IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 5 Ser.5 (May. 2020), PP 55-60
www.iosrjournals.org

Analysis of results of Surgical Treatment of Acetabular Fractures by Modified Stoppa Approach

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Background: *Acetabular injuries are complex and prognosis is guarded. For displaced acetabular fractures, aggressive surgical treatment is needed for optimal functional outcome and proper operative approach is very important for fracture exposure and reduction. . Since the introduction of the Stoppa approach the enthusiasm of use of this approach has increased in recent times. The aim of our study is to assess the outcome and effectiveness of this approach in treating (select) Acetabular fractures.*
Materials And Methods: *A total of 12 acetabular fracture patients who were admitted from March2017 to October 2019 were enrolled into this study. 6 patients had anterior column fractures, 2 patients had Transverse fracture, 2 patients had a T-type fracture, and 2 patients had a double column fracture. After stabilization, operation was performed as early as possible; open reduction and internal fixation by Modified Stoppa approach was performed.*
Result Analysis: *Among these 12 patients, 7 (58.3%) patients revealed good anatomical reductions in postoperative X-rays; and the remaining 5 had fair/satisfactory reduction. Clinical outcome was evaluated according to the Harris Hip scoring System, excellent to good outcome found in 11 patients (91.7%).*
Conclusion: *The modified Stoppa approach for the treatment of acetabular fractures has advantages of less trauma, adequate and rapid exposure, convenient and effective fracture reduction and fixation, less complications and hence excellent to good functional outcome could be expected. This could be used as an alternative approach of the ilioinguinal approach.*
Keywords: *Acetabular fracture, Modified Stoppa approach.*

Date of Submission: 01-05-2020 Date of Acceptance: 14-05-2020

In recent years, the incidence of acetabular fractures resulted from high energy trauma such as those caused by traffic accidents, fall from height and crush by heavy objects have significantly increased. The injuries are complex and prognosis is guarded. For displaced acetabular fractures, aggressive surgical treatment is usually advocated for optimal functional outcome and proper operative approach is very important for fracture exposure and reduction. Traditionally most of the time anterior acetabulum is exposed and operated by ilio-inguinal approach. There are many drawbacks in the traditional ilioinguinal approach like complicated anatomy, difficulty in exposure, limited reduction and fixation spaces of fracture, more dependency on operative room imaging and more complications. Since the introduction of the Stoppa by Hirvensalo et al[1] the Stoppa approach and its modified approaches have became alternative approaches for traditional ilioinguinal approach due to advantages of better visualization, more operative space, direct quadrilateral plate fracture fixation, and less neurovascular complications. Hence, the enthusiasm of use of this approach has increased in recent times. The aim of our study is to assess the outcome and effectiveness of this approach in treating (select) Acetabular fractures.

I. Materials & Methods

A total of 12 acetabular fracture patients who were admitted from March 2017 to October 2019 were enrolled into this study. All patients underwent 3 position- Judet Pelvic X-ray film photography series and pelvis CT scans with 3 dimensional reconstructions. Among the 12 patients with acetabular fractures, according to Letournel-Judet classification 6 patients had anterior column fractures, 2 patients had Transverse fracture, 2 patients had a T-type fracture, and 2 patients had a double column fracture. We excluded those patients who had associated posterior fracture dislocation of hip and displaced posterior column or wall fracture requiring posterior Kocher-Langenbeck Approach. There was no vessel, nerve, or pelvic organ injury in preoperative patients. These patients were first stabilized after admission. After stabilization, operation was performed as

early as possible; open reduction and internal fixation by Stoppa approach was performed. Among these patients, 2 were treated combined with the iliac fossa approach for iliac blade fracture. Surgery was performed under spinal anaesthesia. After anesthesia, the patients were placed in the supine position, and a pillow was placed under the ipsilateral hip and hip was kept in flexion posture to improve exposure. A Pfannenstiel incision of approximately 10 cm in length was made. subcutaneous tissue were incised, the linea alba was longitudinally incised, the rectus abdominis insertion was erased .Then, lower abdominal wall muscles, external iliac blood vessels, femoral nerve were retracted laterally, and bladder was protected. The "corona mortis" vessel was isolated and ligated. The iliopectineal fascia was incised, and the subperiosteally dissected to expose the fractures. The fractures were reduced fixed with contoured recon plate. Placement of plate was determined by pattern of fracture under guidance of C-arm. Hip joint functions combined with active and passive ROM exercise started as early as possible after the operation, partial weight-bearing were started 6 weeks post-operation, and the time of initiating full weight-bearing depended on the review of the X-ray films.

