



Accuracy of reduction and early clinical outcome in acetabular fractures treated by the standard ilio-inguinal versus the Stoppa/iliac approaches



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ABSTRACT

In acetabular fractures, the correct choice of the surgical approach is mandatory to achieve accurate reduction and to avoid complications. Anterior approaches include the ilio-inguinal, the Stoppa, the ilio-femoral and the para-rectal exposures. The first two are the most commonly used approaches nowadays. The aim of this study was to compare these two approaches. The standard three window ilio-inguinal approach was compared to the intra-pelvic Stoppa approach with an added iliac window. The study enrolled 54 patients. Patients were divided into two groups. The first group consisted of 33 patients presented with acetabular fractures and had ORIF starting with an ilio-inguinal exposure. This group was compared to a second group of 21 patients who were treated with the Stoppa/iliac window approach. All patients were treated by one surgical team. The accuracy of reduction, the early clinical results and the approach related complications were compared.

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Introduction

In acetabular fractures, the correct choice of the surgical approach is mandatory to achieve accurate reduction and to avoid complications. The exposure of the anterior column of the acetabulum is routinely done through the ilio-inguinal approach, introduced by Letournel in 1965 [1]. The intra-pelvic Stoppa approach, a less invasive alternative to the ilio-inguinal one, was introduced to orthopaedic surgery in the early 1990s [2]. This approach avoids the middle window of the ilio-inguinal approach and at the same time provides a wider exposure to the quadrilateral plate. Commonly, the iliac window of the ilio-inguinal approach is added. Following its introduction, the Stoppa approach gained wide popularity especially in Europe. The reported rates of anatomical reduction and early clinical results were similar to the published results of the standard ilio-inguinal approach. However, comparative studies that take into consideration the variability in patients' demographics, fracture types and more importantly, the level of surgical experience are lacking.

The aim of this study was to compare early outcomes of acetabular fractures requiring anterior exposure treated by the

standard ilio-inguinal approach versus the Stoppa/iliac approach. The two approaches were compared to each other considering operative time, fixation techniques, intra-operative complications, accuracy of reduction, and early clinical results.

Patients and methods

From June 2007 to December 2012, 192 acetabular fractures were treated at our institution. All of these fractures were due to high energy trauma (RTAs). All patients were firstly stabilized following the ATLS protocol. Thereafter, the anterior–posterior and Judet X-rays were studied to classify the acetabular fracture according to Letournel's classification [1]. CT scan with 3D reconstruction was done to explore the articular injury. Articular comminution was stated if there were more than three separate articular segments bearing articular surface. Preoperative adhesive skin traction was done to guard against further injury to the femoral head. Any associated skeletal injury was recorded.

In skeletally mature patients, fractures that met indications for the use of an anterior approach, and completed at least one year follow-up, were included in this study. Accordingly, 54 patients were included. All patients were treated by the same surgical team.

Patients were divided into two groups: Group I, included 33 patients treated by the formal ilio-inguinal approach. This was our routine approach until May 2011. Should we shift to the newly emerging Stoppa/iliac approach? In order to answer this question,

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and after approval from the ethical committee, the current study was set aiming at comparing the preliminary results of the former to the later. Therefore, starting from May 2011, all cases formally treated by the ilio-inguinal approach were treated exclusively by the Stoppa/iliac one. Patients who completed the first year of follow-up after this Stoppa/iliac approach were 21 patients. These patients were included in the second group (Group II).

Fractures indicated for an anterior approach were the anterior wall, anterior column, associated columns, anterior column posterior hemi-transverse, some T-shaped fractures, and some transverse fractures. Transverse and T-type fracture patterns were included if the fracture was trans-tectal or juxta-tectal and no posterior wall involvement was noted.

In order to compare the quality of reduction among different fractures in the two groups, the AO/OTA classification was used to group the included Letournel fractures [3]. Type A fractures contain simple types without a posterior column fracture, i.e. anterior wall, anterior column. Obviously, no posterior fixation was needed in this group. Type B contains the transverse, T-shaped and anterior column with a posterior hemi transverse fractures. In these fractures, the posterior column fracture line is transversely oriented, runs in an oblique sagittal plan crossing the pelvic brim. The fracture line is relatively low so that the proximal part of the posterior column remains attached to the stable ilium. Type C includes only the associated both column fractures in which no part of the posterior column remains attached to the intact ilium. The fracture is high and runs in a coronal plan parallel to the pelvic brim.

