

# The Post-Operative Outcome of Stoppa Approach in the Treatment of Anterior Column Acetabular Fractures

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## Abstract

**Background:** Choosing the proper approach to surgical treatment of various types of acetabular fractures can play an important role in minimizing adverse outcomes during and after surgery. In the present study, we described our experience on the outcome of Stoppa approach in anterior column acetabular fractures.

**Methods:** This was a retrospective analysis of 40 patients with acetabular anterior column fractures that had undergone surgery with Stoppa approach. The study information, Harris Hip Score (HHS), and pre- and post-operative radiographic findings were collected by reviewing the hospital recorded files.

**Results:** HHSs of 80 to 100 were achieved in 75.0% of patients. Completed (anatomic reduction less than 2 mm) displacement reduction was found in 97.5%. 2 mg/dl decreased serum level of hemoglobin (Hb) was found in 75.0%, leading to blood transfusion in 60% of subjects. Regarding post-procedural complications, the common event was infection in 15.0%, followed by degenerative joint disease (DJD) in 15.0%. The post-operative complications were similar in men and women, but were significantly higher in patients older than 50 years than the younger patients.

**Conclusion:** Stoppa approach is associated with high success rate and the occurrence of rare and tolerable major complications.

**Keywords:** Acetabulum; Fracture; Surgical Procedures

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## Background

The first published papers on the treatment of acetabular fractures date back to early 1940s. In these reports, fracture treatment was performed using plates and screws (1-5). In some reports, treatment of fractures through surgical fixation with anterior iliofemoral approach has been described (6). However, the first reported cases of the treatment approaches were published in 1956 by Okelberry, in which the internal fixation of seven fractures was described through an anterior iliofemoral approach (7). In a relevant article, for the first time, it was noted that open surgery was much preferred to the methods of manipulation and traction (8). In 1961, the first comparison of the consequences of surgical and non-surgical treatment on fractures of acetabulum was described with an average follow-up of six years (9). The study found that the outcome of surgery was associated with improved weight bearing, femoral head position, adequate reduction or joint fit, and joint stability after one year. They also showed that fractures involving the upper surface of the acetabulum had far worse prognosis than those of the lower surface. In 1964, for the first time, a classification of the types of acetabular fractures and surgical approaches was described for each fracture type, explaining the possibility of understanding the injury and the appropriate surgical approach (9). This has had a positive effect on improving the surgical outcome of the disease.

Overall, various studies have shown different outcomes in different fracture patterns. For instance, some studies have suggested that anterior wall fractures are associated with the worst prognosis (10). However, the results may be influenced by different factors such as the surgeon's experience, fracture classification, surgical procedure selection, placement and fixation techniques, patient cohorts, instrumentation, and the type of clinical/radiographic analysis that all confound the patients' outcome (11). In general, it seems necessary to examine the consequences of different surgical techniques as well as to determine the related factors for each medical center and considering the major differences in the consequences in different centers and different surgeons (12). By determining the surgical results and also identifying the effective factors, it will be possible to achieve better outcomes by utilizing the appropriate technique as well as correct patient selection (13). It should be noted that some surgeons may apply a combination of different surgical approaches. Stoppa approach was described in 1990 and widely used due to easy replication (14). The main advantages of this approach as compared to the ilioinguinal approach is in bypassing the middle window in the former method and thus sparing the neurovascular structures (15). Moreover, according to the literature, Stoppa approach is better for treatment of quadrilateral plate instead of ilioinguinal approach (16). In the present study, we described our experience on the outcome of one of these procedural approaches including Stoppa approach.

