

Evaluation of Functional Outcome of Open Reduction and Internal Fixation of Pelvic Ring Fractures

Adnan H.Hnoosh

ABSTRACT:

BACKGROUND :

Unstable pelvic ring fracture (PRF) constitute 17 – 23% of pelvic fracture , it occurs as a high – energy injuries , and usually associated with multiple concomitant injuries. The mortality has been reported between 18 – 25%. Conservative treatment carries a high rate of complication. Recent studies recommended surgical stabilization by open reduction and internal fixation (ORIF).

OBJECTIVE:

Evaluate the functional outcome, morbidity and mortality rate in the patients treated by anterior and posterior fixation of (PRF).

PATIENTS AND METHODS:

This is a prospective study on 23 patients sixteen male and seven female , age range 18 – 50 years with unstable PRF were operated upon by (ORIF) , there were 12 patients with sacro – iliac joint (SIJ) dislocation and 8 patients with SIJ fracture – dislocation , three with sacral fracture , various implants used for stabilization assessment of the outcome based on patients oriented score of Majeed scale , follow up period range 14 – 37 months postoperatively.

RESULTS :

The functional outcome were as follow using Majeed's scale as excellent in 12 patients (52%) good in 5 (21%) and moderate in three (13%) and poor in one (4.7%) . Two patients died during follow up period (8.6%). There was statistical significant relation between the severity of injury and low grade outcome.

CONCLUSION:

Early ORIF of unstable fracture of pelvic ring is recommended.

KEY WORDS: pelvic ring fracture, open reduction, majeed scale.

INTRODUCTION:

Pelvic fractures are uncommon injuries, occurring in 2 – 8.2% of all trauma patients⁽¹⁾ , according to Tile⁽²⁾ of all pelvic fractures 46% are unstable. Pelvic ring fractures (PRF) constitute 17 – 23% of pelvic fractures.

Unstable(PRF) are frequently associated with various types of combined soft tissues or visceral injuries , the conservative treatment of these injuries has been disappointing , early rigid fixation and anatomical reduction of the pelvic ring was recommended by several authors over conservative treatment or external fixation ⁽²⁾. Tornetta & Matta et al⁽³⁾ reported reduction of mortality to less than 10% from 15 – 30% due to hemodynamic instability in those patients .

Lateral compression injury and external rotational instability requires anatomical reduction anteriorly and posteriorly. Whoever stable

fixation of sacro-iliac joint (SIJ) posteriorly technically demanding and it is mor important than that of anterior ring ⁽⁴⁾ .

AIM OF THE STUDY:

To evaluate the effectiveness of anterior pelvic stabilization (plating) with or without subsequent SIJ fixation posteriorly in patients with unstable (PRF).

PATIENTS AND METHODS:

Between march 2007 and February 2011 , 86 patients with PRF were admitted to orthopedic surgical wards of Medical City Hospital - Baghdad. There were 42 patients treated conservatively , and 14 patients treated by external fixation and 30 patients have been treated by ORIF. Seven patients out of 30 excluded from the study , the remaining 23 patients constituted our cohort analysis. The study group comprised 16 men and Seven women , with an average age of 31 years (range 18 – 58 years). The inclusion in criteria were ⁽¹⁾ age 18 years or older , ⁽²⁾ hemodynamic stability , ⁽³⁾ well

Dep. Surg. College of Medicine. Baghdad University.

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oriented patients, ⁽⁴⁾ the ability to cooperate in answering the questions in Majeed's functional outcome scale 5 which consist of 7 questions each with four – six possible answers a total of 100 points. Patients did not want to be included in the study, or were not able to cooperate or missed to follow, or died shortly after surgery were excluded. Surgery performed according to our hospital protocol. Patients ask to fill a form provided at the last visit which range between 37 – 14 months after operation for evaluation.

Motor vehicle accident were the leading mechanism of injury in 14 patients, followed by four patients fall from a height (Builders) and three cases of motorcycle collisions and Two crush injuries during explosions.

