



THE ROLE OF SURGICAL MANAGEMENT OF ANTERIOR ACETABULAR WALL AND COLUMN FRACTURES THROUGH ANTERIOR APPROACHES

Dr. Rajesh K. Ambulgekar

Prof & Head, Department of Orthopaedics, Dr. Shankarrao Chavan Government Medical College, Vishnupuri, Nanded, Maharashtra, India - 431606.

Dr. Rohit R. Somani*

Chief Resident Doctor, Department of Orthopaedics, Dr. Shankarrao Chavan Government Medical College, Vishnupuri, Nanded, Maharashtra, India - 431606. *Corresponding Author

ABSTRACT

Background: Acetabulum fractures generally occur due to high energy trauma in the young as opposed to the elderly, in whom, it can also occur due to a simple fall. Isolated anterior wall and column fractures are a fairly rare entity due to which most of the studies analyze them in combination with other fractures of acetabulum, thereby distorting the actual picture. Recently, the Modified Stoppa approach has come into the picture for being an excellent approach for the management of the anterior wall and column fractures of the acetabulum.

Methods: A total of 22 cases of fractures involving the anterior acetabular wall and column treated surgically with Open Reduction and internal fixation using reconstruction plates for the pelvic brim, spring plates for the quadrilateral surfaces through the anterior approaches. Patients were assessed pre-operatively and post-operatively using clinical findings, radiological and functional measures on 1st, 3rd & 5th month for first 6 months and third monthly thereafter.

Results: 14 patients had anatomical reduction, 5 had imperfect reduction and 3 had poor reduction. Out of 22 patients, 7 patients had excellent, 8 had good, 4 had fair and 3 had a poor result based on the Modified Merle d'Aubigne score. The average blood loss during the procedures in our study was 862.04 ml \pm 254.65. The average surgical time was 279 minutes. There were 2 cases of superficial infection, 1 case of sciatic nerve neuropraxia with transient foot drop which recovered fully in 5 to 6 months, 3 patients developed early osteoarthritis.

Conclusion: The anterior intra pelvic approach with lateral window of ilioinguinal approach can be a good alternative to the standard ilioinguinal approach. The spring plate application to the quadrilateral surface helps in providing an excellent buttressing to this area which helps in union and establishing a good bone stock in case future surgeries are planned in this region.

KEYWORDS :

INTRODUCTION:

Marvin Tile rightly said that "Fractures of the acetabulum remain an enigma to the Orthopedic Surgeon." Fractures of the acetabulum generally occur due to high energy trauma like high velocity road traffic accidents or a fall from height, as opposed to the elderly, in whom, it can also occur due to a simple fall.¹

Acetabular fractures were managed conservatively in the form of strict bed rest, up until about 50 years ago when the drawbacks of conservative management were brought to light by the pioneering work of Judet and Letournel in the year 1964. Since then, over the latter half of the 20th century, the treatment of acetabular fractures has transitioned from conservative to operative fixation upto the point where right now, the anatomical reduction, articular continuity and fixation has become the mainstay in the management of these complex fractures.²

Isolated anterior column and anterior wall fractures are uncommon and account for only 6.3% of acetabular fractures.³ Hence, outcome is often analysed with other associated fracture patterns, usually hemi-transverse fractures, which masks their true prognosis. Despite extensive literature on the management of acetabular fractures in general, data on outcome following open reduction and internal fixation (ORIF) of anterior column and anterior wall fractures is meagre at best.³

MATERIALS AND METHODS:

From 01/01/2019 to 30/06/2020, a total of 22 cases of fractures involving the anterior acetabular wall and column treated surgically with Open Reduction and internal fixation using reconstruction plates for the pelvic brim, spring plates for the quadrilateral surfaces through the anterior approaches, were included in the study. The approaches used were the Modified

Stoppa approach or the Anterior Intrapelvic Approach along with the lateral window of the Ilioinguinal approach according to the necessity in the case after thorough pre-operative planning.

There were 17 Males and 5 Females with mean age of 40 years. There were 17 cases of road traffic accidents, 3 cases of fall from height and 2 cases of self-fall.

Patients once included in the study were assessed pre-operatively and post-operatively using clinical findings, radiological and functional measures.

After the initial resuscitation, all the patients were evaluated pre operatively by the physicians and anaesthetist. The evaluation of the fracture in depth was done and the injury was defined, following which, the decision on operative intervention was taken based on the involvement of the roof of the acetabulum using the roof arc angles described by Matta⁴, and the patient posted for the procedure at the earliest possible, most often between 3-8 days post injury.