## Methods

This retrospective analysis was performed on 40 patients with a variety of acetabular anterior column fractures that had undergone surgery with Stoppa approach. In this study, by reviewing the hospital records of the patients undergoing Stoppa approach, demographic characteristics, type of fracture, duration of operation, changes in hemoglobin (Hb) level, and transfusion rate during surgery were evaluated and documented. Also, Harris Hip Score (HHS), reduction rate, as well as possible post-operative complications including infection, nerve damage, heterotopic ossification, venous thromboembolism (VTE), malunion, chondrolysis, or osteoarthritis (OA) were recorded. The HHS assesses 4 items: pain, function, range of motion (ROM), and absence of deformity and the maximum scores for each item are 44, 47, 5, and 4, respectively. The quality of reduction was examined by assessing the pelvic radiological iliac and obturator views. To assess the post-procedural complications, the patients were followed for a mean period of 18 months (ranged 8 to 36 months).

For statistical analysis, results were presented as mean  $\pm$  standard deviation (SD) for quantitative variables and were summarized by frequency (percentage) for categorical variables. Categorical variables were compared using chi-square test or Fisher's exact test when more than 20.0% of cells with expected count of less than 5 were observed. Quantitative variables were also compared with t test or Mann-Whitney U test. For the statistical analysis, the SPSS statistical software (version 23.0, IBM Corporation, Armonk, NY, USA) was used.

## Results

In the present study, 40 patients who underwent surgery with Stoppa approach were analyzed in terms of surgical consequences. The mean age of patients was  $48.12 \pm 14.90$  years in the range of 19 to 90 years (Figure 1).

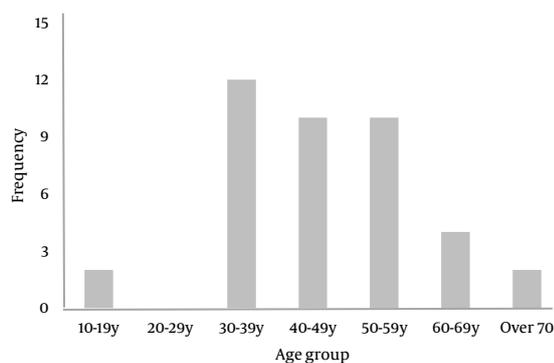


Figure 1. The age distribution in study population

In terms of sexual distribution, 28 cases (70.0%) were men and 12 cases (30.0%) were women. All patients were treated with Stoppa technique. The post-operative sequels are summarized in table 1. Overall, HHS score ranged in excellent condition in 75.0%. Acceptable reduction was achieved in 97.5% and it was inappropriate in 2.5%. Reduction in serum level of Hb was found in 75.0% of cases, leading to blood transfusion in 60% of subjects. The transverse fracture, associated with both-column and T-shape fractures according to computed tomography (CT) scanning, were revealed in 8, 22, and 10 cases, respectively.

The common complications were infection and degenerative joint disease (DJD) (15.0%). Heterotopic ossification was revealed in 18 cases based on the Brooker's criteria and radiological evidence as class I, II, and III were seen in 7, 8, and 2 cases, respectively. One patient was categorized as class IV of ossification requiring total hip arthroplasty (THA).

Table 1. Post-operative consequences outcomes with Stoppa approach in patients with acetabular fractures

Outcomes	Mean $\pm$ SD
Mean HHS score	82.94 $\pm$ 18.01
HHS classification	n (%)
Excellent	30 (75.0)
Good	4 (10.0)
Fair	0 (0)
Poor	6 (15.0)
Proper reduction	39 (97.5)
Reduction in Hb level	30 (75.0)
Intraoperative transfusion	24 (60.0)
Post-operative complications	12 (30.0)
DJD	6 (15.0)
Infection	6 (15.0)
Iatrogenic venous injury	2 (5.0)
DVT	1 (2.5)
Severe bleeding	1 (2.5)

Data are presented as mean  $\pm$  standard deviation (SD) or frequency and percentage. HHS: Harris Hip Score; Hb: Hemoglobin; DJD: Degenerative joint disease; DVT: Deep vein thrombosis

In total, post-operative complication rate was 30.0%. We observed no significant difference in the rate of post-operative complications in men and women (28.6% and 33.3%, respectively,  $P = 0.763$ ). The complication rate was significantly higher in patients older than 50 years as compared to the younger patients (50.0% versus 16.7%,  $P = 0.037$ ). Accordingly, the mean age in patients with and without complications after surgery was  $14.06 \pm 12.02$  years and  $45.50 \pm 14.40$  years, respectively, which showed a significant difference between the two groups ( $P = 0.048$ ).

