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Early reduction of acetabular fractures decreases the risk of post-traumatic hip osteoarthritis?

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ABSTRACT

Background: Acetabular fractures are complex high-energy injuries. Increasing in recent years with the increased use of high-speed motor vehicles. One of the most important complications of acetabular fracture is the post-traumatic hip osteoarthritis; this complication has been associated to poor fracture reduction, type of fracture and delay in the reduction and fixation of acetabular fracture (Timing surgery). The aims of this study were to determine the incidence of post-traumatic hip osteoarthritis after acetabulum fracture and demonstrate whether the delay surgery is associated to early post-traumatic hip osteoarthritis.

Methods: Using the database of patients with acetabular fractures treated with open reduction and internal fixation (ORIF) over 3 years (2011–2014) with minimum of 2 years follow-up. Data was acquired and saved in a digital format. Demographic information was obtained from each patient with minimum of 2 years follow-up. Acetabular fracture was distributed according to the classification of Judet. The quality of reduction was classified in anatomic (0–1 mm) and non-anatomic (>1 mm) and the timing surgery, early (<7 days) and delay (>7 days). Clinical and radiographic follow-up was generally performed at six weeks, three months, one and two years after fracture fixation. Multivariate logistic regression analyses were performed to assess the strength of the covariates in relation to the development of post-traumatic hip osteoarthritis.

Results: 59 (48%) patients of 122, developed post-traumatic hip osteoarthritis before 2 years. Posterior wall fracture with or without transverse fracture was associated with higher post-traumatic hip osteoarthritis compared with other types of fractures ($p < 0.05$). Patients with better anatomical reduction had less post-traumatic hip osteoarthritis compared with those who had nonanatomic reduction ($p < 0.05$). There was no evidence of association between early timing of the surgical procedure and the presence post-traumatic hip osteoarthritis ($p = 7092$).

Conclusions: According to our results, the anatomical reduction of the articular surface in acetabular fractures is the most important factor in hip osteoarthritis prevention. This factor is strongly associated with early surgical treatment, preferably done within seven days. The timing surgery it is not a factor associated with post-traumatic osteoarthritis.

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1. Introduction

Acetabular fractures are life-altering injuries that commonly occur in young, active, and productive members of society, although the number of elderly patients sustaining acetabular fractures has increased.[1] The main goal of treatment of fractures of the acetabulum is to preserve the native hip joint, so that it can continue to function for the remainder of the patient's life.[1,2] Acetabular fractures are complex high-energy injuries, increasing in recent years along with the increased use of high-speed motor vehicles.[1–5] The diagnosis and classification of acetabular fractures is based on radiographic findings. the most widely used classification is Letournel's, but also the classification of the AO is widely accepted, which is more specific but with greater complexity which is why its use is limited.[6–9] One of the most important complications of acetabular fracture is the hip osteoarthritis; this complication has been associated mainly to poor fracture reduction, the type of fracture and the delay in the reduction and fixation of acetabular fracture (Timing surgery).[2,5,10] The aims of this study were to determine the incidence of post-traumatic hip osteoarthritis after acetabulum fracture and

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demonstrate whether the delay in surgery is associated to early post-traumatic hip osteoarthritis.

2. Methods

This study was approved by our local institutional review board. Using the database of patients with acetabular fractures treated with open reduction and internal fixation (ORIF) over 3 years (2011–2014) with minimum of 2 years follow-up. Data was acquired and saved in a digital format. Demographic information was obtained from each patient which included age (years), sex, and BMI, mechanism of injury, timing of surgery, classification of the fracture and complication as well as follow-up and patients with hip osteoarthritis demonstrated by radiography, according to the classification of hip osteoarthritis by Bombelli.[11] Acetabular fractures that were treated non-operatively, those that required acute primary total hip, and those in which the acetabular fracture was periprosthetic were excluded. Surgical site infections were also excluded, because if it's narrow association with implant loosening or avascular necrosis of the femoral head.

All patients were evaluated with the use of five standard radiographic views: anteroposterior radiograph, two Judet views, cephalic and caudal views of the pelvis. All patients were further evaluated with computed tomography (CT) of the pelvis. Each fracture was classified on the basis to the method of Letournel and Judet.[12] Patients were divided into 2 groups: Those, which are operated within 7 days (early surgery), and those operated after 7 days (delay surgery). Each group was analyzed by the accuracy of reduction, measurements of the greatest residual displacement of any of the six acetabular reference lines of Letournel and Judet. The reduction was graded as anatomical (0–1 mm of residual displacement) or non-anatomical (>1 mm). Clinical and radiographic follow-up was generally performed at six weeks, three months, one and two years after fracture fixation.

