

## **INTERNAL FIXATION FOR UNSTABLE PELVIC FRACTURE: THE VALUE OF ANTERIOR APPROACH AND SMALL FRAGMENTS BIOSYNTHESIS**

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### **Abstract**

Fifty patients with unstable pelvic fracture were subjected to internal fixation through anterior approach by small fragment biosynthesis over sixteen year of experience. Their age, range between 15–45 years. Forty patients were males and ten patient females.

Thirty patients with type B rotationally unstable fracture pelvis, 15 patients with type C vertically unstable and 5 patients with combined rotationally and vertically unstable fracture.

In type B fracture, 30 patients were surgically approached anteriorly by pfennenstiel incision, while type C (15) patients required ilioinguinal extension to fix anterior and posterior ring. Combined unstable fracture in 5 patients require anterior and posterior approach as two stages surgical exposure with one week interval.

It is concluded that anterior approach to displaced pelvic fracture was good and suitable for young and thin patients. In addition anterior ring fixation was the key for anatomical reduction of displaced fracture and horizontal application of small fragment implant across the sacroiliac joint and anterior ring could be achieved and maintain the stability if full weight bearing is delayed to 6 month. Other advantages and limitation of the procedure were discussed.

### **Introduction**

Open reduction and internal fixation of displaced pelvic fracture has become more accepted as clinical experience and certain technologies had improved, and it is considered the most stable form of stabilization<sup>1-5</sup>.

The superiority of internal fixation over external fixation was supported by several biomechanical evaluation<sup>6,7</sup>. Therefore internal fixation becomes more popular and in the last three decades introduced by AO group using specialized reconstructed plate and screws or a designed rod for SI joint fixation<sup>8</sup>.

The method was supported by other studies from other trauma centers in the world, but still the surgical approach to posterior pelvic ring whether anterior or posterior remains a subject of controversy<sup>1-5,7</sup>.

The objective of this study is to stress the advantages of anterior approach for fixation of unstable fracture pelvis with small fragment biosynthesis over the posterior approach and over all methods of internal fixation.

### **Material and Methods**

Between January 1994 and January 2011, fifty patients with unstable pelvic fracture admitted to Basrah orthopedic center were selected for internal fixation through anterior approach to fix pelvic ring. Type B (rotationally unstable) (30 patients), type C (vertically unstable), and simple combined pelvic fracture were included in this study. Complex fracture pelvis including ace tabular fracture were excluded (Table I).

Forty patients were males and 10 patients females, theirs age ranged between 15–45

years (Table II). Forty five patients had body weight 70 kg. and below while remaining five have body weight more than 90 kg.

All patients received intensive primary life support measures to survive acute trauma. Plain radiography of the pelvis was routinely done and CT scan in selected cases (i.e. in the earlier period of the study CT was non available).

Five patients had associated injuries such as fracture humerus 1, fracture femur 2, and intra-abdominal injury 2. They all had preliminary heavy skeletal tibial or femoral traction. They were operated upon within two weeks except in two patients. One of them was a female who refuses operation initially to accept fixation after 4 weeks, the second one needed to manage associated injuries.

The attendance of general surgeon was required in five cases for meticulous inguinal canal repair and to deal with urologic problems.

The operative procedure was performed under general anesthesia in supine position. The skeletal traction was continued through the whole procedure to help and maintain the reduction. The incision was Pfannenstiel suprapubic approach to pubic symphysis or through inguinal canal in case of rami fracture. Fixation was accomplished by using small fragment plate and screws. The posterior ring (SI) joint was approached by posterior half of ilioinguinal incision through retroperitoneal retroiliacus reflection. Double horizontal parallel small fragment plate and screws were fixed across SI joint. In five patients (type C) who required posterior approach were operated one week later as second stage procedure.

Intraoperative radiography was limited to minimum operative time and total hospital stay was estimated and the patients were nursed in bed. Stitches removed after two weeks and the patients were allowed to be nursed in a mobile

chair until 12 weeks. Supervised weight bearing using pair of axillary crutches after 12 wks to total period of follow up ranged between 12 wks to 36 months.

## Results

Supine position during operation was comfortable to the patient and easy for anesthetist to control and deal with any complication. In addition the surgeon was able to reduce and fix most pelvic fractures in presence of continuous skeletal traction and with help of lateral compression by assistant under direct vision reducing the demand for intraoperative radiographic control.

