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Original Article

OUTCOMES OF EXTERNAL ROTATORS-SPARING APPROACH IN THE TREATMENT OF POSTERIOR WALL ACETABULAR FRACTURES: A RETROSPECTIVE STUDY

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Abstract

Purpose: *Posterior wall acetabular fractures are typically treated via a kocher-langenbeck approach. This approach can be associated with complications such as avascular necrosis of the femoral head, heterotopic ossification, sciatic neurapraxia and compromise of the hip muscle. In this study we assessed clinical and radiological outcomes of muscle-sparing posterior approach for the treatment of posterior wall acetabular fractures.* ***Methods:*** *This retrospective case series study included 37 cases of surgically-treated posterior wall acetabular fractures using muscle-sparing posterior approach. It depended on superior and inferior intermuscular windows for plate osteosynthesis. Cases were operated in the period between March 2013 and January 2019 in orthopedic surgery department in the University Hospitals. Clinical and radiographic assessment were assessed with minimum 3-years follow up utilizing the Merle d' Aubigne and Matta scoring systems respectively.* ***Results:*** *The mean patients' age was 38.8 ± 11.1 years. Average operative time was 60.3 min. Average intra-operative blood loss was (123.9±10.5 ml). There were no cases of avascular necrosis of the femoral head. Anatomical reduction was achieved in 31 hips (83.8%). At one-year follow-up, final Merle d' Aubigne scores were excellent in 27 hips (73%), good in seven hips (18.9%). Cases with anatomical reduction revealed clinically excellent results in 27 cases (87.1%), good in three cases (9.1%).* ***Conclusion:*** *External rotators-sparing approach may be considered as alternative to conventional Kocher-Langenbeck approach in posterior wall acetabular fractures treatment, with good results and few complications.*

Keywords: *External rotators Posterior approach, Acetabulum, Posterior wall fracture, Muscle sparing*

1. Introduction

Posterior wall acetabular fractures represent approximately up to 33% of all acetabular fractures. Surgical treatment of displaced acetabular fractures should achieve anatomical reduction and rigid fixation to attain a mobile, painless and stable hip [1]. The most commonly used approach for surgical stabilization of posterior acetabular fractures is the conventional Kocher-Langenbeck (KL) which allows the exposure of the posterior wall and retroacetabular structures by division of short rotators. The long term complications of KL approach include iatrogenic nerve palsies (3–18%) [2], wound infections (3-12%) [3], thromboembolic complications (8%) [4], avascular necrosis (AVN) of the femoral head (2-10%) [5], heterotopic ossification (HTO) (4–30%) [1], and hip posttraumatic osteoarthritis (4–35%) [4]. Besides, the conventional KL approach induces surgical injury to the external

rotators [6], over traumatic external rotators injury that may be exist [7]. Many literatures encourage rotators repair to stabilize the hip joint and decrease failure rate and dislocation of arthroplasty later on, by acting as a physical scaffold [8,9]. Meanwhile, the better external rotation function, the more balanced hip joint motion were also mentioned [10]. Gibson had described a modification of the Kocher approach in 1950, by moving the skin incision line anteriorly, approaching anterior fibers of gluteus maximus, to minimize muscle injury. Magu has described a modification of Kocher-Langenbeck approach in 2011, for the treatment of posterior wall acetabular fractures. It allowed access to the acetabulum through two windows: the superior was between the (gluteus medius and piriformis) and the inferior was between the (external rotators and ischial tuberosity) inferiorly [11]. In this study we aimed to assess short-term outcomes of external rotators muscle-sparing posterior surgical approach in the treatment of posterior wall acetabular fractures.

2. Materials and Methods

2.1. *Ethical review and study design*

Institutional review board approval was obtained for this retrospective case series study (IRB#4820). This retrospective study included 37 cases of posterior wall acetabular fractures that were treated by internal fixation through external rotator muscle-sparing approach. All cases were operated by the same surgeon between March 2013 and January 2019 in orthopedic surgery department in the Univ. Hospitals. Informed consent was obtained from each patient participate in the study.