3. Statistical analysis

SPSS version 21 statistical software (Chicago, Illinois, United States) was utilized to perform the statistical analyses. The chi-square test was used to compare the categorical data. A p value less that 0.05 with the two-tailed test was considered statistically significant. Multivariate logistic regression analyses were performed to assess the strength of the covariates (Timing surgery, type of fracture, accuracy of reduction, age, gender and BMI) in relation to the development of post-traumatic hip osteoarthritis, emphasizing the placed upon impact of timing surgery. A threshold for statistical significance was also established at $p < 0.05$.

4. Results

According to the data collected, 147 patients were initially obtained. Exclusion criteria were applied to eleven patients that present surgical site infection during follow-up (7%), fourteen had avascular necrosis of the femoral head.

Of the 122 patients remaining, 90 (74%) male and 32 (26%) were female. Mean age was 41 years (range 20–79 years) with a mean duration of follow-up of 2.4 years. We found 59 (48%) patients with development of post-traumatic hip osteoarthritis before 2 years. No difference was found between age, gender, BMI and post-traumatic hip osteoarthritis ($p > 0.05$). (Table 1)

The mechanism of injury was high-energy trauma in all cases (100%) (70 car accidents, motorcycle 32 and 20 falling more than 3 m high). 16 patients (13%) had associated lesions, which required admission to the ICU for hemodynamic stabilization. 30 patients with associated dislocation, 24 were reduced closed form within 24 h of admission, remaining 6, continued dislocated between 24 and 48 h, due to delay in the transfer to a first level hospital, skeletal traction was used until surgery in all cases. Directly related to trauma 21 (17%) patients had neurological symptoms from admission with sciatic nerve injury. Six patients (4%) had sciatic nerve injury after surgery, all by posterior approach. Two of them clinically recovered at 3 months, two at 6 months and one patient at 12 months.

Table 1
Demographics. *Average age. OA = Osteoarthritis.

	No (%)	Hip OA (%)
Total	122 (100)	59 (48)
Gender		
Male	90 (74)	44 (36)
Female	32 (32)	15 (12)
Age*	20–79 (41)	
Type of accident		
Car accident	70 (57)	
Motorcycle accident	32 (26)	
Fall (3 m heights)	20 (16)	
Intensive Care Unit (ICU)	16 (13)	
Sciatic nerve injury (before surgery)	21 (17)	
Sciatic nerve injury (after surgery)	5 (4)	

4.1. Type of fracture and hip osteoarthritis

Of the 122 acetabular fractures, 80 (65%) had a simple fracture pattern and 42 (34%) had an associated fracture pattern. Of the 59 patients with post-traumatic hip osteoarthritis, 12 (9%) were associated with transverse fractures, 26 (21%) had posterior wall fracture, 19 (16%) had transverse with posterior wall fracture and 2 (2%) had both columns fracture. Patients with anterior column and anterior wall fracture did not present hip osteoarthritis at 2 years.

Patients with posterior wall fracture, and with transverse plus posterior wall fracture being higher rate of post-traumatic arthritis compared with other types of fracture ($p < 0.05$) (Fig. 1)

4.2. Accuracy of reduction

The postoperative reduction was graded as anatomical in 75 (61%) patients and nonanatomic in 47 (39%). Patients with better anatomical reduction had less post-traumatic hip osteoarthritis compared with those who had nonanatomic reduction (24:35 $p < 0.05$). The rate of anatomical reduction was significantly higher in hips with simple fracture (posterior wall fracture mainly) compared with associated fracture types ($p < 0.05$). Fractures with involvement of the quadrilateral plate had a significantly lower rate of anatomic reduction ($p = 0.05$). (Fig. 2).

4.3. Timing surgery

The average time between injury and surgery was 11 days ± 7.5 days with a range from 4 to 18 days. The main reason why the surgery was performed after 7 days was because our hospital is not a trauma center and operating room time is shared with other specialties. 83 patients were operated after 7 days (41 with anatomic reduction), and 39 within 7 days (34 with anatomic reduction). In the univariate analyses, it was found that the post-traumatic hip osteoarthritis was lower in patients who were operated within the first 7 days compared with those operated after 7 days (OR: 0.2393, 95% CI: 0.1031 to 0.5550 $p < 0.05$). When analyzed, the relationship between timing surgery and quality of reduction, better results are found in patients who underwent surgery within 7 days (OR: 0.1162, 95% CI: 0.0418 to 0.3230 $p < 0.0001$) (Figs. 2–3).

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