Posterior ring fixation is required for 15 patients with type C (vertically unstable) through ilioinguinal approach following anterior ring fixation, because of insufficient stability in vertically unstable fractures. Anterior ring fixation alone was sufficient to achieve stability in rotationally (type B) unstable fractures, this indicates anterior ring fixation was the key point in treatment of unstable pelvic fracture in general. In five patients with combined instability (rotational and vertical) sacroiliac joint fixation was difficult because of relative obesity a reason behind a second stage operation to fix the SI joint through posterior approach in prone position 7 days later. Single vertical three holes small fragment plate was used for fixation.

Satisfactory anatomical reduction could not be achieved in one patient (female) who accept the operation 4 wks later and in whom the anterior ring disruption (displaced pubic rami fracture) was ignored.

Entrapment of injured urinary bladder within separated pubic symphysis was found in one patient. It was initially missed at a time of notified negative laparotomy.

The operative time required ranged between 90 to 120 minutes.

Superficial wound infection encountered

in one patient and superficial sacral sore in another one. Both responded to local care, nursing, and antibiotic.

One patient died on the third post-operative day because of pulmonary embolism his operation was performed late (after 3 wks), and he had associated fracture around the elbow joint treated initially by internal fixation and laparotomy to correct colonic injury.

Partial implant failure was reported in one patient after three months following fixation of posterior ring by posterior approach in obese patient (body weight more than 90 kg), because of early weight bearing and engagement in sport (football). Fortunately it passes without complication and it did not required removal of biosynthesis. The anterior ring was stable and the patient still active for the last two years.

Other patients were committed to post operative rehabilitation and returned to their usual activity gradually without disability.

Leg length inequality (3cm) was encountered in one patient (female) who developed gradually increasing gluteal and back pain because of imbalance during walking, this indicates in situ fixation of displaced fracture did not reduce post operative disability because of uneven distribution of stress on anatomical and displaced sides during moderate and high physical activity.

Neither incisional nor inguinal hernias were reported during the period of follow up. Total hospital stay was 3 to 6 weeks.

Table III summarized result.

## Discussion

This study can verify the indications, advantages and disadvantages of anterior internal fixation for unstable pelvic fracture excluding the complex type. The procedure can be performed at the time of emergent laparotomy or delayed for few days to allow evaluation and treatment of life threatening injuries, preoperative planning and assembly of necessary

equipment. In reports from large trauma center patient with pelvic fracture were susceptible to pulmonary failure and septic state described by Seibel et al has led some authors to consider early open reduction and internal fixation of disrupted pelvic ring<sup>9</sup>. In this study one patient died as a result of pulmonary embolism because he was operated upon very late (more than 3 wks) to stabilize unstable pelvic fracture. The author recommended early stabilization of unstable pelvic fracture (within 2 wks) in order to prevent thrombo-embolism and to achieve perfect anatomical reduction since malalignment encountered in one patient (a female) who accepts surgery after 4 weeks. The last observation was supported by Russel and Depaolo in their series using the technique recommended by simpson et al<sup>10</sup>. Matta and Tornetta emphasized the importance of early reduction and fixation of unstable pelvic fracture within 21 days was excellent compared to delayed operation<sup>11</sup>.

We agreed with other reports from trauma center that coordination between radiologist, trauma and orthopedic surgeon was important in reduction of mortality and since urologic injuries could be identified and dealt with at the same time<sup>12</sup>.

Controversy still existing over the ideal anterior pelvic implant especially with significant posterior pelvic instabilities that stresses the anterior fixation. Tornetta Dickson and Matta advocated the use of single 3.5mm reconstruction plate for symphyseal diastasis<sup>13</sup>. Webb et al reported good results in their series with use of two holes dynamic compression (DCP with 6.5 mm screws directed down the bodies of pubis)<sup>14</sup>. Other authors had advocated double plating at a right angle of symphysis especially in type C pelvic fracture. They found it was biomechanically more rigid than single plate but they require more extensive soft tissue stripping and had increased potential for blood loss<sup>15</sup>. We found in

this study 4 screws holding small fragment plate could be contoured and sufficient for symphysis pubis since we didn't observe any implant failure in all patients put one during observation period. It limits the amount of soft tissue dissection which contributes to stability. In addition the author agreed with others that small plate allow more physiological motion at the symphysis pubis<sup>15</sup>.

