

Clinical assessment of external fixation in pelvic ring fractures

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Summary:

Background: Unstable pelvic ring fractures (PRF) are high energy trauma, commonly associated with systemic and soft tissues elements injuries, the external fixation as an emergency and final treatment is one of the options in its management.

Objective: to evaluate the value and role of external fixation for unstable (PRF) and its clinical outcomes.

Patients and methods: twenty one patients with unstable P.R.F have been treated by external fixation , they were 16 men and 5 women ,their average age was 28 years (range ;18-60 years) , two thirds of the cases were due to road traffic accident , 85% were hemodynamically unstable , urological and neurological, anorectal injuries were the commonest associated injuries ,follow up period was 1.6 year range (1.00-6 years). Tile classification and Majeed outcome scale had been used.

Results: Excellent or good results obtained in 83% of Tile type B injuries , and 44% in type(C) P.R.F. Complications were noted in 42% in the form of skin problems , pin loosening, nerve injury.

Conclusion; External fixation may be useful or even life saving in the acute resuscitation phase of the management of unstable pelvic fracture.

Key words: pelvic ring fracture , External fixation, Tile , Majeed scale.

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Introduction

Pelvic ring fractures (P.R.F) are high energy trauma (1),and are caused mostly by road traffic accident,or fall from a hight. It is commonly associated with systemic and soft tissues elements injuries of the pelvic basin which is life threatening with a mortality approximately 10% (2). Urgent and appropriate treatment is necessary in order to regain pelvic stability especially when the ring disruption has occurred.The associated injuries requires urgent treatment (Haemorrhage , urinary tract injuries , anorectal.etc),and due consideration must be given to the long term functional results of the bony injuries as early as possible and at emergency department in many instances. There are several options of treatment could be used , ranging from conservative treatment to surgical intervention by open or percutaneous reduction and osteosynthesis , or external fixation . all those techniques have their advantages and disadvantages .It is up to the surgeon to chose the most suitable strategy , depending on the type of injury and his experience.External fixation for unstable injuries of (P.R.F) in many instances being the only method of fixation and the only treatment required. (3).The aim is to stabilize anterior injury of PRF with posterior P.R.F if present being dealt with subsequently as required(4).There are several types of external fixators designs available, some are applied in cases of haemorrhagic shock, e.g Pneumatic antishock garment, wrapping with sheets, etc, while others are aimed for long terms stabilization of the lesion .e.g C – clamps system(5), Ganz ‘s antishock pelvic clamp, trapezoid compression frame etc.

Patients and methods:

From March 2005 to January 2012 a total of 86 patients were admitted to the Orthopedic department at surgical specialties Hospital. With pelvic fractures, thirty five patients were treated conservatively, and 23 patients were subjected to open reduction and internal fixation (ORIF) for unstable P.R.F, while 28 patients were subjected for external fixation of pelvic Ring injuries. From which two died within the first week after surgery, and five patients had inadequate data and follow up. Those seven patients were excluded from this study and the remaining 21 patients constituted our present study, they were 16 men, and five women. The patient’s weight ranged from 58-110 Kg with average of 78Kg. The average patients age was 28 years. (range 18-60 year) Road traffic accidents were the cause in eleven patients (51%), 7 Drivers + 4 passengers), and fall from a hight in three (14%) and in seven patients (35%) the fractures due to various causes (major crushing in two and explosion in four patients (under wreckage) and pedestrian accident in one. Eighteen patients showed haemodynamic instability on admission, and neurological defecit were elicited in three patients.Urogenital system injury were found in five patients (23.8%) at the bladder or urethra, laparotomy was performed as emergency for three patients , one with Reptured spleen ,the other with rectal injury to whom colostomy was performed , the third patient had negative laparotomy. The mean time before transfer to our unit was 8 days , (range) 1-14 days.Radiographic examinations were done for all patients Ant-post. and outlet and inlet views were done for some. C.T scan was done for 14 patients, 66.6%. The type of (P.R.F) determined according to Tile classification which focus on

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stability of pelvis. In type A fracture the pelvic ring is stable . Type B is partially stable , such as open Book , and (bucket handle) fractures are caused by external or internal rotational forces , and type C injuries which designate complete disruption of the posterior sacroiliac complex with vertical instability . all those major types are subdivided into several subtypes as (B1) and (B2) and (B3) , while type (C) into (CI)

,(C2) ,(C3). Tile (1995) (6)There were 12 patients with type B in this study (eight B1 , two B2 , two B3), and 9 patients had type C injury (five CI three C2 , one C3) , open pelvic ring fractures were seen in two patients. In three patient there was concomitant femoral shaft fracture, and fracture- dislocation of hip in one, Table (1).

