Recent Trends in Management of Acetabular Fractures

A Systematic Review of Literature

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List of Contents

Title	Page No.
List of Tables	i
List of Figures	ii
List of Abbreviations	iii
Abstract	iv
Introduction	1
Management of Acetabular Fracture	6
Aim of the Work	24
Materials and Methods	25
Results	29
Discussion	47
Summary and Conclusion	51
References	52
Arabic Summary	

List of Tables

Table No.	Title	Page No.
Table (1):	Acetabular Fractures Nonoperative Treatment	6
Table (2):	Studies discussing Stoppa approach	31
Table (3):	Studies discussing Percutaneus approach	32
Table (4):	Reduction Quality Using Stoppa Approach	33
Table (5):	Clinical outcome Using Stoppa Approach	35
Table (6):	Complications of Stoppa Approach	37
Table (7):	Complications between the two approach**s**	38
Table (8):	Mean Time of Surgery and Blood Loss Using Stoppa Approach	40
Table (9):	Reduction Quality using percutaneus Approach	43
Table (10):	Complications of Percutaneus Approach	44
Table (11):	Complications of Percutaneus Approach	45
Table (12):	Mean Time of Surgery and Blood Loss Using Percutaneus Approach	46

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Roof arc measurements	9
Figure (2):	Fixation by Kocher-Langenbeck approach	13
Figure (3):	Fixation by Kocher-Langenbeck approach with trochanteric flip osteotomy	16
Figure (4):	Fixation by Ilioinguinal approach	18
Figure (5):	Stoppa approach	21
Figure (6):	Fixation by Percutaneous approach	23
Figure (7):	Flow chart of the study selection process.	29
Figure (8):	Reduction Quality in the two studied groups.	34
Figure (9):	Clinical outcome in the two studied groups.	36
Figure (10):	Complications between the two approachs.	39
Figure (11):	Mean time of surgery between the two approaches.	41
Figure (12):	Mean blood loss between the two approaches.	42
Figure (13):	Reduction Quality using percutaneus Approach.	43
Figure (14):	Statistical analysis of complications of Percutaneus Approach.	45

List of Abbreviations

Abb.	Full term

DVT.....*Deep Venous Thrombosis*

hrs.....*Hours*

LAT.....*Lateral*

MI.....*Myocardial infarction*

O.A.....*Osteoarthritis*

THA .....*Total Hip arthroplasty*

ABSTRACT

Background: The ‘‘gold standard’’ for accessing acetabular fractures involving the anterior column is the ilioinguinal approach. However, the access morbidity of this approach is high, particularly when dissecting within the second window. Therefore, the modified Stoppa approach was presented as a less invasive alternative for surgical access, often resulting in reduced intraoperative blood loss, shortened operative times and more frequently obtaining an anatomic reduction.

Purpose: To discuss the recent trends of management of acetabular fractures through a systematic article review of studies conducted in English.

Patients and Methods: Potentially relevant articles describing recent techniques used in management of acetabular fractures will be identified by online search for studies conducted in English using the PubMed, ScienceDirect and ResearchGate computerized literature database.

Results: From electronic searching, a total of 1324 studies were identified. 750 studies remained after duplicates were omitted. Based on titles and abstracts 724 studies were removed. Full texts of 26 studies were reviewed, eight of them were excluded because either Studies before 2000, non acetabular fracture or not human studies. Finally 18 studies were included in the systematic review.

Conclusion: The percutaneous approach has the advantages of minimal soft tissue dissection, minimal blood loss, lowering infection rates and iatrogenic neurovascular injury. Further high quality randomized controlled trials are needed to verify the results.

Keywords: *Deep Venous Thrombosis - Myocardial Infarction - Total Hip Arthroplasty*

INTRODUCTION

Acetabular fractures represent approximately 37 per 100,000 pelvic fractures annually so they are rare fractures [1]. High-energy trauma is the primary cause in younger individuals and commonly associated with other fractures and pelvic ring disruptions. Fractures secondary to moderate or minimal trauma are increasingly of concern in those over 35 years [1].

Acetabular fractures are most often associated with lower limb fractures resulting from falls [1, 2]. Posterior wall fractures are the most common and account for approximately 24% of acetabular fractures [3].

Fractures of the acetabulum occur by impact of the femoral head with the acetabular articular surface. This force to the femoral head may be applied via the greater trochanter (along the axis of the femoral neck) or from anywhere along the long axis of the femoral shaft [4].

Subsequently, the pattern of the resulting acetabular fracture depends on the position of the hip at the time of impact, as well as the location and direction of the originally applied force [5].

Fractures of the acetabulum are frequently associated with other musculoskeletal and visceral injuries. In some series, such associated injuries occurred in more than 50% of patients. [6, 7]

Overall, in the large series reported by ***Matta*** [8] 35% of the acetabular fractures were associated with an injury involving an extremity, 19% with a head injury, 18% with a chest injury, 13% with a nerve palsy, 8% with an abdominal injury, 6% with a genitourinary injury, and 4% with an injury of the spine. In a more recent study, lower extremity fracture was found to be the most commonly associated injury (36%), followed by injuries to the lungs, retro-peritoneum, and upper extremities (respectively ranging from 21% to 26%). Other injuries occurred, in increasing order, to the bowel, kidney, vascular system, bladder, spleen, liver, brain, and spine (respectively ranging from 2% to 16%).[9]

Acetabular fractures are classified based on the concept that two columns or pillars, one anterior and one posterior, comprise the acetabulum. This is currently the most commonly used classification system.