Tile classification (2) was used to identify pelvic fractures type, all the injuries were rotational and or / vertically unstable fractures, 13 patients had type C1, four with C2 and three had type C3, and one patient B2, two patients with B3. The distribution of posterior lesion as follows, 12 (SIJ) dislocation, five with (SIJ) fracture – dislocation, three (SIJ) fracture, three sacral fracture, two patients had bilateral (PRF), the anterior (PRF) distributed as 15 patients with pubic symphysis dislocations, six with unilateral ramus fractures, two bilateral ramus fracture, four patients had an open pelvic fractures (two patients with type C3 and 2 patients with B3). Fig. 1, 2, 3, 4.

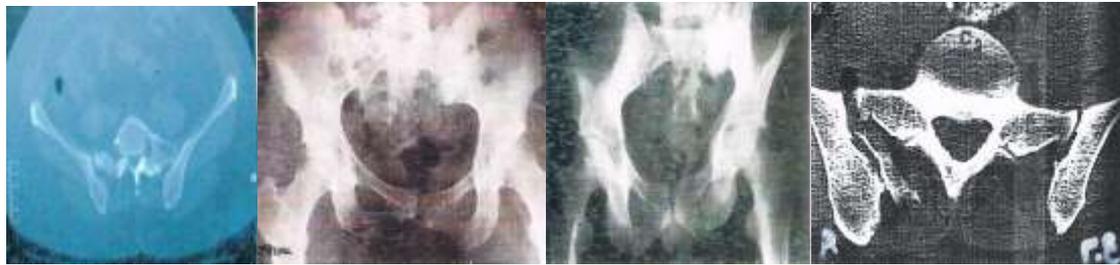


Fig. (1)

Fig. (2)

Fig. (3)

Fig. (4)

The mean arrival time at the emergency departments 8 hours range (3 – 18 hours) following the accident, immediate hemodynamic stabilization by blood and fluids replacement, radiological examination included anterior – posterior with inlet and outlet views in most of the cases. Associated injuries were dealt with accordingly, Table (1) the most common of those were lower and upper extremities fractures, 23 fractures, three with neurological and one with vascular injuries. Abdominal injury in four patients required laparotomy (visceral and urological). Skin or skeletal traction performed, three patients had external fixation in the same day (3 – 6 hours). ORIF performed for all

patients within an average time of 15 days. (range 2 – 32 days) after injury table (2).

Patients with open pelvic fracture, two had fracture connection with anorectal region, one patient with bladder and ureter avulsion with huge scrotal hematoma, one with negative exploratory laparotomy on suspicion of ruptured spleen. Colostomy performed for two patients. Suprapubic catheter was placed for two patients at emergency department.

For symphysis pubis dislocation Pfanenstiellioinjuinal approach was used. four–six holes plate used when the diastasis greater than 2.5 cm, and pubic rami displacement more than 2 cm at the fracture. Fig. 5.

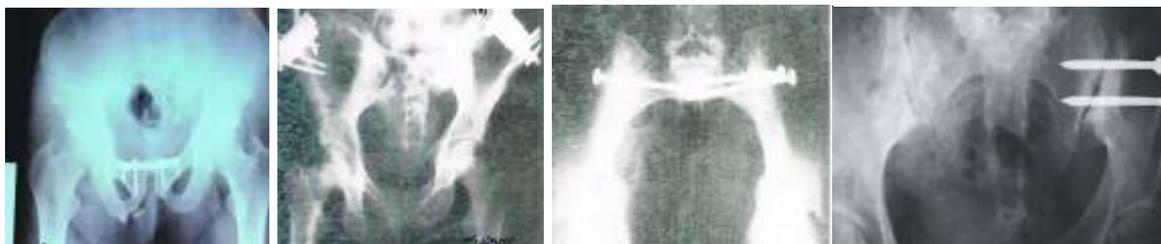


Fig. (5)

Fig. (6)

Fig. (7)

Fig. (8)

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External fixation performed by 5 mm Schanz screws two on both iliac crests as a temporary procedure for haemodynamic stability. Fig. 6. Anterior intrapelvic approach for (SIJ) dislocation or fracture – dislocation was used. Two to four holes 3.5 mm plate for stabilization , percutaneous iliosacral fixation with 6.5 mm. screws performed by posterior approach for five patients, Fig. 7, 8. fluoroscopy used in two patients , the prone position used in 12 patients. Total operating room time was 80 minutes a range of 35 – 190 minutes, average estimated blood loss for percutaneous stabilization 75 mm (range 50 – 300 mm), fluoroscopy time around 18 minutes (range 12 – 40 minutes). Low molecular weight heparine administered subcutaneously to all patients.