2.2. *Patient selection*

All cases that have simple posterior wall acetabular fractures and treated utilizing external rotator-sparing approach in the period between March 2013 and January 2019 in orthopedic surgery department in the University Hospitals were included in the study. Cases with traumatic external rotators injury, marginally-impacted fractures, open fractures, associated femoral head fractures and those who missed follow up were excluded. Preoperative diagnosis was made clinically and radiologically, and then operative planning was made for each case, fig. (1).

Figure (1) 3D CT scan of Rt hip shows: posterior wall fracture of Rt acetabulum.

2.3. *Surgical technique*

Under general anesthesia, patients were located in prone position on a radiolucent table and skin incision was marked. The knee remained in flexion to reduce traction on sciatic nerve. A straight skin incision 20 to 30 cm in length extending from midthigh to the iliac crest was done. Dissection was carried out till the fascia over the gluteus maximus muscle. The anterior border of the gluteus maximus was identified and retracted posteriorly [12]. The sciatic nerve was and protected, fig. (2).

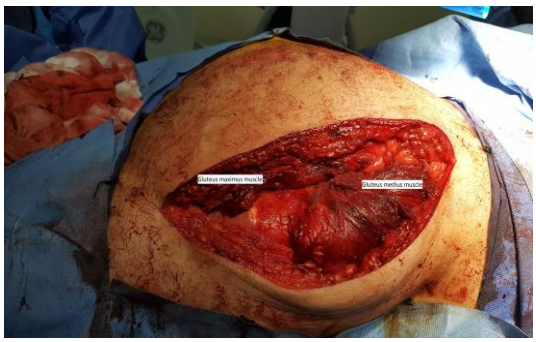

Figure (2) Shows Gibson interval between gluteis maximus and gluteus medius muscles.

A superior window was created between the piriformis and gluteus medius muscles. A passive abduction and external rotation of the affected hip were done to relax short rotators and help in identification of fractured fragments. The proximal part of posterior column could be approached and fixed through this window, fig. (3-a & b).

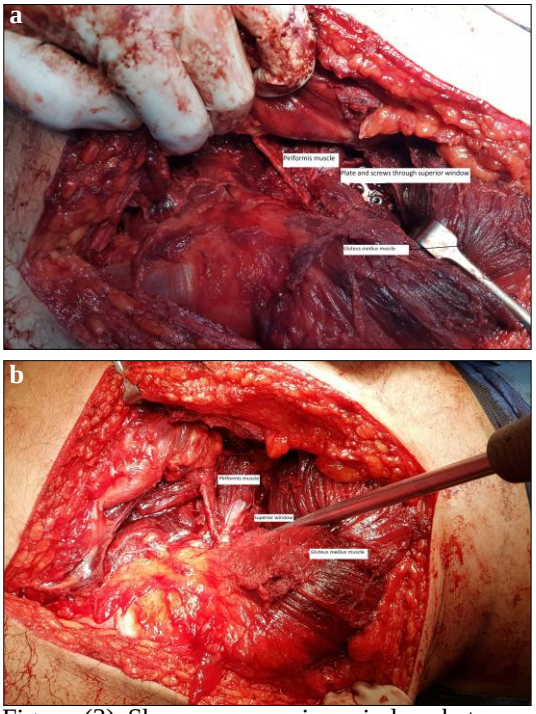

Figure (3) Shows **a.** superior window between piriformis muscle and gluteus medius muscle, **b.** plate and screws through superior window.

An inferior window was created between external rotators and ischium, fig. (4).

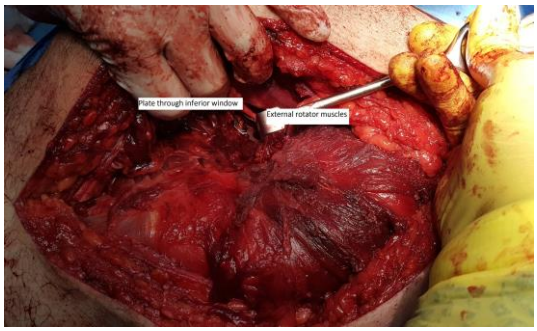

Figure (4) Inferior window with lower part of 3.5 mm reconstruction plate fixing the fracture.

