

Outcome of Anterior Wall Acetabulum and Pelvis Fracture through a Modified Stoppa Approach: A Prospective Cohort Study

KEYUR LAXMISHANKAR UPADHYAY¹, RAJKUMAR M BAGEWADI², GIREESH KHODNAPUR³, DAYANAND BANAPATTI BIRADAR⁴, NAGESH INGINSHETTY⁵, JAYESH KUMAR SONI⁶, RONAK Y KHATRI⁷



ABSTRACT

Introduction: Acetabular fractures are becoming more common these days. The treatment of complicated acetabular fractures is challenging due to their location and associated injuries. Since the development of the Stoppa approach, it has been used as an alternative to the conventional ilioinguinal strategy.

Aim: To assess the postoperative outcomes based on clinical and radiographic results in patients with fractures of the pelvis and acetabulum treated using the Modified Stoppa method.

Materials and Methods: This prospective cohort study was conducted at Shri BM Patil Medical College, Hospital and Research Centre in Vijayapura, Karnataka, India, from January 2021 to May 2022. The study included 30 patients with acetabular fractures. Fracture reduction was achieved using a modified Stoppa technique. The patients were followed-up for six months, and postoperative function was assessed using the Merle D'Aubigne Score and postoperative X-rays. Frequency distribution was used to analyse the frequency and percentage of study variables. The Chi-square test was used to determine the association between outcomes and radiographic results.

Pearson's correlation coefficient test was used to compare the follow-up time of the patients and the Merle D score.

Results: Out of the 30 cases operated on using the modified Stoppa approach, 86.67% achieved anatomical reduction, with 53.33% showing a good outcome and 33.33% achieving an excellent outcome post-surgery. The results were subjected to statistical analysis. Frequency distribution was used to analyse the frequency and percentage of study variables. The Chi-square test was used to determine the association between outcomes and radiographic results. Pearson's correlation coefficient test was used to compare the follow-up time of the patients and the Merle D score. There was a statistically significant correlation (r -value of 0.007) between the patient's outcome and the radiographic results post-surgery.

Conclusion: The use of less invasive techniques has simplified surgery and reduced complications in the treatment of difficult acetabular fractures. With improved surgical skills and early intervention, this innovative technique for anterior exposure of the acetabulum can be used effectively.

Keywords: Ilioinguinal approach, Merle D'Aubigne hip score, Modified rives stoppa

INTRODUCTION

The incidence rate of pelvic and acetabular fractures resulting from high-energy injuries, such as those caused by traffic accidents, falls from height, and crush injuries, has significantly increased in recent years due to rapid industrialisation and transportation. This has led to an increased risk of pelvic fractures from road traffic accidents. The short-term prognosis for these injuries is poor, and they can lead to severe consequences such as uncontrollable bleeding. Aggressive surgical treatment is typically recommended for displaced fractures of the pelvis and acetabulum [1]. If left untreated, displaced acetabular fractures can progress to the development of premature hip osteoarthritis [2]. Open reduction and rigid internal fixation of displaced fractures have been shown to result in better outcomes compared to conservative treatment [3]. The modified Stoppa method avoids inguinal canal dissection, which occurs in the second window of the ilioinguinal approach. Consequently, it is less invasive and may be a preferable option for joint-preserving surgery, especially in elderly patients [3]. The modified Stoppa approach has replaced the classic ilioinguinal approach as an alternative due to its benefits, including a smaller incision, direct visualisation for replacing quadrilateral body fractures, and fewer complications. This has led to an increasing utilisation of this approach [1]. Since then, operative management of such fractures has become the standard approach [4]. Managing both pelvic and acetabular fractures requires considerable effort. While operative procedures for acetabular surgery have been developed over the past 40 years, research is still ongoing, and the optimal treatment methods are

still being scientifically evaluated and subjected to critical debate, particularly regarding the management of pelvic fractures [5,6].