Weight bearing and mobilization decision individualized as to stability of the fixation , generally 6 weeks post – operatively on crutches for unilateral ring fracture and 8 – 12 weeks for the bilateral , passive and active exercises monitored on chair until crutches usage.

Reduction assessment postoperatively was graded radiologically according to method of Tornetta and Matta⁽³⁾.

X – ray in all 23 cases , and C.T.Scan to eight was used. The grades as excellent (≤ 4 mm) , fair or good (10 – 20 mm) , poor (> 20 mm). Statistical analysis of the data via the SPSS program.

RESULTS :

A total of 23 out of 30 patients treated with ORIF for unstable pelvic fracture were included in the study , Seven patients were excluded (two patients died shortly at post – operative period ,uremia in one and septicemia in the other ,four patients lost to follow and one patient younger than 18 year of age). Average follow up period 24 months (range 14 – 37 months). Average hospital stay was 16.1 day (range 11 – 28 days). Average blood transfused within the first 24 hours following the operation and before it was 3 units, range (1 – 12 units).

There was no deep infection in the anterior pelvic fixation , superficial one in eight cases treated conservatively.

Five patients developed deep infection in the posterior pelvic fixation, four of them by open technique and one by percutaneous fixation of (SIJ). Two patients due to nearby decubitus

ulcers and the other two due to association of severe soft tissues contusion. Implant failure occurred in three patients, screws removed through the infected wound. One patient treated for nonunion by bone graft after infection clearance 6 months later.

One patient developed L5 nerve root injury due to excessive traction during anterior approach recovered later. Hard ware removal for screws in two patients , plate and screws in three , after 14 and 18 months respectively due to pain .

Sciatic nerve injury in one patient who had posterior fracture dislocation of the hip, still had it.

Deep venous thrombosis (D.V.T) had occurred in two patients during early postoperative period and adult respiratory distress in one lung atelectasis and decubitus ulcers in three patients. Acute renal failure developed in one patient with pulmonary complication who died three weeks later. All the above non orthopedic complications resolved with specific treatments by other medical or surgical displants. Posterior incision infection in two patients with colostomy. The outcome of reduction of the posterior PRF evaluated using the scale recommended by Tornetta and Matta (3) as excellent in 12 cases , good in 5 and moderate in three and poor in three , $P < 0.05$. (table3). Finally , limbs length discrepancy range 10 – 22 mm in 12 cases.

Assessment of functional outcomes of all cases was determined using Majeed score (5) at the final follow up visit around the 12th postoperative month. 12 patients 52% reported a change in sexual intercourse, namely two patients (2 women) reported dysparunia , painful penile erection in 4 men , premature ejaculation in one patient.(Most patients refused to answer the sex category of the form in detail , for known social and cultural reasons). Sitting was clearly limited in one patient , 12 patients (52%) being able to sit without complaints, Sixteen 75% of patients did not use walking aids and 18 patients reported slight or no change in walking pattern, $p (= 0.04)$. There was no relation of these dysfunctions to any particular type of injury.

Urinary functions affected in nine patients (40%) in the form increase frequency (3 patients) , urinary tract infection in Seven patients and retention in three patients .($p < 0.079$).table four

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Table 1: Distribution of the pelvic ring fractures.

S.I.J Dislocation		S.I.J fracture dislocation	S.I.J fracture	Sacral
Posterior No. 12		5	3	3
	Pubic synph. Disloc. No	Unilat. Ramnsfract. No	Bilat. Ram. Fract. No	
anterior	15	6	2	
Bilateral Pelv. Rin. Frac. 2				
Tile c3		Tile B2	Total	
Open pelvic fract.	2	2	4	

Table 2: Systemic injuries associated with the pelvic ring injuries

systemic	No. of patients	%
Upper extremities fract.	7	30%
Lower extremities fract.	16	69%
Urological injuries	3	13%
Vascular inj.	1	
Abdominal inj		
1. Ano-rectal	(2)	17%
2. Intra-abdominal	(2)	
Neurological	2	8.6%
Spine	Nil	