II. Result Analysis

In this study, among these patients, 9 were males and 3 were females; and the age of these patients ranged between 24-60 years old, with a mean age of 38.2 years old. Reasons of injuries: road traffic accident (8 patients), fall from height (4 patients). Associated injuries found were- head injury in one case, haemothorax in one patient, shaft femur fracture in two patients, patellar fracture in one. Time interval from injury to surgery was 4-10 days, mean six days. operative incision length was 10-15 cm (mean, 12 cm) with the modified Stoppa approach, operative time duration was 70-120 minute,(mean 85 minutes), and the volume of intraoperative blood loss was 600-1,000 ml (mean, 700 ml). Among these 12 patients, 7 patients (58.3%) revealed good anatomical reductions in postoperative X-rays; and the remaining 5 (41.7%) had fair/satisfactory reduction. Clinical outcome was evaluated according to the Harris Hip scoring System, 6 patients were excellent (>90 points), and 5 patients were good (> 80 points) and 1 had fair (> 70 points) outcome- excellent to good outcome found in 11 patients (91.7%). These patients were postoperatively followed-up for 6 months to 36 months, mean 18.2 months; fracture healing time was 12-16 weeks, mean 14.4 weeks. Postoperative surgical site infection occurred in one patient, and the wound healed two weeks after wound debridement. Per operative no bladder injuries occurred. We started ROM mobilization, static quadriceps, ankle mobilization exercise to prevent DVT, no cases of DVT found even without use of chemoprophylaxis. No cases of Heterotrophic Ossification, posttraumatic arthritis, nonunion, joint penetration by inadvertent screws found.

III. Discussion

Surgical approach to the acetabulum and accurate reduction and internal fixation are difficult because of its complicated anatomical structure and its deep location. Therefore, it is necessary to perform a thorough radiographic analysis and determine the preoperative plan including the order of reduction and method of fixation. Moreover, sufficient surgical field must be secured by deciding which approach is to be applied and in what order during the actual surgical procedure. After fixation Functional results are proportionate with extent of radiographic results in the acetabular fracture. Fracture with more comminution pose greater difficulty in achieving anatomical reduction with an ensuing poor result. The traditional ilioinguinal (Letournel and Matta[4, 5, 15]) approach used for the treatment of acetabular fractures could expose and facilitate fixation of anterior ring of the pelvis, the anterior acetabular and transverse fractures. However, in the ilioinguinal approach the fractures need to be exposed in three windows. The surgical trauma is great, technically difficult with steep learning curve and only anterior column and roof fracture could be fixed, the quadrilateral plate fracture could not be treated under the direct vision. And opposite side injury need to be explored with separate lengthy and time consuming traumatic incision.

The Stoppa approach was initially applied for the treatment of abdominal wall hernia. Subsequently, this approach was used for acetabular fractures (Cole and Bolhofner)[7].Femoral artery and vein, femoral nerve, femoral lateral cutaneous nerve and other important tissues need not required to be exposed; and it is a soft tissue-friendly approach with better visibility[9] and exposure of the symphysis pubis, quadrilateral body, and anterior of the sacroiliac joint. Most of the surface of the quadrilateral body could be directly visualized[9] .It had significant advantages of exposure and reduction, and fixation of fractures. Compared with the ilioinguinal approach, the modified Stoppa approach could reduce blood loss, reduce the amount of blood transfusion, and shorten operation time[13]. In the modified Stoppa approach, chances of damage caused to the vascular structures (External iliac) and the lateral femoral cutaneous nerve are less compared to ilioinguinal approach. In this study, there were no injuries occurred in iliac vessels, lateral femoral cutaneous nerves and femoral nerves.

Letournel and Judet[4, 5]reported that anatomical reduction was achieved during the operation via the ilioinguinal approach in 73% of the patients with acetabular fractures. Matta[6]reported anatomical reduction in 74% of the cases. Hirvensalo et al.[1]reported the results of operation through the modified Stoppa approach as follows- good result was obtained in 84% of the cases, with the clinical and the functional results of the

Harriship score (HHS) of more than 75 points in 80% of the patients. In our study, we were able to achieve anatomical reduction in 7 (58.3%) out of the 12 patients treated via the modified Stoppa approach and the good to excellent clinical results were obtained in 11 cases (91.7%). The functional outcome in our series is slightly better than the results obtained by the other researchers. The radiographic discrepancy may be due to short cohort, short term follow up or maybe we achieved near anatomic reduction (including the anatomic reductions also) in all cases or maybe we deliberately excluded posterior hip dislocations, posterior wall and column comminuted fractures requiring posterior approach which means weight bearing dome was preserved in our cases .