Operative approaches to the acetabulum can be broadly classified as extensile, posterior, anterior, or mixed approaches. These approaches include the iliofemoral, extended iliofemoral, Kocher-Langenbeck, ilioinguinal, triradiate, and combined anterior and posterior approaches [5,7,8]. The ilioinguinal approach has been the standard method for anterior acetabular fixation since Letournel's original description in 1961, although the specific technique employed depends significantly on the shape and nature of each acetabular fracture [6,8]. Stoppa devised a midline technique using Dacron mesh to treat inguinal hernias in 1989. This technique garnered interest for acetabular fixation after Stoppa demonstrated excellent exposure of the true pelvis. Subsequently, Cole JD and Bolhofner BR independently described this approach to the anterior acetabulum and pelvis, involving intrapelvic dissection from the midline [5], followed by Hirvensalo E et al., [6]. The main difference between the modified Stoppa method and the ilioinguinal approach is the elimination of the "middle window," which avoids dissection of the femoral nerve, external iliac arteries, and inguinal canal. The modified approach allows access to the pubic body, superior ramus, pubic root, ilium above and below the pectineal line, quadrilateral plate, medial aspect of the posterior column, sciatic buttress, and anterior sacroiliac joint through the acetabulum [8].

While there is general agreement that the modified Stoppa technique should be used for the majority of fractures that can be treated with an ilioinguinal approach, there is disagreement regarding its utility

in more challenging fracture patterns, such as posterior column fractures [8-10].

The purpose of this study was to assess the postoperative outcomes based on clinical and radiographic results of fractures of the pelvis and the anterior wall of the acetabulum treated using the Modified Stoppa method. The primary objective of the study was to determine the association between outcomes and radiographic results in postsurgery patients. The secondary objective was to test the correlation between the follow-up time of the patients and the modified Merle D'Aubigne score

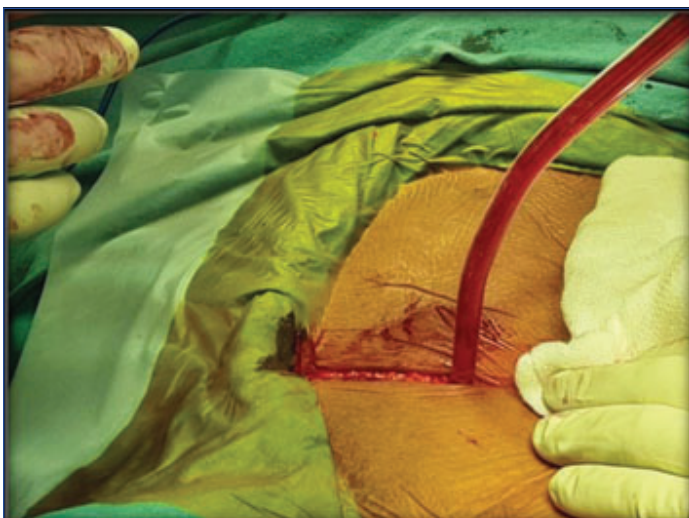
MATERIALS AND METHODS

A prospective cohort study was conducted in the Department of Orthopaedics at Shri BM Patil Medical College, Hospital and Research Centre in Vijayapura, Karnataka, India. Ethical clearance was obtained from the Institute's Ethical Committee (IEC NO-09/21). Thirty cases of diagnosed acetabular fractures admitted to the Orthopaedic department between January 2021 to May 2022 were included in the study after obtaining informed, written consent. A detailed history of the condition was obtained, followed by clinical examination and necessary laboratory and radiological investigations. The Letournel and Judet classification [11,12] was used to classify the acetabular fractures.

Inclusion criteria: Patients aged 18 years and above with superior pubic ramus fractures or anterior column acetabular fractures, willingness to participate in the rehabilitation program and follow-up, and patients willing to undergo treatment and providing informed and written consent.

Exclusion criteria: Cases below 18 years, active infection, posterior wall fractures, pathological fractures, patients with severe osteoarthritis of the hip joint, patients unfit for surgery, or those who refused surgery were excluded from the study.

Operative approach: The patients underwent surgery using a modified Stoppa approach. After completing all the necessary preoperative work-up, the patient was positioned supine on the operating table. Fracture reducibility was assessed using a C-arm. With a sandbag under the knee, hip flexion was performed to relax the iliopsoas muscle, external iliac/femoral neurovascular bundle, and abdominal muscles, facilitating multidirectional traction for fracture reduction. The lower limb and lower abdomen were aseptically draped, and a 2 cm arc-shaped skin incision was made approximately 12 to 15 cm in front of the superior pubic ramus [Table/Fig-1].



[Table/Fig-1]: Superficial skin incision extending upto the anterior rectus fascia, 1 to 2 finger breadths above the pubic symphysis.