Another controversy is the treatment of displaced rami fracture, some report suggested that fixation of displaced rami fracture, some reports suggested that fixation of displaced rami fracture were rarely indicated unless the fracture is located medial to pubic tubercle<sup>16</sup>. While other reports recommended internal fixation with either plate or modularly screws in those with displaced pubic rami fracture with pelvic instability<sup>17</sup>. In this study successful anatomical reduction was achieved in all patients except one treated by internal fixation using small fragment plate and screw for displaced fracture of anterior ring in both symphyseal disruption and displaced rami fracture through ilioinguinal surgical approach. The ignorance of displaced pubic rami fracture in a female patient in whom the operation was delayed and pelvic fracture was vertically unstable was the second reason behind improper reduction, residual deformity and shortening of the leg on same side of pelvic fracture more than 3 cm .

The present study is supported by observation of others who indicated rotationally unstable pelvic injuries (Type B) are most commonly associated with symphyseal disruption so that open reduction and internal fixation (ORIF) of symphysis pubis all that was required because the intact posterior SI joint ligament will support the posterior pelvis after anterior reduction and fixation<sup>18,19</sup>. We checked the stability clinically and radiologically in 30 patients with type B fracture which didn't required SI joint exploration and fixation. In 10 patient

who had type C pelvic injuries they require SI joint fixation because no sufficient ligamentous support were available after fixation of anterior ring<sup>18,20</sup>. Fixation of fracture was accomplished by two parallel horizontal small fragment plates and screws through retroperitoneal retroiliacus anterior approach. The author found the biosynthesis easy to be countered within the cave of iliac bone posteriorly, and could be applied under direct vision on adjacent side of SI joint.

One patient whose body weight was above 90 Kg. anterior SI joint fixation was failed because of excessive traction on medial structures and nerve root could not be avoided. The procedure was terminated to second stage posterior approach for SI joint fixation a week later. Other 4 obese patient (>90 kg) were electively planned for staged surgery from the start.

Implant failure could be reported in one patient during period of observation unfortunately weight bearing was started earlier and presented with break of superior screws which did not produce any complications, it seems that posterior SI ligament was subjected to great stress and single vertical small fragment plate and screw could not be with standard this force. Reports suggested large fragment screws or rods were superior to light biosynthesis when posterior approach to SI joint was contemplated<sup>4</sup>.

Owing to good soft tissue cover and vascularity the infection rate was low and could be controlled by simple measure. In addition to that the low morbidity associated with the procedure led the patient to leave the hospital in shorter time (3–6 wk), and physical activities was resumed without permanent disability.

In conclusion the following facts were realized.

Anterior internal fixation of unstable pelvic fracture required surgical experience and team work affect the chance of morbidity and mortality. It is

single stage surgical procedure can be performed at the time of emergent laparotomy to deal with any urological injury and avoid missing entrapment of viscera such as bladder or bowel within the symphysis pubis diastasis. This is supported by reports of right et al Salome et al, and staubber at al<sup>21-23</sup>.

Thin patient were suitable for anterior approach to SI joint fixation since the danger of excessive traction can't be avoided in obese one. Anterior pelvic ring (symphyseal diastasis) or displaced rami fracture fixation is the corner stone to achieve anatomical reduction in displaced posterior ring in both rotationally and vertically unstable fracture since fixation of associated anterior pelvic injury

improve over all stability and implant can be fixed under direct vision.

Small fragment horizontal implant fixation to both anterior and posterior rings (i.e. in vertically unstable fracture) through anterior approach is not inferior to other type of biosynthesis since it provide stability by fractionation of burden borne on implant at the anterior and posterior rings provided full weight bearing should be deferred until six months to achieve an optimal results.

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**Table I: Types of fractures**

Ring fixation	No. of patients	Type of fracture
Ant. Ring only	30	Rotationally unstable (type B)
Ilioinguinal approach	15	Vertically unstable (type C)
Two stage ant.+post. approach	5	Combined

**Table II: gender of the patients**

40	Male
10	Female

**Table III: Complications encountered**

Remarks	No. of patients	Complication
Over weight excessive traction cannot be avoided by anterior approach.	5	Failure of anterior approach to post ring.
Early weight bearing (<3 months)	1	Implant failure
A female, late operation (4 wks) anterior ring fracture ignored.	1	Non anatomical reduction
	1	Leg length inequality
	1	Gluteal pain
Urinary bladder missed at initial negative laparotomy.	1	Entrapment injury
Superficial, respond to local care and antibiotic	1	Wound infection
	1	Sacral sore
	0	Incisional hernia
On third postoperative day. Because of pulmonary embolism. Late operative (after 3 wks) on pelvis. Had associated colonic injury and fracture humerus.	1	Mortality

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