DVT prophylaxis with 40mg of Low molecular weight heparin (LMWH) given subcutaneously once daily started on the day of admission. DVT prophylaxis stopped one day prior to surgery and restarted on 3rd post-operative day and continued for next 5 days. A written informed consent for surgery was taken from patients and accompanying relatives.

Consent for photography in preoperative period, intraoperative, postoperative and follow up was taken. The patients were then operated by open reduction and internal fixation using reconstruction plates for the pelvic brim, spring plates for the quadrilateral surfaces according to the case in hand.



Figure 1: Preoperative Radiographs In The Anteroposterior And Oblique Views

All patients were given prophylactic antibiotics pre-operatively and post operatively for 7 days. Drain removal done on 2nd post-operative day. Suture removal was done on post-operative day 12 to 14. Indomethacin 25mg TDS was prescribed orally for 6 weeks from next day after surgery for selective cases. Low molecular weight heparin was given 7 days for DVT prophylaxis. Active physiotherapy in the form of mobilization with 1kg skin traction was started on post-operative day 2. Active movements gradually increased in accordance with pain. Weight bearing was allowed as the fracture consolidates mostly on the 3rd or 4th month. Radiological and functional examination was done on 1st, 3rd & 5th month review for first 6 months and third monthly thereafter. Post-operative analysis of our patients was done using the Matta's Reduction criteria⁵ and the functional outcome analysed using Modified Merle d'Aubigné And Postel Grading System⁶. This grading system includes three parameters namely Pain, Ambulation and Range of motion. Based on the above parameters patients are classified as excellent, good, fair and poor.

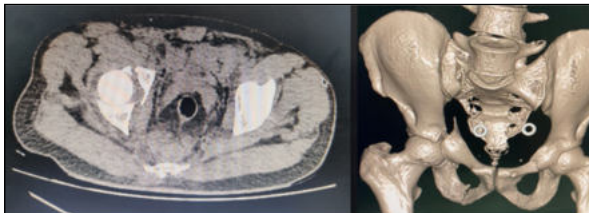


Figure 2: Preoperative CT scan 2D and 3D reconstructions

RESULTS:

63.3% belongs to less than 50 years. 13.64% patients belong to 5th decade followed by 6th decade (22.73%). Males dominated in our study group forming 77.27% of the whole and females were 22.73%. Road traffic accidents contributed to the injury in 77.27% of our patients, 13.64% sustained by fall from height and the remainder 9.09% had a trivial fall leading to the fractures. Anterior column fracture was the most common type in our study (36%) whereas combined transverse fracture with posterior wall fracture and associated anterior column with posterior column fractures were the least common type (4.5% times each). This finding can be attributed to the rarity of acetabular fractures and the fragmentation of experience between different trauma centres which could be due to the referral patterns in our region. 10 patients had associated skeletal injuries, while 1 patient had visceral injuries, 5 patients had both skeletal and visceral injuries and 6 patients had no associated injuries. According to Matta's criteria, 14 patients (63.64%) had anatomical reduction, 5 (22.73%) patients had imperfect reduction and 3 patients (13.63%) had poor reduction (>3mm gap). Out of 22 patients, 7 patients (31.8 %) had excellent, 8 patients (36.4%) had good, 4

patients (18.2%) had fair and 3 patients (22.73%) had a poor result based on the Modified Merle d'Aubigné score. The average blood loss during the procedures in our study was 862.04 ml \pm 254.65 (range 580 to 1400ml). The average surgical time was 279 minutes (range 240 min – 320 min) with a standard deviation of 26.24. There were 2 cases of superficial infection, 1 case of sciatic nerve neuropraxia with transient foot drop which recovered fully in 5 to 6 months, 3 patients developed early osteoarthritis.

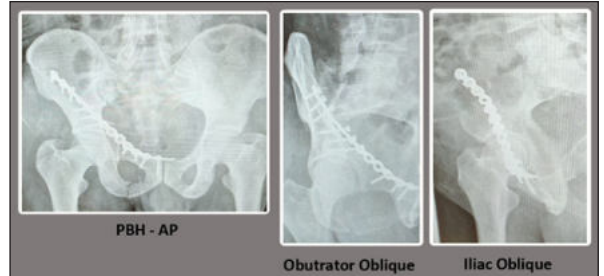


Figure 3: Post-operative Radiographs In The Anteroposterior And Oblique Views



Figure 4: Six Months Post-operative Follow Up With Full Functional Recovery

DISCUSSION:

The outcome for patients with a fracture of the acetabulum is continually evolving through improved surgical approaches^{7,8,9} and new methods of fixation.^{5,10,11} There is ample evidence that surgery for displaced acetabular fractures results in a favourable outcome.^{9,12}

In our study the average surgical time delay was 8 days ranging from 3 days to 19 days with a standard deviation of 3.66. Majority of the patients were operated on the 9th day after trauma. A meta-analysis done by P. V. Giannoudis et al² on operative treatment of displaced fracture noted the time before surgery being recorded in 14 publications (1496 patients) and a mean delay on 8.9 \pm 2.9 days was found. In a study done by Sagi HC et al¹³, the mean delay to surgery was 5 days and Singh SV et al¹⁴ mentioned that the timing of surgery after trauma was average 5.83 days (range three to 15 days) in their study. The mean surgical time in our study was 279 min ranging from 240 min to 320 minutes with a standard deviation of 26.24 min. In a study done by Singh SV et al¹⁴, mean surgical time was determined to be 214.66 min (range 150-350 min) and the one by Sagi HC et al¹³, the mean operative time was found to be 263 min. The average blood loss during the anterior intra-pelvic approach with lateral window of ilioinguinal approach in our study was 862.04 ml \pm 254.65 (range 580 to 1400ml). This was consistent with a study done by Sagi HC et al¹³ and Singh SV et al¹⁴, where the average blood loss was 750 ml and 683.33 ml (range 230-1250 ml) respectively. Whereas Elmadag et al¹⁵ had a mean perioperative bleeding of 970 ml (range 800-1250 ml).

According to Matta's criteria, 10 patients (45.5%) had anatomical reduction, 5 (22.7%) patients had imperfect reduction and 7 patients (31.8%) had poor reduction (>3mm gap). In a study done by Sagi HC et al¹³, 57 patients were

operated out of which 70% of the reductions were graded excellent, 22% were graded good, and 8% poor. In contrast, Nayak T et al¹⁶ stated that in 18 of their cases the reduction was anatomic, imperfect in 2 cases, and poor in 3 cases.

The mean Modified Merle d'Aubigne score in our study was 14.95 ± 1.91 (range 12 to 17) which was similar to study by Moed BR et al¹⁷ on Functional outcomes of acetabular fractures where The mean modified Merle d'Aubigné score was 16.8 (range 9 to 18). Stratification of the patients did not alter these overall results. However, the presence or absence of associated injuries was a significant factor for the Merle d'Aubigné score ($p = 0.03$). In addition, the Merle d'Aubigné score data were asymmetric, demonstrating a ceiling effect.

In our study we came across two instances of superficial infection which recovered by antibiotics, 3 patients were in early stages of osteoarthritis at follow up. It was noted that all 3 patients who had osteoarthritis had a poor reduction according to Matta's criteria. We did not encounter any cases of HTO (Heterotopic ossification) or DVT (Deep Vein Thrombosis).

In a study done by Isaacson MJ et al¹⁸, out of 22 patients, 3 experienced deep postoperative infections, all of whom returned to the operating room for formal irrigation and debridement and maintenance of implants; all of whom subsequently went on to uneventful union. 3 patients experienced a postoperative deep vein thrombosis and 1 patient was diagnosed with a nonfatal pulmonary embolus. 1 patient developed a postoperative rectus hernia at 4 months postoperatively, eventually requiring surgical repair. 2 patients, both of whom required use of the lateral window, developed a lateral femoral cutaneous nerve palsy, 1 of which subsequently resolved without sequelae.

CONCLUSION:

In our short term study of the role of surgical management of anterior acetabular wall and column fractures through anterior approaches we were able to conclude that the most common causative factor of acetabular fractures was high velocity trauma in the younger age group and self-fall in the elderly age group. An early surgery helps in achieving anatomical reduction with greater ease thereby reducing the complications of a prolonged surgery and total blood loss. A delay more than 10 days leads to difficulty in visualizing the corona mortis due to the excess hematoma collection and the formation of collaterals in the vicinity. The difficulty in visualization of the quadrilateral surface due to lack of proper illumination at the fracture site could affect the fracture site visualization.