The incision was deepened to reach the abdominal fascia. The exposed rectus abdominis muscle was separated along the linea alba to access the internal portion of the pelvis. Subperiosteal

dissection was then performed along the pelvic brim to expose the fracture fragments after initially identifying and ligating the corona mortis. The obturator nerve and veins passing through the obturator foramen were typically easily identified and preserved during the subsequent procedure. Special care was taken to protect the external iliac artery and vein, which are located directly over the retracted iliopsoas muscle. Once the fracture site was clearly visible, internal fixation was attempted after reduction [13].

If the modified Stoppa technique alone was insufficient for reduction or internal fixation, a lateral window was created along the iliac crest to fix the high anterior column fracture (exiting the iliac crest) or to fix the posterior column with a lag screw. A screw and/or plate were used alone or in combination for greater reduction and stability. The wound was closed, and a dressing was applied [13].

Postoperative management: Postoperatively, plain X-rays of the pelvis with the hips and obturator in oblique and Judet views were obtained to verify the accuracy of the reduction. Mobilisation was limited to toe-touch weight-bearing for the first three months, along with physiotherapy.

Follow-up: All cases were followed-up for six months postoperatively, and X-ray images of the pelvis with both hips were reviewed. The functional outcome of the patients was assessed using the Modified Merle D'Aubigne score [14], which includes pain, mobility, and the ability to walk, with each criterion scored from 0-6. The total score provided an absolute estimation of hip function, which was then categorised as excellent outcome (score 18), good outcome (score 15, 16, 17), fair outcome (score 13, 14), or poor outcome (score <13).

Radiographic assessment of fracture reduction included anatomic reduction (residual displacement up to 1 mm), imperfect reduction (residual displacement of 2 to 3 mm), and poor reduction (residual displacement of >3 mm) [14].

STATISTICAL ANALYSIS

All the data obtained were entered into a data entry form, and the data were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS) version 20.0. Frequency distribution was used to determine the frequency and percentage of study variables. The chi-square test was used to assess the association between outcomes and radiographic results in postsurgery patients. Pearson's correlation coefficient test was used to examine the correlation between the follow-up time of the patients and the modified Merle D'Aubigne score. A p-value of less than 0.05 was considered statistically significant.

RESULTS

In the present study, a comprehensive clinical examination and radiological evaluation were conducted on patients who had received general resuscitation. Lower femoral pin traction was applied to the patients. A total of 30 cases were included, with the majority being 93.33% males and 6.67% females. The largest proportion of patients, 33.33%, belonged to the age group of 31-40 years. The most common fractures observed were superior pubic rami fractures in 12 cases (40.00%), followed by anterior column fractures in 10 cases (33.33%) and anterior wall fractures in 8 cases (26.67%). All 30 cases were treated using the modified stoppa technique, with surgical procedures lasting between 90 to 120 minutes depending on various factors [Table/Fig-2].

Patient epidemiology	N (%)
Age (in years) (M±SD)	42.4±12.32
21-30	5 (16.67)
31-40	10 (33.33)
41-50	8 (26.67)
51-50	7 (23.33)

Gender	
Males	28 (93.33)
Females	2 (6.67)
Fracture type	
Anterior column fracture	10 (33.33)
Anterior wall fracture	8 (26.67)
Superior pubic rami fracture	12 (40)
Duration of surgery (in minutes)	
90	8 (26.67)
95	6 (20)
100	9 (30)
>100	7 (23.33)
Modified Stoppa Approach	30 (100)

[Table/Fig-2]: Distribution of patient epidemiology such as age, gender, fracture type, duration of surgery and approach of perioperative data in this study.

Outcome of the patient postsurgery: Post-surgery, all patients underwent clinical and radiological follow-up for a period of 3 weeks to 6 months. The Modified Merle D'Aubigne score, which assesses pain, mobility, and ability to walk on a scale of 0 to 6, was used to evaluate the outcomes. The majority of cases (53.3%) had a good outcome, followed by cases with an excellent outcome (33.33%), and a small number of cases with fair or poor outcomes (6.7%). Radiological reports during follow-up showed that the majority of cases (86.67%) achieved anatomical reduction, while a small number of cases (6.7%) had incomplete or poor reduction [Table/Fig-3].

Study variables	N (%)
Follow-up (weeks) (M±SD)	14.53±1.38
Merle D Score (M±SD)	16.1±2.04
Excellent	10 (33.3)
Good	16 (53.3)
Fair	2 (6.7)
Poor	2 (6.7)
Modified Stoppa approach	30 (100)
Radiograph results	
Anatomical reduction	26 (86.67)
Imperfect reduction	2 (6.67)
Poor reduction	2 (6.67)

[Table/Fig-3]: Patients demography of postoperative data.