Fracture reduction was done by gentle manipulation of fragments with fingertips and ball spike tool to maintain reduction. Fixation of fracture by two interfragmentary screws and a reconstruction plate was done with full respect to soft tissue attachment of fragments. The buttress plate was undercontoured to allow compression and buttressing of the fracture. The plate was first secured caudally into the ischium then the cranial screws were fixed to the intact ilium [12]. The reduction was assessed through coaptation of fracture edges. The position of the plate and screws was assessed by fluoroscopy. Finally, closure of wound in layers was done. Immediate postoperative plain x-ray, fig. (5) and CT were done [13], fig. (6-a, b & c) and radiological scoring was made. The follow up was done clinically and radiologically at one, two, four, six, 12, 24 weeks, one year, 2 years and three years postoperatively. Assessment was done clinically using modified Merle d' Aubigne and Postel scoring system scoring system one year postoperatively [14] and radiologically using Matta scoring system immediately postoperatively [15].

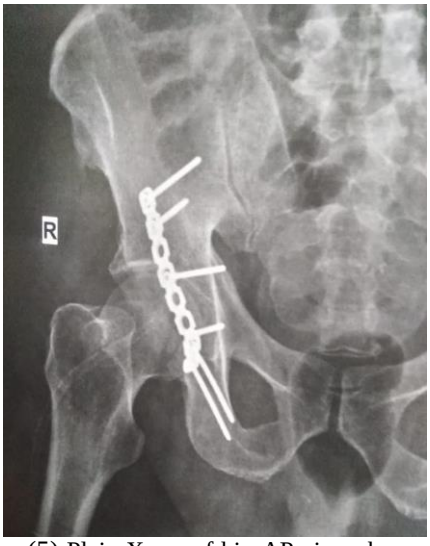

Figure (5) Plain X-ray of hip AP view shows postoperative fixation of fracture fracture by 2 interfragmentry screws and 3.5 mm reconstruction plate and 4 screws.

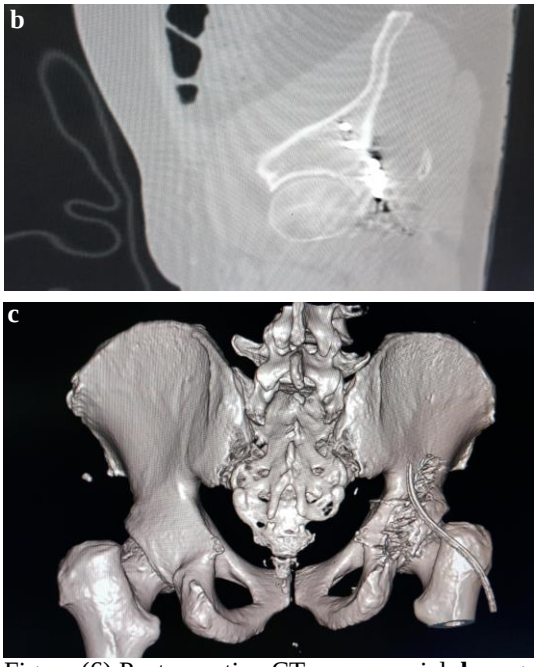

Figure (6) Postoperative CT scan **a.** axial, **b.** sagittal and **c.** 3D reconstruction of both hips shows reduction of Rt aceatbular fracture with fixation.

2.4. *Statistical analysis*

Results were reported in this study as minimum, maximal, mean, standard deviation, number, and percent. SPSS software (version 23 for Windows, Chicago, Illinois) was used for data analysis. *P* value was considered statistically significant if less than 0.05.A sample size calculation was not done because this study included all patients who met the inclusion criteria during the time frame of the study.

3. Results

The mean patient age was 38.8 ± 11.1 years (range 23–65 years). There were 32 males and five females. The mode of injury was road traffic accident in 32 patients and falling from a height in five patients. Eight patients had hip dislocations at time of presentation to hospital. The average interval time between injury and surgical treatment was about 5.5 ±1.9 days (range 2-9 days) and average operative time(skin to skin) was about 60.3±10.5 mins (range 45-80 min). Average intraoperative blood loss was 123.9±10.5 ml. (range 100-140 ml). Fracture reduction quality was graded using Matta score as anatomical in 31 (83.8%) hips, imperfect in six (16.2%) patients and poor in none. At one-year follow-up, final functional score using Merle d'Aubigne scores were excellent in 27 (73%) hips, good in seven (18.9%) hips, fair in three (8.1%) hips. In 31 patients with radiological anatomical reduction, there were 27 patients (87.1%) had excellent clinical outcomes, three patients (9.1%) had good clinical score, and one patient (3.2%) had poor clinical outcome. Statistical analysis showed strong positive correlation between radiological score and clinical outcome ($r=0.7$, $p<0.001$). There was one case (2.7%) complicated by heterotopic ossification (HTO). Five cases had post-traumatic arthritis on two-year evaluation. One case had preoperative sciatic nerve injury and exploration revealed neurapraxia that improved 14 weeks postoperatively.

