sup>10, 11</sup>. However in our level-I Trauma Centre, where we are performing this procedure in a substantial number, nevertheless no such specific study has been done. Hence to determine the clinical and radiological outcomes of anterior plate fixation for open book pelvic fracture and to compare our results with existing literature, the current study is being undertaken.

### METHODS:

This retrospective and cross sectional study was performed at Department of Orthopaedic, Dr KM Pfau Civil Hospital affiliated to Dow Medical College, Karachi, Pakistan from January 2017 to December 2019. Ethical approval was not required due to its retrospective nature. Data

was extracted prospectively by reviewing the medical record and radiographs of all skeletally mature patients who sustained open book pelvis fracture (Tile B and Young-Burgess APC II) and underwent anterior symphyseal plate fixation alone or in combination with posterior sacro-iliac screw fixation when necessary. Patients with open fractures associated acetabular fractures, concomitant spinal injuries, and those definitively managed with an external pelvic fixator were excluded. All surgical procedures were performed by a senior orthopaedic surgeon, by using the previously presented standard surgical technique. All patients underwent open reduction and fixation of the anterior pelvic ring via a Pfannensteil incision, using four to six holes reconstruction plates with or without percutaneous fixation of posterior SI joint using 6.5mm cannulated screw if required. Predesigned data collection sheets were used. Preoperative and operative patients' demographics and clinical data including age, gender, injury mechanism, pelvis fracture type (Tile and Young-Burgess classification), associated urogenital and abdominal injury, operative procedure, an implant used, time to surgery, length of hospital stay, postoperative radiological assessment, functional outcome score, post-fixation complication and follow-up duration were gathered through a review of the medical record and radiographs. The functional outcome was evaluated using a Majeed scoring system<sup>12</sup>, which was based on the clinical findings as pain, sitting, sexual intercourse, walking and work. Immediate postoperative and follow-up radiographs at a minimum 6-month were reviewed for evidence of screw loosening and implant failure.

#### DATA ANALYSIS:

The data were analyzed with IBM SPSS statistics base for windows, version 22.0. Descriptive statistics including frequencies,

percentages, means, and standard deviations were used to summarize the demographic characteristics of the study sample. Statistical significance was determined using the Student T test with a P value of < 0.05 considered significant.

#### RESULTS

A total of 19 patients were inducted; 4(21.1%) females and 15(78.9) males with a mean age of  $38.47 \pm 10$  years. (Table. I); these gender differences may be due to higher exposure of male to traffic accidents because, in our country, male are still main working population. Five patients (26.3%) underwent combined anterior plate fixation and posterior SI joint screw fixation. 14 patients (73.7%) underwent only anterior symphyseal plate fixation. Four-hole plate was used in 11 and a six-hole plate in 8 patients for anterior symphyseal fixation whereas single screw was used in 4 patients and double screw in 1 patient for posterior fixation. Trauma due to road traffic accidents was the most frequent cause and was observed in 13 (68.4%) cases, followed by fall from height in 5 (26.3%) and crush injury in 1 (5.3%) case. 5 patients had other concomitant injuries. Mean delay between the trauma and surgery was  $4.31 \pm 1.24$  days. The reason behind such surgical delay were mainly late reporting of patients, and delay in admission due to over burden in our government setup hospital. The mean length of hospital stay was  $6.57 \pm 1.89$  days. Partial screws back-out was noted in 1 patient. However, despite implant failure, no patients to date had required revision as they had a good functional outcome. According to Majeed functional scoring system averaged 77.94 (50–96); 04(21.1%) patients achieved excellent while 11(57.9%) patients had good outcome. 03 (15.7%) patients showed a fair outcome while 1 (5.3%) had a poor functional outcome.

**Table 1. Patient's demographic data and clinical characteristics.**

Variables		N (%)
Age, Mean±SD (year)		38.47 ± 10 years
Sex	Male	15(78.9)
	Female	4(21.1%)
Day (from injury to operation)		4.31±1.24 day
Hospitalization time		6.57±1.89 days
Injury mechanism	Traffic related accident	13 (68.4%)
	Fall from a height	05 (26.3%)
	Others	01 (5.3%)
Surgical procedure	Anterior plating alone	14 (73.7%)
	Anterior plating + Sacroiliac screw	05 (26.3%)
Implant used	Anterior symphyseal plate	
	Four hole	11 (57.9%)
	Six hole	08 (42.1%)
	Posterior SI joint Screw	
	Single	04 (21.1%)
	Double	01 (5.3%)
Mean Majeed score		77.94 (50-96)
Majeed functional grade	Excellent	04 (21.1%)
	Good	11 (57.9%)
	Fair	03 (15.7%)
	Poor	01 (5.3%)



**Figure.1: Pre-operative X-ray of patient with openbook pelvic fracture**



**Figure.2: Post-operative X-ray of patient with anterior plate osteosynthesis**

## DISCUSSION

The pelvic ring is anatomically composed of the two paired innominate bones and the sacrum that held together anteriorly by pubic symphysis and anterior sacroiliac (SI) ligaments and posteriorly by posterior sacroiliac, sacrospinous, and sacrotuberous ligaments<sup>13</sup>.