Association between outcome and radiographic results of the postsurgery patient: Out of 26 cases (86.67%) that underwent anatomical reduction, the majority, 16 (53.33%) had good outcomes, and 10 (33.33%) had excellent outcomes, demonstrating a statistically significant association between the patient's outcome and the radiographic results following surgery (p-value=0.0001), with a higher proportion of good and excellent outcomes observed in cases with anatomical reduction (p-value=0.0001) [Table/Fig-4].

Correlation between follow-up duration of the patients and merled score: No statistically significant correlation was found

Outcome	Radiographic results			Total no. of cases	Chi-square test	p-value
	Anatomical reduction	Imperfect reduction	Poor reduction			
Excellent	10 (33.33%)	0	0	10 (33.33%)	60	0.0001*
Good	16 (53.33%)	0	0	16 (53.33%)		
Fair	0	2 (6.67%)	0	2 (6.67%)		
Poor	0	0	2 (6.67%)	2 (6.67%)		

[Table/Fig-4]: Association between of outcome and radiographic results of the postsurgery patient.

*significant when p<0.05

between the duration of patient follow-up and the Merle D Score (p-value=0.38) [Table/Fig-5]. Preoperative and postoperative X-rays are shown in [Table/Fig-6-9].

	Correlation coefficient @ (Pearson's correlation test)	95% CI		r-squared	p-value
Follow-up vs Merle D score	-0.17	-0.49	0.25	0.027	0.38

[Table/Fig-5]: Correlation between follow-up duration of the patients and Merle D Score.

Significant when p<0.05



[Table/Fig-6]: Preoperative X-ray of anterior column fracture.



[Table/Fig-7]: Postoperative X-ray of anterior column fracture fixation with plate and screw.



[Table/Fig-8]: Preoperative X-ray of anterior column fracture with anterior wall fracture.



[Table/Fig-9]: Postoperative X-ray of anterior column fracture with anterior wall fracture fixation with plate and screw.

DISCUSSION

The Modified Rives-Stoppa technique is extensively researched for treating acetabular fractures. Treatment options for complex acetabular fractures are numerous and continually improving. These fractures pose challenges as they require significant exposure and cannot be reduced with a single approach. Research papers discuss the use of lateral and longitudinal skeletal traction along with conservative management to achieve congruent reduction. However, it is essential to emphasise the importance of immobilisation and its consequences [10].

Authors [4,13] highlight that rigid fixation, anatomic reduction, and early mobilisation are crucial for maintaining joint function in open reduction and internal fixation of fractures. The quality of reduction directly affects the clinical outcome. Complications, lengthy operations, and difficult surgical exposure present significant challenges for surgeons, but skill and consideration can help overcome these issues. The chosen method for treating displaced acetabular fractures should provide sufficient exposure while minimising morbidity. An ideal technique allows inspection of both the articular surfaces and the columns. Extensive methods around the hip joint often result in a high rate of problems [15].

According to Hirvensalo et al., a triradiate approach resulted in a 53% incidence of heterotopic ossification, while an extended iliofemoral approach resulted in an 86% incidence. Non-extensile techniques were adopted to operate on these patients [6]. The modified Rives-Stoppa method is well-known for its safety and simplicity. By bypassing the neurovascular window, the likelihood of traction injury to the femoral nerve and vascular bundle decreases. This method reduces the risk of complications like inguinal hernia since it does not disturb the inguinal canal. It provides clear visualisation of the posterior column and quadrilateral surface. The corona mortis, which requires special attention, can be safely split and ligated. In the present study, corona mortis bleeding complications were not observed as it was dissected, ligated, and sealed using cautery in each patient. Another important structure during repair of the quadrilateral surface is the obturator nerve, which needs to be identified and secured [4,7].

In the present study, the average age of the patients was 42.4 years, similar to other studies [7]. The study group predominantly consisted of males, as they are more likely to be involved in traffic accidents, consistent with other studies [15]. The modified Stoppa method was used to treat 30 patients in the present study, and anatomical reduction was achieved in 26 (86.7%) of them. Out of these, 38.4% showed excellent outcomes, and 61.5% showed good outcomes post-surgery. These findings were comparable to or slightly better than those of other studies [Table/Fig-10] [2,6-8].

