

# Outcome of Open Reduction and Internal Fixation of Traumatic Unstable Pelvic Ring Fractures

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## ABSTRACT

**Background:** High energy trauma is responsible for pelvic fractures and multi-disciplinary approach is demanded for their management. The main objective of treatment should be the stability of haemodynamics. The stability of reconstructed pelvic ring should be the aim of any surgery that is carried out.

**Aim:** To study physical function and X-rays result of unstable pelvic ring fractures that were surgically managed by open reduction and internal fixation.

**Methods:** This retrospective study included a series of 30 patients who sustained unstable pelvic ring fractures as a result of road traffic accident during the period 1432-34 (2011-2013) and were managed surgically with open reduction and internal fixation at Prince Mutaib Bin Abdul Aziz Hospital Sakaka, Aljouf, Saudi Arabia. Patient's age was 18-55 years. All were males. We followed Tile's classification. Seventeen patients had type B and 13 patients had type C fractures. Modified Stoppa surgical approach was followed. Majeed score system was helpful for grading quality of reduction of pelvic ring fractures.

**Results:** The mean age of patients was 38.70 years (range 18-55 years). Strictly adhering to Tile's classification, there were 17 type B and 13 type C pelvic fractures. Seven patients sustained additional injuries. The lower extremity fractures being the commonest additional injury. The mean follow-up was 21.93 months (range 10-18 months). Function was excellent in 70.5%, good in 17.6% and fair in 11.9% of total patients with type B pelvic ring fractures while it was excellent in 76.9%, good in 15.9% and fair in 7.7% of total patients with type C fractures. We noticed infection post-operatively in only one patient. There was no neurological deficit or any impairment in sexual function post-operatively.

**Conclusion:** Rigid surgical stabilization emerged as the best management for unstable pelvic ring fractures in our study. It must be carried out as soon as the general condition of the patient permits and even upto two weeks post-injury.

**Key words:** Trauma, Unstable pelvic ring fractures, Open reduction and internal fixation, Rigid stabilization

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## INTRODUCTION

3-8.2% of all trauma patients reveal pelvic ring disruptions<sup>1,2</sup>. Pelvic fractures may contribute to 1-3% of all skeletal fractures and 3% of orthopaedic hospital admissions. The amount of displacement in X-rays key role rather than the instability of pelvic fractures in surgical management. Significant posterior ring instability is observed in more than 10 mm of posterior pelvic ring displacement. Pubic symphyseal displacement of more than 2.5 cms reveals pelvic floor disruption. Displacement of superior and inferior pubic rami of more than 1.5 cms is associated with damage to obturator-inguinal fascio-ligamentous complex. Rarely some rotational element may be observed in stable pelvic ring injuries.<sup>3,4</sup> Undisplaced crescent fracture of sacrum may exhibit instability. If significant posterior

instability and additional break in pelvic ring anteriorly co-exist and if patient's haemodynamics is not stable then patient's haemodynamics is not stable then immediate surgery is indicated. External fixation is used primarily. It should be avoided when internal fixation can be performed on a stable patient.<sup>5,6</sup> Classically venous haemorrhage accounts for 90% of bleeding from pelvic fractures and arterial only 10%. Most unstable pelvic fractures demand either isolated posterior or combined posterior and anterior surgical fixation in order to achieve anatomical reduction and subsequent early ambulation<sup>7,8</sup>.

There are several techniques of open reduction and internal fixation<sup>7,9,10,11</sup>. Each has its own merits and demerits. Associated injuries, general condition of a patient, surgeon's expertise and nursing requirements of patient are important considerations in determining a specific technique. Appropriate functional outcome and quality of life-related issues are key factors in evaluating pelvic ring injuries.<sup>1,12</sup> The outcome of pelvic fracture management depends largely upon the type of pelvic injury, patients age,

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time of surgery, surgeon's experience, nursing care and associated injuries. Patients often sustain concomitant life threatening injuries. Multiple organ failure, haemorrhage or sepsis (as high as 40-50%) are responsible for early death.<sup>13</sup>