The modified Stoppa approach was applied to: anterior column and anterior wall fractures of the acetabulum, anterior half of the transverse fracture and T shape of the fracture, in which posterior column fracture displacement was minimal, and could be operated by a single modified Stoppa approach. And postoperative recovery was faster. Acetabular quadrilateral plate fracture (combined with central femoral head dislocation) could be treated *by* modified Stoppa approach in a direct field of vision, which could significantly improve the quality of reduction, compared to ilioinguinal approach.

The modified Stoppa approach is unfavorable when there are multiple previous abdominal operations due to peritoneal adhesion with increased risk of injury to pelvic organs. Furthermore, this approach could not be replaced by the ilioinguinal approach. Obese patients, injury more than three weeks, and patients with gross displacement of double column fractures and iliac crest fractures are not suitable to be treated with Stoppa approach alone.

Regarding complications, this is a relatively short-term follow-up study, and a long-term follow-up is necessary to accurately evaluate the occurrence of posttraumatic arthritis as we could not found any case.

IV. Conclusion

The modified Stoppa approach for the treatment of acetabular fractures has advantages of less trauma, adequate and rapid exposure, convenient and effective fracture reduction and fixation, less complications and better postoperative recovery. Furthermore, this could be used as an alternative approach of the ilioinguinal approach. However, the effectiveness of this approach needs to be ascertained by large sample cases due to the small number of cases and short follow-up time in this study.

CONFLICT OF INTEREST: The authors reveal no conflict of interest.

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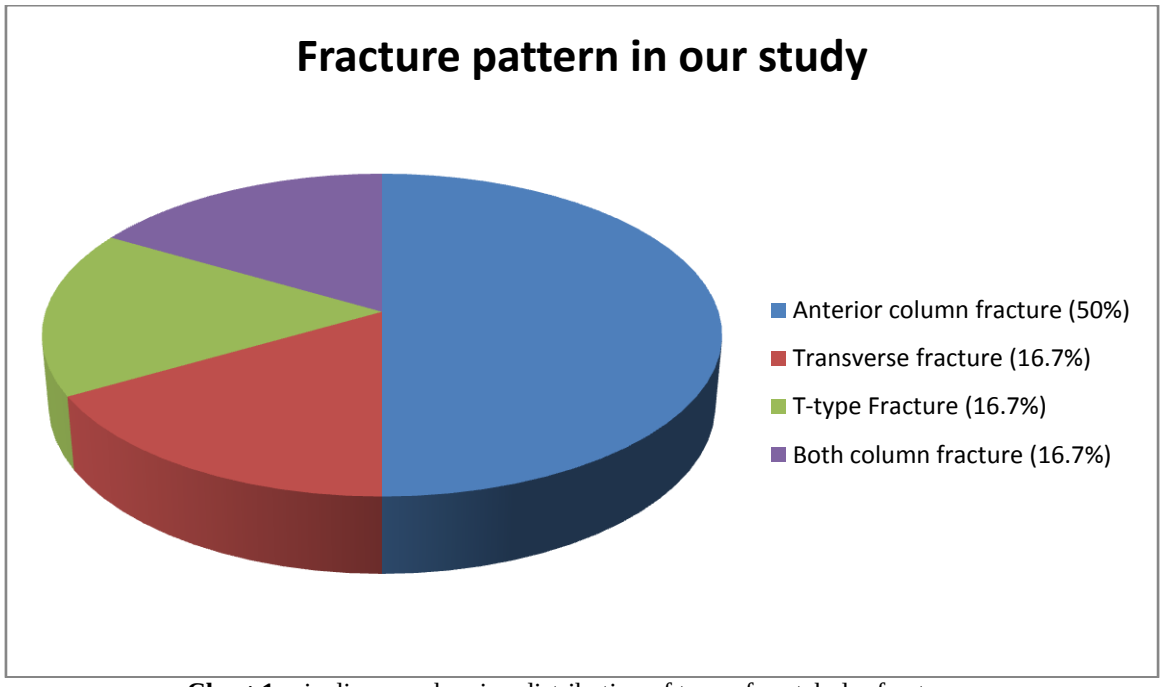

Chart 1: pie diagram showing distribution of type of acetabular fractures.