Table 3

Post. Op. complications	No. of patients	total	%
A. Anterior A. deep infection	Nil		
B. superf. Inf.	8		34%
B. posterior deep infection	4		
A. open	2	5	21%
B. percutan.	3		
Implant failure			
L5 n. inj.	1		
Hardware removal A. Screws	2	5	21%
B. Plates	3		
T.H. Arthroplasty A. Hip dislocation	2	3	13%
B. frac. near acetab	1		
Sciatic n. injury	1		4%
D.V.T	2		8.6%
Decubitus ulcer	2		8.6%
Acute renal failure died	1		4%
Post. Skin infection	2		8.6%
Limb length discrepancy	12		52%
Dysparunia	2		8.6%
Painful penile erection	4		17%
Premature ejaculation	1		4%

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Table 4: Status of the patients according to Majeed's score.

Se r.	Til e.	Pain 30 pts	Sitting position 10 pts.	Work 20 pts.	Sexual relation 4 pts.	mbulation 12 pts.	Help with ambul	Distance walked	Score 100 pts	Quality of result
1	C1	30	10	20	4	12	12	12	100	Excell
2	B2	30	10	20	4	12	12	12	100	ent
3	C1	25	4	16	4	12	12	12	85	Exc.
4	B3	25	8	16	3	12	12	12	88	Exc.
5	C1	10	4	0	0	0	0	12	12	Exc.
6	C2	10	6	12	2	12	8	0	54	Poor
7	C1	15	6	4	0	8	6	8	43	Moderat
8	C3	25	8	16	3	12	10	4	84	e
9	C3	25	8	12	2	12	10	4	79	Moderat
10	C3	30	10	16	3	12	12	10	86	e
11	B3	25	10	20	4	12	12	10	100	Exc.
12	C1	25	10	16	3	12	12	8	90	Good
13	C1	10	4	12	4	8	12	12	81	Exc.
14	C1	25	10	20	4	12	12	12	100	Exc.
15	C1	10	10	20	0	0	0	12	92	Exc.
16	C1	15	10	20	4	12	6	0	100	Exc.
17	C1	25	6	20	0	12	8	8	16	Exc.
18	C1	25	8	0	2	12	10	10	77	Exc.
19	C2	25	4	16	3	12	10	10	59	Exc.
20	C1	25	8	12	3	12	10	4	79	Poor
21	C2	25	8	4	4	12		4	77	Good
22	C1	20	8	16	2	12			85	Moderat
23	C2	25	8	16	0	12			84	e
										Good
										Good
										Good
										Exc.

DISCUSSION:

Pain , pelvic tilt ,with non - union , gait impairment , limb – length discrepancy scoliosis , sitting difficulties , restriction in the daily activities are long term problems associated with non – operatively treated vertically unstable pelvic fractures , but those complications still associated with operatively treated , but for less extent ^(4,3). Bellabara et al, ^(6,7) stressed that anatomical reduction and internal fixation has been emphasized for good outcome , namely increased survival rate and correct deformities and provided stability , additionally , early mobilization resulted into less incidence of D.V.T , decubitus ulcers , adult respiratory syndrome , depression , U.T.I and renal calculi.

Soft tissues additional injury in pelvic ring fractures give less satisfactory outcome from those patients with PRF only. In our study the deep infection occurred in five patients who had open injuries. Whoever , there was close correlation between radiological and functional outcomes in patients with unstable PRF , as excellent and good results findings not related to stability and symmetry of PRF alone, but also

dependant on the severity and amount of damage to the soft tissues around the pelvis⁽⁸⁾.

Anterior and posterior internal fixation provides biomechanically stable and sufficient stabilization . Authors D.Hakt ⁽⁹⁾ and Bruce ⁽¹⁰⁾ et al, Griffen ⁽⁴⁾ reported that early ORIF reduce mortality and systemic infection rate and later morbidity.In the present study a mortality of 8.5% closely correlate with those authors , though Scalera et al ⁽¹⁾ reported an incidence of 17% , that might be attributed to larger number of type C2 and C3 pelvic fractures in his 107 series of patients.

Pelvic ring disruption were amenable by close reduction and then ORIF according to Borer ⁽⁸⁾ Tornetta ⁽³⁾ and Matta et al.