## Discussion

Choosing the proper approach to surgical treatment of various types of acetabular fractures can play an important role in minimizing adverse outcomes during and after surgery. In this regard, Stoppa approach is considered as one of the common surgical approaches in these patients. In this study, we evaluated the consequences after acetabular fracture surgery with Stoppa approach. What was shown in this study was that, first, a significant improvement in acetabular function was achieved following this surgery, and in fact, the optimal functional status was reported based on HHS classification in 85.0% of patients. Also, perfect reduction was achieved in 97.5% of the cases, which indicated the significant success of the aforementioned approach in our study population. Moreover, in this study, we found that despite the success of the above procedure, the incidence of post-operative complications was reported in 30.0% of patients although in almost all of these patients, it was mild and recoverable. In this regard, one of the serious complications was traumatic damage to the iliac vein, which occurred in two patients and in one case, it led to severe bleeding requiring repair. However, in all cases, the complications were tolerable and did not lead to major or mortal morbidity. Therefore, in conclusion, Stoppa approach can be considered an acceptable approach in repairing acetabular fractures. However, it should be noted that the consequences after the mentioned surgery can be affected by various factors. In the present study, these complications were not affected by the sex of the patients, but the increase in the prevalence of these

complications was predictable with increasing age of the patients. In this regard, in half of the patients affected over the age of 50, the occurrence of post-operative complications was quite expected, which is a significant finding. Therefore, in this age group of patients, it may be considered to replace this surgical approach with other approaches such as posterior approach, which of course, will require evaluation and comparative intervention study. But in general, regardless of sex and age, Stoppa approach is quite acceptable and the results will be satisfactory in patients with anterior column acetabular fractures. It should be also noted that with respect to quadrilateral plate fracture, Stoppa approach can be very useful and safe and its use can be helpful for proper reduction.

What we found in the present study was quite consistent with the findings of previous studies. In a study by Caglar et al., complications during and after surgery were reported in two-thirds of patients and 50.0% of patients with anatomical fracture had favorable surgical outcomes, showing our findings to be far more favorable (17). In a study by Yao et al., only one case of deep vein thrombosis (DVT) was reported and none of the patients had other complications, indicating a more favorable status for the surgery in their study (18). In a study by Kilinc et al., the optimal anatomical outcome was determined in 82.5%, and iatrogenic vascular damage in 2 patients (19).

Elmadag et al., in a study on 36 patients who underwent Stoppa approach, reported a mean HHS score of 77.9%; anatomical reduction was achieved in 80.5% of patients, and complications including iliac vein injury in 1 patient (20). In a study by Isaacson et al., post-operative complications included infection in 4 cases, lateral leg anesthesia in 2 cases, inguinal hernia in 1 case, while death occurred in 3 cases (12).

Liu et al. achieved anatomical reduction in 96.0%, while serious femoral nerve injury was revealed in two cases that improved after three months (21). In the study by Cole and Bolhofner, reduction was unsuccessful in only one patient. There were also two cases of obturator nerve paralysis, one case of infection and one case of inguinal hernia. Also, 6 cases of arthritis occurred after trauma, and the clinical results were finally good in 89.0% of cases (22), which was completely consistent with our study. Therefore, compared to previous studies, our surgeons had a very good experience with the use of Stoppa approach in anterior column acetabular fractures, and our results were consistent with the results of other similar studies.

### Conclusion

Based on our experience, Stoppa approach in treating acetabular fractures has been associated with high success and the occurrence of rare major complications. However, post-operative complications are significant in the elderly, which require more attention in predicting the onset of these complications in old age.

### Conflict of Interest

The authors declare no conflict of interest in this study.

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