Radiographic criteria of quality of reduction	
Good-	Anatomic reduction
Fair/ Satisfactory-	near anatomic reduction, mild potrusio, hip centre discrepancy <0.5 mm
Poor-	non anatomic reduction, moderate to severe potrusio, hip centre discrepancy >0.5mm

TABLE 1: Radiographic criteria of quality of reduction

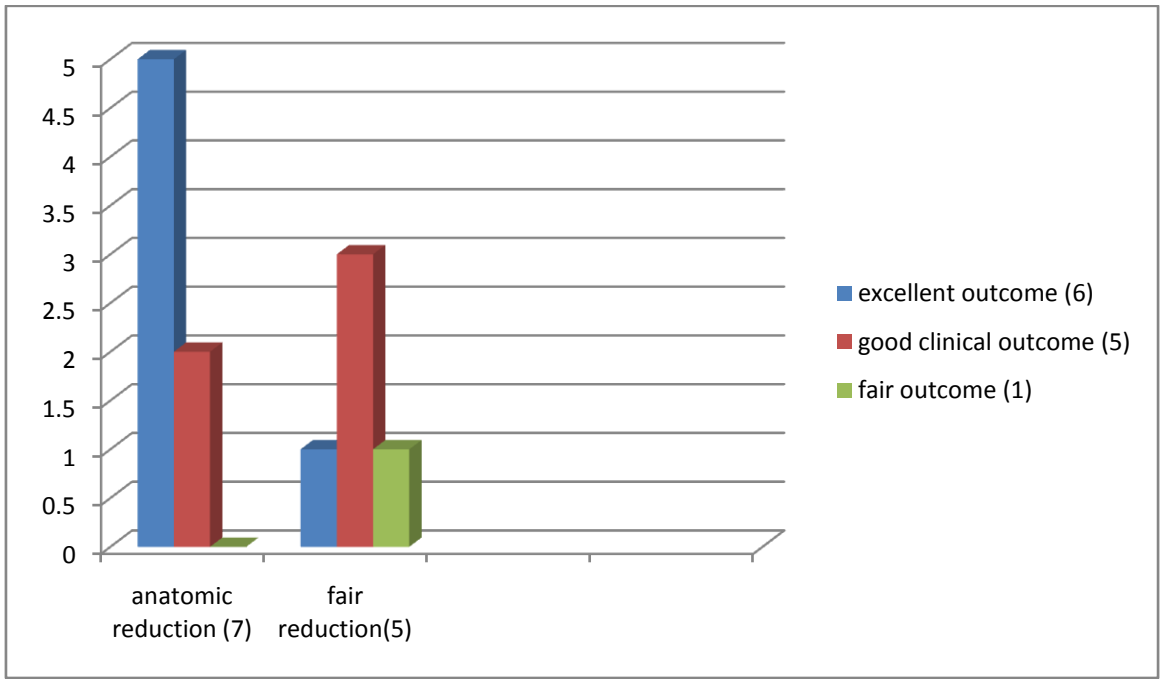

CHART 2: Bar diagram depicting clinical outcome in relation to radiographic reduction.

Clinical outcome Assessed by HHS Radiographic assessment	Excellent outcome(6)	Good outcome(5)	Fair outcome (1)
Anatomic Reduction (7)	5	2	0
Fair Reduction(5)	1	4	1

Table 2: showing functional outcome in individual reduction types (n=12).