Table (1). Types of injury of PRF according to Tile classification

Type	B	no	%	C	No.	%	Open pelvic E
	B1	8	38%	CI	5	28%	2 (9%)
	B2	2	9%	C2	3	13%	
	B3	2	9%	C3	1	4.4%	
Total		12			9		21

Symphyses pubis diastais measured radiologically, was on average of 21 mm (range 8-47 mm), there was two patients presented with transsacral fracture, and Sacro-iliac joint dislocation in the rest. The procedure of external fixation was performed under general anesthesia, the patients placed in the supine position, and two 5.6 Schanz screws placed through stab incisions on both sides of iliac crest sparing the lateral cutaneous nerve of the thigh . External fixator was then installed on the pins, and the injured pelvis reduced by external manipulation under x-ray control. Posterior internal fixation was carried out in a later session (within the first week after injury), if stasisfatory reduction had not been achieved by heavy traction (8-18 kg). Patients mobilization was individualized according to stability of their injured pelvis , and they were mobilized and placed in a sitting position from the first post-operative week in those patients with horizontal instability , while skeletal traction

by transtibial or transcondylar for vertical instability for 4 - 6 weeks , even when posterior fixation has been done .The external fixation was left in place for 8 - 14 weeks depending on the type of the injury and its severity, and physiotherapy monitored during this period. The Majeed's function scale (1989) (7) was used for the assessment of the clinical outcomes. Tornetta and Matta (2005) (8) method was followed for grades of reduction radiologically.

Results:

The average duration of external fixation kept in place was 10.2 week . The average follow up period was 1.6 year (1.00 - 6 years). The average Majeed score was 80.3 points (range 79 -100 points) for type B injury (horizontal instability), and 71 points (range 75-100 points) for type C (vertical instability). The pain score was 23 for type B , and 18 for type C . Table (2).

Table(2) Final assessment of clinical outcome according to Majeed scale

Type	Grade	No.	No.	No.	Total no. pat.
		Excellent or good	Fair	poor	
B	B1	8 83%			12
	B2	2 50%	2		
	B3	2 100%			
C	CI	3 44%	1	1	
	C2	1 30%	2		
	C3			1	9
Open fracture				2	
Total		16% 80,3%		2	21

*excellent 80 - 100 p. , good 70 - 79 p., poor < 60p.

The grades for reduction radiologically were excellent or good in 10 patients of B type (0%) and good to excellent in 6 of type C (60%), and the overall good or excellent were recorted in 16 patients (76%). Concomitant hip fracture or dislocation of the femur or even in the upper limbs deteriorated the functional out come to an average score of 35 (range 12-60p), and the pubis symphysis diastasis radiographs were at a distance range 4-12 mm postoperatively.Percutaneous or

open stabilization of S.I.J was not always easy even after external fixation and skeletal traction, but those procedure performed for five patients in the form of percutaneous for 2 and ORIF for three patients.Para-symphyesal ossification in two cases, total hip arthroplasty due to osteoarthritis of the hip for two patients with concomitant acetabular fracture.Local complications were mainly skin problems, these were summarized in table (3).

Table (3) Complications of external fixation in 21 patients with pelvic fracture

Type of complication	No. patients	%
Surgical pin-site infection	8	38%
Deep infection of pin site	2	9%
Loosening of pins	3	14%
Loss of reduction	5	23.8%
Mal union	7	33%
Non union	1	4.4%
Pin tip cut out	1	4.4%
Lateral cutaneous nerve of the thigh injury	1	4.4%
Pin in soft tissues	1	4.4%
Penetration of femoral head		4.4%
Sacral sores	3	14%

The specific complications were loss of reduction in three (14%) patients, non union in one patient, malunion in two patients. The external fixation failed to give and maintain a

proper reduction in two patients with open book injuries and in one with lateral compression injury, and one patients with type C injury. Pressure sores occurred in two patients.