Authors	Date	Patient number (n)	Anatomic reduction (%)	Excellent/good clinical outcome (%)	Conclusion
Hirvensalo E et al., [6]	2007	164	84	75	The new methods are less invasive than the basic approaches described in the literature.
Sagi HC et al., [7]	2010	50	92	88	Anterior Intra Pelvic (AIP) approach provides a satisfactory exposure for the surgical treatment of displaced anterior wall/column and both column acetabular fractures. Clinical outcome is directly related to the reduction quality.
Isaacson MJ et al., [8]	2014	36	92	82	Good functional outcomes with minimal complications were observed using the modified Stoppa approach for a variety of acetabular fractures.
Elmadağ M et al., [2]	2016	36	80	90	Surgical treatment of displaced acetabular fractures using a modified Stoppa approach.
Present study	2023	30	86.7	33.3	The use of modified stoppa technique has simplified surgical approach and decreased complications. With greater surgical skill and early surgical intervention, one can treat difficult acetabular fractures using this innovative technique for anterior exposure of the acetabulum.

[Table/Fig-10]: Comparison of present study with other studies [2,6-8].

The essential investigations to evaluate acetabular fractures include anteroposterior and Judet views of the pelvis, along with a CT scan performed before joint reduction to assess the injured hip and make treatment decisions. Factors such as initial displacement, injuries to the weight-bearing dome or femoral head, hip joint instability caused by posterior wall fracture, suitability of open or closed reduction, and potential late complications like heterotopic ossification, AVN, nerve injuries, or chondrolysis can all impact surgical outcomes [16-18].

One case of Deep Vein Thrombosis (DVT) using an anterior approach was reported in a study [16], and another study also had one instance of DVT [investigation not specified]. In posterior approaches, a few authors reported an 8% incidence of iatrogenic sciatic nerve palsy [19], while another study reported an 8.3% incidence of iatrogenic sciatic nerve palsy [16].

When compared to research by other authors, where the complication rate of the Anterior Intra-pelvic (AIP) approach was found to be similar to the ilioinguinal approach [4,7,16], the complication rate was relatively low in the present study. Heterotopic ossification was not observed in any cases in the present study, whereas extensile techniques used for complicated fractures have shown heterotopic ossification rates of up to 20%.

In the present study, patients were treated with indomethacin for six weeks as a preventive measure against heterotopic ossification.

Femoral head avascular necrosis, which has been documented in the literature, was not encountered in the present study.

Previous studies have shown that anterior acetabular fractures treated with the modified Stoppa approach had no significant difference in intraoperative blood loss compared to the classic ilioinguinal approach [4,15,20-22]. In the present study, the non-extensile technique had shorter operating times and comparable average blood loss to those described by others. However, the modified Stoppa approach has limitations, including difficulties in reducing and internally fixing posterior column fractures and inadequate visualisation of the femoral head, acetabular labrum, and articular surface of the acetabulum [22].

Therefore, the modified Stoppa approach can be adopted by relatively less experienced surgeons due to better visualisation, minimal complications, and improved clinical outcomes.

Limitations of this study include the small study population and relatively short follow-up period, which may have hindered the identification of statistically significant correlations in certain areas.

Limitation(s)

The number of study population included in this study was very small. The follow-up period was shorter as due to less study duration. Therefore, statistically significant correlation was not encountered in a few domains.

CONCLUSION(S)

Satisfactory results were obtained in this short-term study using the new and promising technique, which has been widely utilised worldwide since 2010. The use of non-extensile techniques has simplified surgery and reduced complications. With improved surgical expertise and early intervention, challenging acetabular fractures can be effectively treated using this innovative technique for anterior exposure of the acetabulum.