Any fracture that results in significant separation of the pubic symphysis and SI joint is termed an open-book pelvic fracture.

The basic goals when treating these open-book fractures are the same as those for fractures of other bones; to provide stable fixation to allow early mobilization.

Various methods of fixation devices have come and gone. Osteofixation using the Plate-Screw system is currently regarded as the gold standard for definitive management and has been shown to provide better results<sup>3, 4, 7</sup>. However, there remains debate regarding posterior pelvic stabilization in addition to anterior plate fixation for these injuries. Many authors believe that posterior pelvic integrity is necessary for pelvic stability<sup>5, 6</sup>. Sagi CH et al<sup>14</sup> compared two-hole and multi-hole anterior symphyseal plating and reported a higher rate of fixation failure in the two-hole anterior plate (17 of 51; 33%) than the multi-hole plate (5 of 41; 12%). Moreover, in their series, 18 patients with APC-3 injury treated with a supplemental posterior screw fixation; interestingly, none had a failure of fixation. Although it was not the purpose of their study, but their findings suggested that posterior ring stabilization enhances anterior stability as evidenced by the significantly lower rate of anterior plate failure. More recently, Avilucea FR et al<sup>7</sup> performed a study to compare combined anterior-posterior pelvic ring fixation with anterior plate fixation alone in adult patients with a traumatic APC-2 pelvic disruption. The results demonstrated that a supplemental posterior SI joint screw fixation significantly reduces the rate of anterior plate failure and malunion compared with an anterior plate fixation alone. In another, similar study, Choy WS et al<sup>4</sup> studied 32 patients with unstable pelvic ring disruptions underwent anterior pelvic plating and subsequent percutaneous SI joint fixation and reported that in patient with unstable pelvic ring injuries, combined anterior-posterior fixation is an effective treatment option since it has shown a high success rate and a low complication rate.

Recently, Moed BR et al<sup>5</sup> conducted an anonymous online international survey among

176 experienced pelvic surgeons regarding their preferred fixation method (combined anterior-posterior or anterior alone) for open-book-pelvic fractures and concluded that concern regarding the inadequate anterior plate fixation alone had led many young pelvic surgeons, to add posterior fixation despite limited data to determine its indication. Similarly in another online questionnaire-based survey published by Gill JR et al<sup>6</sup> among 38 pelvic and acetabular surgeons in the United Kingdom to identify the best fixation method for APC II pelvic injuries and reported 34% favoured a single anterior plate and single SI joint screw. 74% supported a single, opposed to two orthogonal anterior plates. Furthermore, anterior plating supplemented with posterior fixation was preferred by 63% of pelvic surgeons, 58% used a single versus 42% two SI joint screws. Similar results were also shown in this study, out of 19 patients, five patients (26.3%) underwent combined anterior plate fixation and posterior ilio-sacral screw fixation whereas 14 patients (73.6%) underwent only anterior symphyseal plate fixation. At final follow-up, partial screws back-out was noted in 1 patient, however, despite implant failure, no patients to date had required revision as they had a good functional outcome.

In this study, we utilized the Majeed grading system to evaluate functional outcomes due to the fact that it is the most widely used injury-specific functional outcome scale for reporting pelvic ring injuries in the literature. All patients were reviewed after a mean follow-up of 6-months. The Majeed functional score averaged 77.94 (50–96); it was excellent in 4(21.1%) patients while good in 11 (57.9%) patients.

Our results go well along with the good results which have been documented in multiple studies evaluating the anterior plate osteosynthesis. Choy WS et al<sup>4</sup> evaluated, 32 patients with unstable pelvic ring fractures treated with anterior pelvic plating and subsequent percutaneous SI joint screw. After a mean of 51 months, they found 81% an excellent to good clinical outcome and a low complication rate.

Van Loon P et al<sup>15</sup> performed a retrospective review of 38 patients with an open book pelvic lesion who underwent anterior pelvic fixation with or without posterior fixation and reported an excellent functional outcome with a mean Majeed score of 95.7 after a median follow-up of 35 months. Mardanpur K et al<sup>3</sup> found excellent

to good clinical results in 81% (Majeed scores) in a series of 38 cases with an unstable pelvic ring fractures treated with internal fixation after a mean of 25 months.

**Limitation of study:**

Limitations of this study included the following points: Firstly, this was a single-centre retrospective analysis with a relatively small samples and lack of comparison with other fixation methods because isolated open-book pelvic fractures are rare. Secondly, our study lacked long-term functional results, and warrant further studies, a long-term functional score analysis would be more meaningful.

**CONCLUSION**

We concluded that anterior plating and a supplemental posterior fixation is a safe and effective method for the stabilization of anterior pelvic ring fracture. It produces a low rate of complication and provides stable fixation to enable early mobilization.

**ETHICS APPROVAL:** The ERC gave ethical review approval

**CONSENT TO PARTICIPATE:** written and verbal consent was taken from subjects and next of kin

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**CONFLICT OF INTEREST:** No competing interest declared.

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