4. Discussion

Numerous factors affect outcomes of acetabular fractures treatment including type of fracture, dislocation, fracture of the femoral head, associated injuries, timing of surgery, quality of reduction, and the surgical approach [16,17]. HTO, iatrogenic sciatic nerve injury, and AVN are directly related complications of posterior conventional approaches. Besides, short rotators division and glutei muscles stripping and their repair may result in postoperative limitation of internal rotation. There is a direction to decrease tissues morbidity and improve clinical outcome utilizing muscle sparing approaches [18]. Abo-Elsoud et al. used limited approach in superior fractures and kept obturator internus tendon intact, to improve functional outcome and minimize complications [19]. Although Matta et al. reported 100% anatomical reduction in their cases, only 68% achieved excellent and good results [15]. Magu et al. used two windows rotator-sparing technique to minimize soft tissue damage [11]. Lee et al. used modified

fixation technique through spring plates only fixation [20]. Reatiga et al. modified rotator-sparing technique and used only superior window for fixation [21]. Sallam used 3 windows technique in his work for acetabular fractures fixation, first one above piriformis muscle, second one between piriformis and gemellus muscle and the third window at ischium [22]. The current study described muscle sparing approach for treatment of posterior wall acetabular fractures. We kept gluteus maximus intact through Gibson interval and kept hip rotators intact through the two windows technique. Fixation technique depended on interfragmentry screws and reconstruction plate and considered effective method for fixation [23]. In current study the quality of reduction has significant effect on clinical outcome. Cosgrove et al. has also documented the strong relationship between radiological reduction and clinical outcome [12]. In current study, radiological anatomical reduction was achieved in 31 hips (83.8%) and satisfactory clinical outcome (excellent and good functional scores) occurred in 34 cases (91.8%). This is nearly comparable with results of Magu et al. study in which, anatomical reduction and good to excellent results were achieved in 93% of cases [11]. This is better than that described by Josten et al., in which they achieved anatomical reduction in 75% of cases [24], and better than described by Sallam (78%). This is lesser than by Reatija et al. that achieved anatomical reduction in 100% of cases [21]. One case (2.7%) had developed HTO throughout the follow up, and this is comparable to Magu et al. that reported also one case (5%) with HTO whereas other series in literature reported HTO incidence ranging from 4 % to 16 % [25]. Reatija et al. reported no cases with HTO [21]. This is mostly related to gluteal muscle dissection and stripping. The gluteus minimus muscle attachment to the ilium was preserved in this modified approach and this might have decreased HTO incidence. The rates of posttraumatic arthritis and AVN of the femoral head are 13.5% and 0%, respectively, in the present series. Magu et al. reported only 7% of cases of posttraumatic arthritis, and one case (5%) developed avascular necrosis of femoral head, and this is comparable to literature [11]. Reatija repoted 4.2% AVN in their series. Pascarella et al. reported femoral head AVN in 8% of cases [26]. This modified approach decrease the possibility of injury of medial circumflex femoral artery in contrast to the traditional Kocher -Langenbeck approach that involve short rotators division with risk of branches of medial circumflex femoral artery injury [19]. The average operative time was 60.3 min and this is less than time of Magu et al. , that was 73.2 min [11]. The average intraoperative blood loss was 123 ml and this is less than achieved by Magu et al. that was 187 ml [11]. No patients in the current study had iatrogenic nerve palsy. While an incidence of 3% to 18% iatrogenic sciatic nerve has been reported in literature [27]. This study had limitations of being retrospective, the relatively small number of cases and short follow up time.

5. Conclusions

Posterior muscle-sparing approach can be used in fixation of posterior wall acetabular fractures with good results and few complications on short-term follow up.

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