The inclination of Matta & Tornetta<sup>5</sup> and Letournel<sup>14</sup> is towards open surgery and opt for reduction and fixation of posterior pelvic ring as the initial primary choice followed by assessment of anterior pelvic ring injury for need of fixation. While Routt<sup>15</sup> and Griffin<sup>16</sup> prefers surgical stabilization of unstable anterior pelvic ring as the initial primary step followed by closed reduction and percutaneous fixation of posterior pelvic ring. Approach for posterior pelvic ring fixation differs Matta and Tornetta<sup>5</sup> favour open reduction and fixation. Shule et al<sup>17</sup> and Barei et al<sup>18</sup> have advocated percutaneous ilio-sacral fixation technique for stabilizing ipsilateral sacro-iliac (SI) joint and sometimes the contralateral SI joint i.e. transiliac transsacral screw fixation.<sup>19</sup>

Elhence<sup>20</sup> reported that since the posterior pelvic ring constitutes about 60% of overall pelvic ring stability so it needed to be addressed first. Once the posterior pelvic ring disruption is reduced, the anterior ring displacement reduces spontaneously and only requires to be stabilized by plates and screws, as also supported by Letournel.<sup>14</sup> Transverse Pfannenstiel incision is used in open reduction of anterior pelvic ring. Recti are split. Sweep the recti on both sides. Expose the superior pubic rami. Reduction of the symphysis or fractured segment is the main objective. Anterior pelvic ring is fixed with plating. Double plating was advocated by Tile and Kellam<sup>4</sup> but now-a-days it is ruled out since there has been significant improvement in the pullout strength of the plates.

## PATIENTS AND METHODS

This retrospective study included a series of 30 patients who sustained unstable pelvic ring fractures as a result of road traffic accident during the period 1432-34 (2011-2013) and were managed surgically with open reduction and internal fixation at Prince Mutaib Bin Abdul Aziz Hospital Sakaka, Aljouf, Saudi Arabia. Consistent of open book fracture with diastases of pubic symphysis, dissociation of sacro-iliac joint with vertical shear and pelvic fractures with retro-peritoneal haematoma were included. Patients who had acetabular fractures of any type (isolated or in association) were excluded. Road traffic accidents were the only cause of pelvic injury in our series. We followed Tile classification, 17 were type B and 13 were type C fractures. There were 17 cases with diastases of pubic symphysis, 4 cases with bilateral rami fracture and 2 cases with unilateral ramus fracture. The posterior pelvic wall involvement

showed 9 cases with SI dislocation and 4 cases with both SI dislocation and fracture. All these patients reported to our ER and immediate vital signs stabilization was carried out in haemodynamically unstable patients having unstable pelvic fracture. The investigations were X-rays, ultrasonography, CBC, blood pressure measurements and CT scan for detection of associated injuries. Urologic assessment was made by urologist. We carried out open reduction and internal fixation for all patients during first week of admission, 25 patients had surgery within 2 days after injury. In the remaining patients, surgery was delayed for one week due to unstable general condition and associated injury. For unstable symphyseal injuries we used Pfannenstiel surgical exposure, and fixation was carried out with 3.5 mm pelvic reconstruction plate. The pubic rami fixation was carried out with 3.5 mm pelvic reconstruction plate.

The sacral iliac joints approach was through lateral window of ilio-inguinal surgical exposure. Dissection medial to SI joint allows exposure of lateral sacral ala for retractor placement. Posterior ring fixation was done with 3.5 mm reconstruction plates in most cases and with percutaneous cannulated ilio-sacral screw using image intensifier in only one case. Post-operatively patients received antibiotics and low molecular weight heparin (Clexane 40 mg SC). In our series only 2 patients had associated intra-abdominal haemorrhage approved by CT abdomen. They underwent urgent laparotomy. Both had liver and spleen injury. Three patients had associated fractures of femur which were fixed with interlocking nail. DCS and external fixator respectively according to site and type of fracture. One patient had tibial fracture that was fixed by plating. One patient had head injury and neurosurgeon was consulted. There was no associated urological or genital injury. The follow-up period was 10-18 months after discharge from the hospital. Radiological and functional assessment was done on final visit of each patient. Plain X-rays with three standard views were done to notice the result of fracture fixation. The maximum residual displacement in anterior or posterior pelvic ring injuries was measured for grading purposes as excellent for 0-5 mm, good for 6-10 mm, fair for 11-15 mm and poor for more than 15 mm of displacement or established non-union. Similarly Majeed functional scoring system was applied with more emphasis on sitting, work, sexual intercourse, pain, walking distance, gait and waling aids. The total score measures 0-100. Total score grading was as follows i.e. excellent = 95, good = 85-94, fair = 70-84 and poor = less than 70 points. This system is simple and also includes sitting which is often limited after pelvic injury.