Discussion:

External fixation has been used as the main method of treatment for unstable injuries of the pelvic ring since decades, ago. Biomechanical studies showed that trapezoidal frame is not notably strong (8), but for open book injuries is enough to stabilize the ring sufficiently to allow mobilization of the patients. For type C, external fixation combined with skeletal traction is one option in the treatment (9). Tile (1995) drew up a classification based on the severity of injury and the type of instability encountered at the anterior or / and posterior part of the pelvic ring for which osteosynthesis permits successful stabilization of the injury (6). Open reduction and internal fixation (ORIF) used by several teams all over the world, but there are relative contraindications such as decompression of retroperitoneal haematoma, and risk of fixation failure or infection. However external fixation in type B injury in our study gave a satisfactory functional outcome (excellent to good) in (86%), since the principle of transverse compression of anterior injury provide adequate short term stability and encourage consolidation of fractures and healing of ligaments. Direct surgical approach in PRI may carry risk of hemorrhage, there for external fixation with its rapidity of installation made it possible to stabilize hemodynamically unstable patients soon after trauma or even at the emergency department by reducing the pelvic volume by around 10%, and reducing the pain by prevention of undesirable movement at the site of the fracture (Clifford et al 10).

Symphysial diastasis reduction can be feasible and achieved whatever the type of injury, in this study Tile B or C with an average range of 7 mm in the immediate post-operative period has been achieved. Failure of external fixation system to reduce the symphyseal separation may be due to urethral or vesical incarceration (11), that was noticed in two patients when the initial reduction was impossible, then when cystography was performed it confirmed the diagnosis. C.T. scan later revealed

intact posterior ligamentous structures.

However several authors (12) (3) reported that external fixation alone faces problems in providing control of reduction in posterior injuries of Tile type C (S.I.J fracture dislocation or trans-sacral fracture) whatever the type of fixator used even trapezoidal frame according to Ziran et al (2005)(13) and Colling(2004) (14), i.e it does not have any effect on the quantity of reduction of posterior injuries and doesn't improve anterior stability according to Clifford et al(2012) (10). However transtibial or transcondylar traction enabled us to obtain anatomical reduction in 86% of type B and 75% of type C, while in vertically unstable injuries associated with ascent of the hemipelvis this must be reduced gradually by traction prior to external fixation, additional posterior metal fixation by ORIF or percutaneous stabilization should be considered. Two patients were subjected to ORIF at 5 day and 15 days after external fixation application. Orbien (2006)(15) and Evans et al (2012)(9) reported good to excellent results regarding pain on Majeed scale(1989) (7) in 50% of type C injury compared to 80% of type B, this is related to the severity of the initial trauma in which ligamentous damage occurred in different grades and levels, and above all insufficient reduction which may lead to mobility with further mechanical damage to neighboring structures and lead to pain which is more in sitting position or after prolonged ambulation, kabak et al(2003)(16). However Hak et al(2009) (1) attributed pain at S.I.J to degeneration within the joint. The anatomical reduction is not only conditional for good functional outcome but the associated vascular or neurological or urological injury gives poorer results. This conclusion was closely correlated to our end results in five patients with urological and three with neurological in whom the good or excellent results down to 21%, similar poor results in patients with associated fractures in there extremities or acetabulum, which lead to degenerative change in the joint and ultimately limited the mobilization of

the patients, Olson et al(2005)(17).Pin-tract infection in this study was 38% , this rate exceeded that of Bottlang et al 18% (4) and Collinge et al 21% (14), this result mostly attributed to lack of hygiene of some patients, and lack of care by the surgeon during pins introduction and lack of care by the nursing staff in obese patients in particular, this infection may deepened and lead to osteolysis then loosening.

Conclusion:

Unstable pelvic ring fracture type B and C can be best treated by external fixation which may give excellent results in 86% of cases. Failure of reduction of unstable posterior pelvic injuries in spite of heavy skeletal traction is an indication for additional fixation.

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