Modern instruments like self-illuminating Hohman's & Langenback's retractors, Matta's reduction clamps, Farabeauf's clamps, etc. can give additional assistance in surgery. The anterior intra pelvic approach with lateral window of ilioinguinal approach is an excellent approach with minimum complications, for treatment of acetabular fractures involving the anterior column, wall and the quadrilateral surface. We can avoid neurovascular complications by this approach, less blood loss with shorter duration of surgery. The only major drawbacks being the possible injury to the corona mortis and that articular surfaces cannot be visualized. Therefore, the anterior intra pelvic approach with lateral window of ilioinguinal approach can be a good alternative to the standard ilioinguinal approach. The spring plate application to the quadrilateral surface helps in providing an excellent buttressing to this area which helps in union and establishing a good bone stock in case future surgeries are planned in this area. We recommend that further studies be done on a larger scale in a population based setting for longer duration of follow up.

REFERENCES

1. Moed BR, Reilly MC. Acetabulum fractures. In: Court-Brown CM, Heckman JD, McQueen MM, Ricci WM, Tornetta P III editors. *Rockwood and Green's Fractures in Adults*; Wolters Kluwer Health, 2015 (8th edition); p 1891-978.
2. Giannoudis PV, Grotz MR, Papakostidis C, Dinopoulos H. Operative treatment of displaced fractures of the acetabulum: a meta-analysis. *Bone & Joint Journal*. 2005 Jan 1; 87(1):2-9.
3. Giannoudis PV, Kanakaris NK, Dimitriou R, Mallina R, Smith RM. The surgical treatment of anterior column and anterior wall acetabular fractures: short to medium term outcome. *J Bone Joint Surg Br*. 2011 Jul; 93(7):970-4.
4. Matta JM, Merritt PO. Displaced acetabular fractures. *Clinical orthopaedics and related research*. 1988 May 1; 230:83-97.
5. Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. *J Bone Joint Surg [Am]* 1996; 78-A: 1632-45.
6. Beaulé PE, Dorey FJ, Matta JM. Letournel classification for acetabular fractures. Assessment of interobserver and intraobserver reliability. *J Bone Joint Surg Am*. 2003 Sep; 85-A(9):1704-9.
7. Matta JM. Operative treatment of acetabular fractures through the ilioinguinal approach: a 10-year perspective. *Clin Orthop* 1994; 305:10-9.
8. Shahulhameed A, Roberts CS, Pomeroy CL, Acland RD, Giannoudis PV. Mapping the columns of the acetabulum: implications for percutaneous fixation. *Injury* 2010; 41: 339-42.
9. Lefavre KA, Starr AJ, Reinert CM. A modified anterior exposure to the acetabulum for treatment of difficult anterior acetabular fractures. *J Orthop Trauma* 2009; 23:370-8.
10. Judet R, Judet J, Letournel E. Fractures of the Acetabulum: Classification and Surgical Approaches for Open Reduction: preliminary report. *JBJS*. 1964 Dec 1; 46(8):1615-75.
11. Brown GA, Willis MC, Firozbakhsh K, et al. Computed tomography image guided surgery in complex acetabular fractures. *Clin Orthop* 2000; 370:219-26.
12. Giannoudis PV, Bircher M, Pohlmann T. Advances in pelvic and acetabular surgery. *Injury* 2007; 38: 395-6.
13. Sagi HC, Afsari A, Dzadzadz D. The anterior intra-pelvic (modified rives-stoppa) approach for fixation of acetabular fractures. *J Orthop Trauma*. 2010 May; 24(5):263-70.
14. Singh SV, Chopra RK, Puri G, Phero M Sr, Kumar S Sr, Bansal A, et al. Clinicoradiological Evaluation of Modified Stoppa Approach in Treatment of Acetabulum Fractures. *Cureus*. 2020 Sep 2; 12(9).
15. Elmadag M, Guzel Y, Aksoy Y, Arazi M. Surgical Treatment of Displaced Acetabular Fractures Using a Modified Stoppa Approach. *Orthopedics*. 2016 Mar-Apr; 39(2):e340-5.
16. Nayak T, Mittal S, Trikha V, Farooque K, Gamanagatti S, Sharma V. Short-term results of surgical treatment of acetabular fractures using the modified Stoppa approach. *J Clin Orthop Trauma*. 2020 Nov-Dec; 11(6):1121-7.
17. Moed BR, Yu PH, Gruson KI. Functional outcomes of acetabular fractures. *J Bone Joint Surg Am*. 2003 Oct; 85(10):1879-83.
18. Isaacson MJ, Taylor BC, French BG, Poka A. Treatment of acetabulum fractures through the modified Stoppa approach: strategies and outcomes. *Clin Orthop Relat Res*. 2014; 472(11):3345-52.