## RESULTS

Our study included 30 traumatic unstable pelvic fractures. We followed Tile's classification. All patients in our study had internal fixation. There were 17 patients with type B fractures and 13 patients with type C fractures. The average hospital stay was 9.20 (range 8-12 days). One patient had postoperative wound infection. There was no DVT or any sexual and urinary dysfunctions. The average time postoperatively to start active mobilization was 6.27 days (range 2-9 days) for patients not having associated serious skeletal injuries (26 patients) and 6.40 days (range 5-9 days) for patients with associated skeletal injuries (4 patients). The mean follow-up time for all patients was 21.93 months (range 10-36 months). All our patients had bony union of their fractures. All our patients were pain-free and active in their routine and occupational activities almost to their pre-injury status. There was no influence of age of the patient on the final outcome of internal fixation of pelvic unstable fractures. The effect of patient's sex on the final outcome could not be determined as all our patients were males who suffered road traffic accidents (Tables 1,2,3).

Table 1: Overall mean±SD of the parameters

Parameter	Mean±SD
Follow-up (10-36 months)	21.93±5.21
Age (18-55 years)	38.70±9.01
Hospital stay (8-12 days)	9.20±1.19
Mobilization time (2-9 days) without skeletal injuries	6.27±1.36
Mobilization time (5-9 days) with skeletal injuries	6.40±1.22

Table 2: Functional outcome after internal fixation

Outcome	Type B Fracture		Type C Fracture	
	No.	%	No.	%
Excellent	12	70.5	10	76.9
Good	3	17.6	2	15.4
Fair	2	11.9	1	7.7
Poor	-	-	-	-

Table 3: Maximum residual displacement in X-rays (grading) after internal fixation

Outcome	Type B Fracture		Type C Fracture	
	No.	%	No.	%
Excellent	12	70.5	9	69.2
Good	5	29.5	4	30.8
Fair	-	-	-	-
Poor	-	-	-	-

## DISCUSSION

Pelvic injuries are very serious and are the result of high energy trauma. The commonest cause is a road

traffic accident. Profuse internal haemorrhage and associated injuries contribute to early mortality. About 10% of patients with haemodynamically unstable pelvic fractures will die.<sup>22</sup> Sepsis is related to late mortality<sup>21</sup>.

Variety of closed methods have been employed in the management of unstable pelvic ring injuries but they often result in significant disability, moreover the mortality can rise to 21.8%<sup>23,24</sup>. External fixation reduces venous and bony bleeding and improve temponade by maintaining the pelvic volume to the extent that other interventions are rarely required<sup>23,25</sup> but according to recent studies sufficient stability could not be achieved by external fixation to allow mobilization. The risk of redisplacement of the fragments remains there. Use of external fixation in unstable pelvic injuries is only temporary as part of emergency management and that too in order to place the patient with the trunk in upright position to improve ventilation<sup>24,26,27,28</sup>.

The outcome of our study is in accordance with other studies and confirm excellent stability after anterior or/and posterior pelvic internal fixation. Decline in morbidity and mortality rate is not controversial.<sup>28,29</sup> There is wide consensus that general condition of the patient determines the timing of surgery which may be 2-7 days post-trauma or even upto 2 weeks post-injury<sup>28</sup>. The incidence of associated injuries in our study was 23.4% (7 patients). This low incidence is directly related to less complications rate and thus high success rate after open reduction and internal fixation of unstable pelvic fractures.

## CONCLUSION

Pelvic fractures are a major challenge. Treatment begins with the trauma team in the emergency room, a team of general surgeons, orthopaedic surgeons, anaesthesiologists, neurosurgeons and nurses who work together to control bleeding, address damage to the head and chest, and other organs such as bladder and intestines, and to stabilize fractured bones. Stabilization of vital parameters takes preference and significantly reduces mortality. Once the patient is stabilized, bleeding has stopped and other life threatening injuries have been addressed, the fractures can be treated definitively. Open reduction and internal fixation in unstable pelvic injuries is the key to acceptable functional outcome and decrease in morbidity. Associated injuries have substantial effect on the psychology of patients. However satisfactory outcome can be achieved after proper management. Following surgery rehabilitation specialists play a key role in recovery.

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