All operations were performed on a standard table in the supine position. General anaesthesia was administered. A urinary catheter was inserted preoperatively. The image intensifier was positioned accurately before draping of the patient. Check preliminary images were taken in the A/P and oblique projection.

The surgical exposure in the ilio-inguinal and in the Stoppa approaches was done following the steps described by Letournel [1] and Sagi et al. [4], respectively.

The technical tips regarding the reduction and fixation vary according to the fracture pattern. In high anterior column fractures, reaching the iliac crest, the reduction starts at the lateral window. This is identical for both approaches. The anterior column is reduced to the pelvic brim, following Letournel's proximal to distal rule. In low anterior column/anterior wall, the reduction was done through the middle window of the ilio-inguinal approach versus the Stoppa window. Fixation of the anterior column was done using a pelvic brim plate, inter-fragmentary screws and iliac wing plates. Extension to the contra-lateral side was done in case of symphysis diastases.

The two approaches differed in the way of reduction and fixation of the posterior column. In the ilio-inguinal approach, a large asymmetric clamp was spanned between the middle window and lateral ilium. In the Stoppa approach, the oblique Matta clamp was applied from the quadrilateral plate to the pelvic brim or a picador was inserted pushing the posterior column towards the pelvic brim. The posterior column was commonly fixed with screws. These screws were inserted respecting the orientation of the fracture line.

To support a comminuted quadrilateral surface, a spring plate was applied through the middle window of the ilio-inguinal approach. This plate had to be perfectly bent to allow its free distal end to reduce and buttress the quadrilateral surface as accurately as possible (Fig. 1). The infra-pectineal plate was used as alternative to the spring plate when using the Stoppa approach. When using an infra-pectineal plate, the pelvic brim plate was lateralized about 1.5 cm to allow a space for the proximal end of the infra-pectineal plate to be mounted on the iliac wing. The infra-pectineal plate was under-contoured and attached to a reduction

clamp to protect weak quadrilateral surface against clamp penetration. Screws were inserted proximally and distally while the reduction was maintained to allow maximum buttressing effect for the quadrilateral surface (Fig. 2).

If reduction of the posterior column was difficult from the anterior approach, a posterior approach was done in the same session of anaesthesia.

Postoperatively, A/P and oblique X-rays were done to measure the maximum residual displacement. If an additional posterior approach was planned, the maximum displacement was measured on the images taken by the image intensifier after finishing the anterior exposure. Measurements were done using ImageJ software version 1.47v for Windows. The thread diameters of the small fragment cancellous screw are 4 mm. This diameter is not affected by the obliquity of the X-rays. Therefore, it was used for the calibration from pixels to millimetres. The residual displacement was then graded according to Matta grading system for the accuracy of reduction [5].

Non-anatomical reductions (>1 mm) were also classified according to the site of the residual displacement into: (1) Reductions in which the residual displacements occurred in the weight bearing area and resulted in loss of the congruency between the femoral head and acetabular dome. (2) Reductions in which residual displacements occurred outside the weight bearing area, with restored congruency between the femoral head and acetabular dome. Assessment of the hip congruency was done on the A/P view of the pelvis comparing the normal side to the operated one.

Clinical outcome was measured using the Matta modification of the Merle D'Aubigne score. Excellent results were for 17–18 points, good for 15–16 points, fair for 13–14 points, and poor for less than 13 points [5].

Patients were followed in at the 2-week, 6-week, 3-month, 6-month and 1-year marks. Thereafter, patients were followed annually. The accuracy of reduction was reassessed in the first three visits to take in consideration any loss of reduction. The recorded one year clinical results for Group A was compared to the clinical results after one year for Group B.

Statistical analysis was done using SPSS version 11.0.1 for Windows (SPSS Inc., Chicago, Illinois). Spearman's correlation was used to detect linear relations between quantitative variables while Mann–Whitney and Kruskal–Wallis tests were used to rank and compare qualitative variables. p value $\leq .05$ was considered to be statistically significant.

Results

The mean age of the whole cohort was 32.05 ± 11.88 years. Two thirds of the patients were males ($n = 37$, 68.5%). According to Letournel classification, associated fractures represented more than 80% of cases. Associated skeletal injuries were found in 11 (21.4%) patients.

Distribution of non-controllable variables

The general homogeneity of the two groups was confirmed as there was no statistically significant difference between the two groups considering all non-controllable variables (Table 1).

Operative data

The mean operative time was longer in the Stoppa approach group as compared to the ilio-inguinal group. The difference was statistically insignificant. Additional posterior approach was utilized in 23% of cases treated via an ilio-inguinal approach while in the Stoppa group the posterior approach was used in 14%

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