REFERENCES

- [1] Guo HZ, He YF, He WQ. Modified stoppa approach for pelvic and acetabular fracture treatment. *Acta Orto Brasileira*. 2019;27(4):216-19.
- [2] Elmadag M, Guzel Y, Aksoy Y, Arazi M. Surgical treatment of displaced acetabular fractures using a modified Stoppa approach. *Orthopedics*. 2016;39(2):e340-45.
- [3] Tannast M, Keel MJ, Siebenrock KA, Bastian JD. Open reduction and internal fixation of acetabular fractures using the modified Stoppa approach. *JBJS Essential Surg Tech*. 2019;9(1):e3(01-12).
- [4] Matta JM. Fracture of the acetabulum: Accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. *Ortho Trauma Directions*. 2011;9(2):31-36.
- [5] Cole JD, Bolhofner BR. Acetabular fracture fixation via a modified stoppa limited intrapelvic approach description of operative technique and preliminary treatment results. *Clin Orthop and Rel Res*. 1994;305:112-23.
- [6] Hirvensalo E, Lindahl J, Kiljunen V. Modified and new approaches for pelvic and acetabular surgery. *Injury*. 2007;38(4):431-41.
- [7] Sagi HC, Afsari A, Dziadosz D. The anterior intra-pelvic (modified rives-stoppa) approach for fixation of acetabular fractures. *J of Ortho Trauma*. 2010;24(5):263-70.
- [8] Isaacson MJ, Taylor BC, French BG, Poka A. Treatment of acetabulum fractures through the modified Stoppa approach: Strategies and outcomes. *Clin Orthop and Rel Res*. 2014;472(11):3345-52.
- [9] Azar FM, Canale ST, Beaty JH. *Campbell's Operative Orthopaedics*, E-Book. Elsevier Health Sciences; 2020.
- [10] Olson SA. Diagnosis and treatment of acetabular fractures: Historic review. *InFractures of the Pelvis and Acetabulum*. 2007:137-150.
- [11] Judet R, Judet J, Letournel E. Fractures of the acetabulum: Classification and surgical approaches for open reduction. Preliminary report. *J Bone Joint Surg Am*. 1964;46:1615-46.
- [12] Alton TB, Gee AO. Classifications in brief: Letournel classification for acetabular fractures. *Clin Orthop and Rel Res*. 2014;472(1):35-38.
- [13] Pennal GF, Davidson J, Garside H, Plewes J. Results of treatment of acetabular fractures. *Clin Orthop and Rel Res*. 1980;151:115-23.
- [14] Tornetta P. *Acetabulum Fractures*. Rockwood and Green's fractures in adults. 9th Ed. Philadelphia: Wolters Kluwer; 2020:3360-482.
- [15] Kim HY, Yang DS, Park CK, Choy WS. Modified Stoppa approach for surgical treatment of acetabular fracture. *Clin Orthop Surg*. 2015;7(1):29-38.
- [16] Routt Jr ML, Swiontkowski MF. Operative treatment of complex acetabular fractures. Combined anterior and posterior exposures during the same procedure. *JBJS*. 1990;72(6):897-904.
- [17] Pantazopoulos T, Mousafiric C. Surgical treatment of central acetabular fractures. *Clin Orthop and Rel Res*. 1989;(246):57-64.
- [18] Kreder HJ, Rozen N, Borkhoff CM, Lafamme YG, McKee MD, Schemitsch EH, et al. Determinants of functional outcome after simple and complex acetabular fractures involving the posterior wall. *The J of Bone and Joint Surg*. 2006;88(6):776-82.
- [19] Giannoudis PV, Grotz MR, Papakostidis C, Dinopoulos H. Operative treatment of displaced fractures of the acetabulum: A meta-analysis. *The J of Bone and Joint Surg*. 2005;87(1):02-09.
- [20] Goulet JA, Bray TJ. Complex acetabular fractures. *Clin Orthop and Rel Res*. 1989;240:09-20.
- [21] Reinert CM, Bosse MJ, Poka AT, Schacherer TI, Brumback RJ, Burgess AR. A modified extensile exposure for the treatment of complex or malunited acetabular fractures. *JBJS*. 1988;70(3):329-37.
- [22] Meena S, Sharma PK, Mittal S, Sharma J, Chowdhury B. Modified Stoppa approach versus ilioinguinal approach for anterior acetabular fractures; A systematic review and meta-analysis. *Bul of Emer & Tra*. 2017;5(1):06-12.

PARTICULARS OF CONTRIBUTORS:

1. Postgraduate Student, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.
2. Assistant Professor, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.
3. Assistant Professor, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.
4. Associate Professor, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.
5. Senior Resident, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.
6. Postgraduate Student, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.
7. Postgraduate Student, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Dayanand Banapatti Biradar,
Associate Professor, Department of Orthopaedics, Shri BM Patil Medical College and Research Centre, Vijayapura-586103, Karnataka, India.
E-mail: dayanand.banapatti@bldedu.ac.in

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

PLAGIARISM CHECKING METHODS: [Jan H et al.]

- Plagiarism X-checker: Apr 26, 2023
- Manual Googling: May 27, 2023
- iThenticate Software: Jun 17, 2023 (14%)

ETYMOLOGY: Author Origin

EMENDATIONS: 8

Date of Submission: Apr 22, 2023

Date of Peer Review: May 25, 2023

Date of Acceptance: Jun 22, 2023

Date of Publishing: Aug 01, 2023