FIGURES

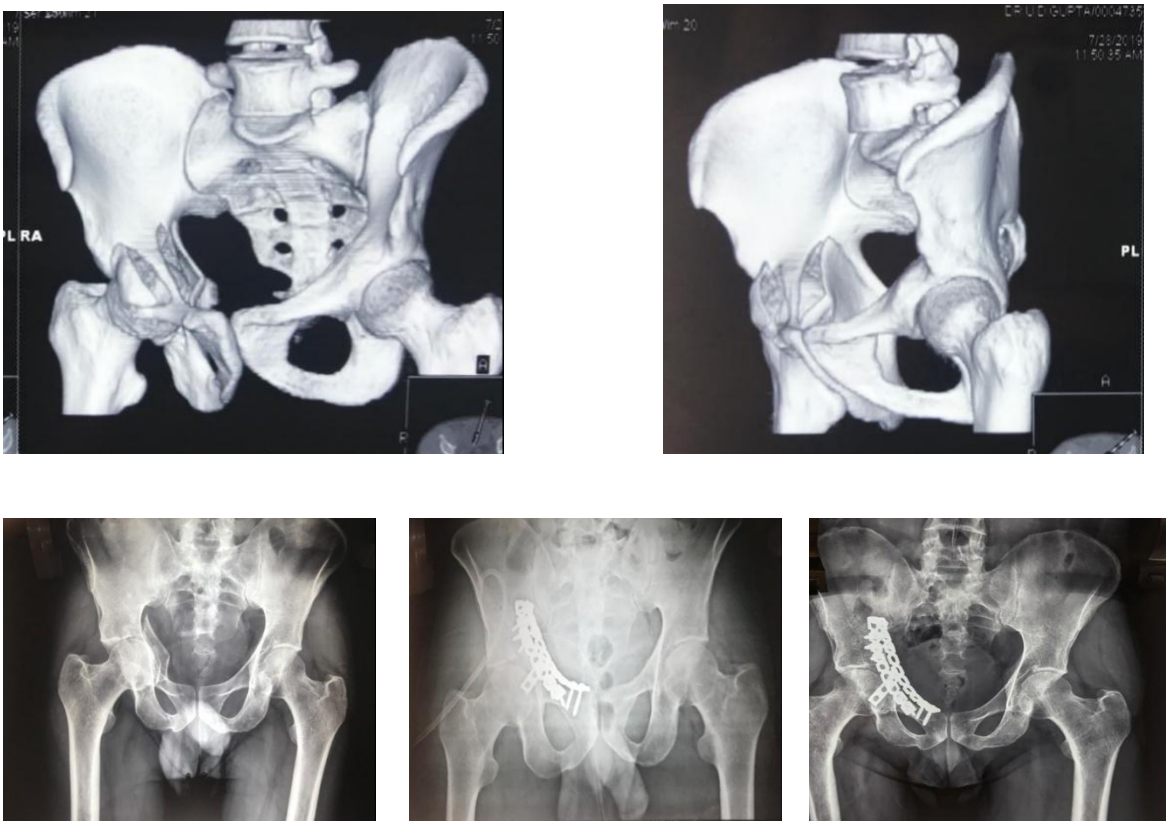

FIGURE 1: Radiographs of comminuted anterior column fracture fixed with two recon plate and one spring plate.

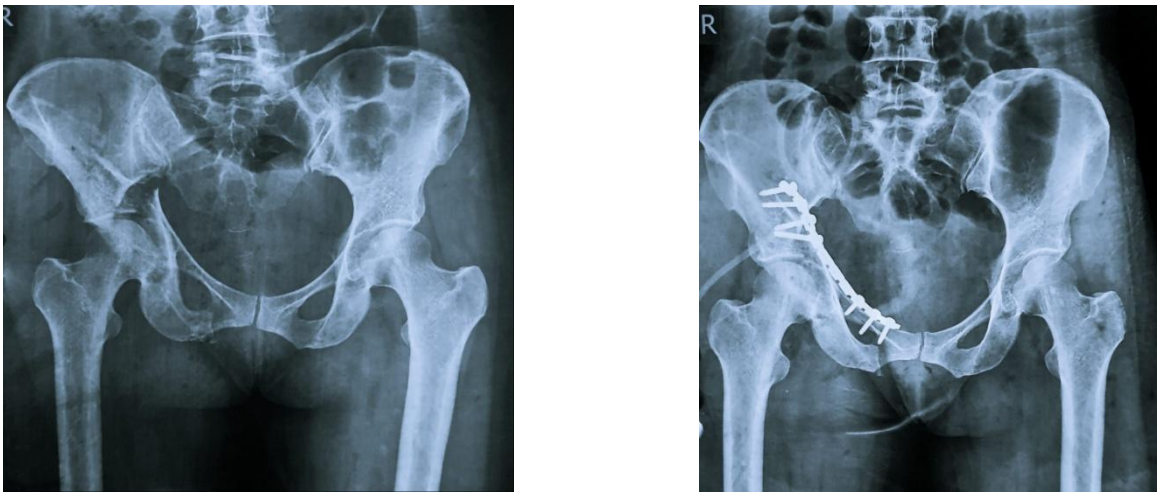

FIGURE 2: Radiographs of T Shaped fracture fixed with one recon plate.

Dr. Dipankar Dholey, et. al. "Analysis of results of Surgical Treatment of Acetabular Fractures by Modified Stoppa Approach."*IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(5), 2020, pp. 55-60.