In our study skeletal and skin traction applied prior to internal fixation which significantly facilitate anatomical reduction which inturn facilitate percutaneous inserted trans-iliac and iliosacral screws , hence that did not decompress the intra – pelvic hematoma. Von der et al (1) bellabarra ⁽⁶⁾ did not report any major infection by this method.

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In the present study , four patients had developed deep infection and three had superficial , the deep type was associated with massive soft tissues injury and two with colostomy nearby . Whoever ORIF is contra-indicated in patients with severe posterior soft tissue injury according to Takushi et al ⁽¹¹⁾ .

The main disadvantages of posterior approach was the risk of impaired wound healing and subsequent infection , an incidence in our study of 29% a rate exceed the 20% of Borer ⁽⁸⁾ and Van der (1). In our study C-arm used in 5 cases only to monitor intra-operative reduction and fixation. Single four – six holes plate fixation for 2.5 cm or more of symphysis pubis disruption anteriorly which we think enough whoever we experienced no plate fatigue or loosening with single plate , although authors Shapiro ⁽¹²⁾ and Bellabara et al ⁽⁶⁾ recommend double plate fixation Implant fatigue minimized when combined anterior and posterior stabilization had been undertaken ⁽⁴⁾ . Removal of the implant in our patients was due to pain complained by the patients.

Ziran ⁽¹³⁾ and Borer et al (8) reported that posterior pelvic destruction less than 4 mm even after fixation are likely to have more severe pain and less functional outcomes. Whoever some of our patients did complains of pain although successful reduction has been achieved , a similar. Results had occurred to Bruce (10) in his 36 cohort study.

In our present study , eight patients with residual displacement of less than 4 mm had pain of pelvic origin , all those patients had SIJ dislocation . This pain according to Takushi et al (11) and Bruce (10) et al was due to degeneration within the(SIJ).

Obrien ⁽¹⁴⁾ and Wade ⁽¹⁵⁾ et al reported that 14% of their 55 patients with unstable pelvic fracture who were treated operatively had an impairment physical outcome score and 52% had mental impairment. Oliver et al ⁽¹⁶⁾ evaluated functional outcome of patients with ORIF of unstable PRF using Majeed's score found that 40% of patients had sexual problems , and 66% had complaints when sitting and 68% returned to their original jobs. In our present study , the rate were in relation to sitting and walking ability without pain up to 80% and 72% had returned to their original jobs , while 28% had changed their work or remained jobless , this difference might be attributed to the nature and hardness of jobs and it's heaviness ,in our locality , the psychology and

compensation motive of our patients and the type of the accidents , since our hospital situated in non – industrialized district.

Several authors reported functional outcomes based on patients oriented systems , and factors that deteriorated the outcome , but most of them have limitations such as small population lack of dogmatic radiographic evaluation , or less ideal status analysis , those systems such as Iwa Pelvic Score (IPS), Medical Outcome Study Short Form 36 – Item Survey(SF 36) and patients oriented questionnaire survey of the Majeeds score .

Whoever we have used the later score i.e(Majeed scale) because it include most of the specific questions that determined the effective status of the patients, in the last visit around one year after injury.

Sigg⁽¹⁷⁾ and bottlang ⁽¹⁸⁾ reported that mortality and morbidity with open PRF were higher than in patients with close fractures , this result closely correlated to our study when two patients died due to sepsis and renal failure.

Several authors have investigated the risk of neurological injury during SIJ fixation by screws due to misplacement to a percentage between 0.5% and 7.7% ⁽¹⁹⁾ . In our study there was one patient (4.3%) developed LS nerve injury due to excessive traction upon the nerve recovered 3 months later.

Whoever we claime that decompression of involved nerve roots in combination with an anatomic reduction might reduce the rate of neurological damage which has been achieved by the (ORIF) conclusion supported by Scalea et al ⁽²⁰⁾ .

Local social and cultural status of our patients prevented us from having full details about their sexual life and activities of women patients in particular, the category of Majeed score (5) had been filled by the accompanied male , which render the data short of dogmatic.

CONCLUSION:

Early ORIF of unstable (PRF) reduced significantly the morbidity and mortality , furthermore the outcomes depend in part on the surgical treatment of the ring fracture and identification and care of physical needs (sitting , walking , job etc) and non – physical (anxiety , depression of the patients postoperatively).

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