The "Letournel" acetabular fracture classification continues to remain the international language of the majority of surgeons treating these complex injuries. This classification is based on the anatomic pattern of the fracture.

The five elementary fracture patterns are the anterior wall; anterior column, posterior wall, posterior column, and transverse. The associated patterns are either a combination of elementary patterns or an elementary pattern with an additional fracture component.

The five associated fracture patterns are the posterior column and posterior wall, anterior column or wall and posterior hemi-transverse, transverse and posterior wall, T-shaped, and both column fracture.[10]

Acetabular fractures are generally associated with other injuries of the pelvis and/or lower limbs which may influence treatment options, surgical approach and clinical outcomes [11]. Patient age, fracture stability, the presence of co- morbidities and osteoporosis, combined with surgeon experience, also influence treatment options.

Treatment options include conservative methods (e.g. traction, progressive weight bearing), open reduction-internal fixation, acute total hip arthroplasty and percutaneous fixation in situ. Open reduction and internal fixation appears to be the standard treatment [1, 2].

Surgical approaches routinely used for operative management are Kocher-Langenbeck, ilioinguinal and extended iliofemoral or triradiate approaches or combinations of them [1, 11].

The ‘‘gold standard’’ for accessing acetabular fractures involving the anterior column is the ilioinguinal approach. However, the access morbidity of this approach is high, particularly when dissecting within the second window. Therefore, the modified Stoppa approach was presented as a

less invasive alternative for surgical access, often resulting in reduced intraoperative blood loss, shortened operative times and more frequently obtaining an anatomic reduction.[12]

The modified Stoppa intra-pelvic approach is gaining wide acceptance as a substitute for the ilioinguinal approach. [13] More recently, as its utility has been more fully appreciated, it is commonly used in conjunction with the lateral window.[13, 14]

This approach is felt to be advantageous because it offers improved exposure of the quadrilateral surface and posterior column while minimizing dissection by avoiding the use of the "middle window" of the ilioinguinal approach.[15] It is especially useful for fractures requiring buttress plating of the quadrilateral surface.

Percutaneous fixation technique for the management of pelvic and acetabular fractures is gaining wider acceptance in the orthopaedic trauma community. The development of new surgical techniques for antegrade and retrograde placement of pelvic and acetabular columnar screws, and the increased access to advanced imaging and navigational tools have resulted in an increased application of the technique. [16]

Recently, percutaneous techniques have emerged for management of the less-displaced acetabular fractures, limiting associated soft tissue disruption, length of surgery, and blood loss

when compared with ORIF. This modern treatment method has a steep learning curve and potentially significant morbidity. [17]

Percutaneous fixation, with or without closed reduction, has been proposed to prevent potential further fracture displacement and for elderly patients with displaced acetabular fractures in whom a less than anatomic reduction could be accepted, as well as for simple fractures with minimal displacements, and for the morbidly obese [18,19].

Percutaneous fixation has also been proposed as an adjunct to standard open reduction and internal fixation techniques [20].

New implants that have been lately introduced in the acetabular surgery are mainly the plates specifically designed for buttressing and fixation of the quadrilateral plate. These plates can be inserted supra- or infra-pectineally, are precontoured but flexible enough to allow adjustment to the fracture configuration and pelvic morphology. [21]

MANAGEMENT OF ACETABULAR FRACTURE

Nonoperative Treatment of Acetabular Fractures:

All stable concentrically reduced acetabular fractures not involving the superior acetabular dome can be considered for nonoperative management.

This group of fractures includes nondisplaced and minimally displaced fractures, fractures in which the intact part of the acetabulum is large enough to maintain stability and congruity, and those with secondary congruence. [22, 23] (Table 1)

Table (1): Acetabular Fractures Nonoperative Treatment

Indications	Relative Contraindications
• Stable non-displaced fractures	• Hip joint instability
• Stable and congruous	• Hip joint incongruity
• Minimally displaced fractures	
• Selected displaced fractures	
• Intact acetabulum maintains stability and congruity	
• Low anterior column fractures	
• Low transverse fractures	
• Low T-shaped fractures	
• Both-column fractures with secondary congruence	
• Wall fracture not compromising hip stability	
• Infirm patients unable to Withstand surgery	
• Severe osteoporosis precluding fracture fixation	

Patients with severe underlying medical problems that preclude surgical intervention may also be selected for non-operative management. They are relatively a small group, consisting mainly of elderly patients. [22, 23, 24, 25]

Rowe and Lowell [25] first recognized the condition of the superior dome of the acetabulum to be a significant prognostic indicator of clinical outcome. The roof of the acetabulum or superior dome is described as the superior third of the weight bearing region of the acetabulum.

Olson and Matta [24] illustrated that axial CT sections of the superior 10 mm of the acetabular articular surface are equal to the weight-bearing dome region and can also be useful in determining if acetabular fracture lines involve this region. Although controversy exists regarding the exact amount of displacement that is considered acceptable when the superior acetabular dome is involved, most authors recommend surgical interference if displacement exceeds 2 mm. [22, 24]

Matta et al. [23] created roof arc measurements to determine whether an acetabular fracture has involved the weight-bearing dome.

This measurement has been applied to determine if the remaining intact acetabulum is sufficient to maintain a stable and congruous relationship with the femoral head. In this way, non-operative versus operative treatment can be choosen. With the leg out of traction the roof arc is measured on all three radiograph views.