



## Original Article

## Comparison of Modified Stoppa Approach versus Ilioinguinal Approach for Anterior Acetabular Fractures

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## ARTICLE INFO

**Key Words:**

Modified Stoppa Approach, Ilioinguinal Approach, Acetabular Fractures

**How to Cite:**

Sajid, M., Raza, J. H., Gill, U. N., Sohail, M. A., Khan, J., & Qasim, M. (2023). Comparison of Modified Stoppa Approach versus Ilioinguinal Approach for Anterior Acetabular Fractures : Modified Stoppa Approach versus Ilioinguinal Approach . Pakistan Journal of Health Sciences, 4(12). <https://doi.org/10.54393/pjhs.v4i12.1148>

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Received Date: 24<sup>th</sup> October, 2023

Acceptance Date: 13<sup>th</sup> December, 2023

Published Date: 31<sup>st</sup> December, 2023

## ABSTRACT

Achieving an anatomically precise reduction of acetabular fractures is vital for obtaining the best possible outcome. The Modified Stoppa approach has demonstrated advantages such as reduced blood loss and shorter surgical durations when dealing with anterior acetabular fractures in comparison to the ilioinguinal approach. **Objective:** To evaluate the outcomes of the modified Stoppa approach in comparison to the ilioinguinal approach. **Methods:** The quasi-experimental study was conducted within the Department of Orthopaedic Surgery at Jinnah Hospital during the period from November 12, 2018, to May 11, 2019. The study involved 60 patients, with 30 individuals in each group. Group A underwent treatment for anterior acetabular fractures using the modified Stoppa method, while Group B received treatment using the ilioinguinal approach. **Results:** Patients ranged between 16–60 years of age with mean age of  $36.9 \pm 11.2$  in group-A and  $35.6 \pm 10.3$  year in group-B. Majority of the patients were male in both groups. Left anatomical side was involved in most of the patients in both groups. The mean duration of injury in group-A was  $7.07 \pm 2.6$ , while in group-B, it was  $6.6 \pm 2.4$ . A statistical analysis revealed a significant difference between the two groups in terms of mean operative time and blood loss ( $p < 0.001$ ). Furthermore, stratification was performed based on age, gender, and the duration of injury, and significant differences were observed in these stratified subgroups as well. **Conclusions:** Our findings showed that modified Stoppa technique outperforms the ilioinguinal method by exhibiting reduced blood loss and shorter operative durations. This positions the modified Stoppa technique as a superior option for addressing anterior acetabular fractures.

## INTRODUCTION

Pelvic and acetabulum fractures often result from high-energy traumas and are commonly linked to organ impairments, contributing to increased morbidity and mortality rates [1]. Timely and precise fixation of acetabular fractures is crucial for achieving favourable outcomes. However, the intricate anatomical nature of the pelvis and acetabulum has historically led to several complications associated with the traditional ilioinguinal approach, including the need for a general surgeon, the necessity to create three separate windows, and the potential risk of injury to the spermatic cord [2]. The

Stoppa approach employs a transverse incision without a lateral window, while the modified Stoppa approach involves a lateral window incision in addition to the primary transverse incision to provide access to higher anterior column fractures [3]. The utilization of the modified Stoppa technique aimed to mitigate complications such as postoperative hernia formation and corona mortise injury while enhancing the success rate of anterior acetabular fracture fixation. Nevertheless, the comparative effectiveness of both approaches remains uncertain [2]. Both surgical approaches demonstrate positive outcomes

in the treatment of acetabular fractures. Various studies have previously been undertaken to assess the effectiveness of these two surgical methods in managing anterior acetabular fractures [4]. Controversy exists, as some studies advocate for the modified Stoppa method, while others demonstrate favourable outcomes in terms of blood loss and repair time when employing the ilioinguinal approach [5]. Fixing various types of acetabular fractures always presents challenges, with fractures involving both columns constituting the most intricate category within this group [6]. Despite significant advancements in surgical technology, the selection of the approach remains a subject of controversy [7]. In the context of acetabular fracture management, the careful selection of a surgical approach is essential for achieving accurate reduction and minimizing complications [8]. Various approaches have been employed in the past, including ilioinguinal, Stoppa, iliofemoral, and para-rectal exposures, with the first two being the most prevalent in current practice [9]. However, in our local context, there is a lack of data comparing the effectiveness of these two approaches.

The main goal of this study was to compare the functional outcomes, particularly in terms of blood loss and surgery duration, between the ilioinguinal and modified Stoppa methods. The study aimed to provide useful guidance for choosing the most effective surgical technique for complex anterior acetabular fractures.

## METHODS

The quasi-experimental study was conducted within the Department of Orthopaedic Surgery at Jinnah Hospital during the period from November 12, 2018, to May 11, 2019. A sample size of sixty participants was determined, with a 95% confidence interval, accounting for a 20% dropout rate, and aiming for an 80% test power. Purposive sampling technique was used to collect the data. The study recruited sixty patients, ranging in age from 16 to 60 years, who were undergoing osteosynthesis for the treatment of acetabular fractures while under general anaesthesia [5]. Patients presenting with anterior column fractures and having an ASA (American Society of Anesthesiologists) classification of III and IV, or with diabetes (blood sugar level >200mg/dl), transverse fractures, osteomalacia, osteoarthritis, rheumatoid arthritis (as documented in their medical records), or those expected to require an extended stay in the intensive care unit due to associated injuries, were excluded from participation in this study. Both male and female individuals were eligible for inclusion in the analysis. Subsequently, these participants were subdivided into two distinct groups: Group A underwent the modified Stoppa technique, while Group B underwent the ilioinguinal approach for repairing anterior acetabular fractures. Data collection was performed using a convenient sampling

technique. This study received ethical approval from the hospital's review board, and prior to their participation, each individual provided informed written consent. Demographic details, encompassing name, age, gender, anatomical side, and injury duration, were documented utilizing a designated data collection form. The allocation of patients into one of the two groups was accomplished through a random selection process using a lottery method. Subsequently, all data were inputted and subjected to analysis using SPSS version 21.0. Quantitative variables such as age, injury duration, operation time, and blood loss were presented as means along with their corresponding standard deviations (SD), while the qualitative variable, gender, was reported in terms of frequency and percentage. The two groups were compared for average operation time and blood loss using independent sample comparisons. Additionally, data were stratified into subgroups based on age, gender, and injury duration. In each subgroup, a comparison between the two groups was conducted using an independent sample t-test for both average operation time and blood loss. Ethically permission to conduct the study was taken from Ethical Review Board committee of Allama Iqbal Medical College via the reference number 269/09/06/2023/S1ERB and date of issuance of ERB was 09/06/2023. Statistical significance was defined as a p-value below 0.05.

## RESULTS

Over a six-month duration, a total of 60 patients participated in this investigation, with an equal distribution of 30 individuals in each group. Group A underwent the modified Stoppa procedure, whereas Group B received the ilioinguinal method. The patients' ages varied between 16 and 60 years, with an average age of  $36.9 \pm 11.2$  years for Group A and  $35.6 \pm 10.3$  years for Group B. The majority of patients in both groups were male, and the left anatomical side was predominantly affected in most cases (see table 1). The average duration of injury was  $7.07 \pm 2.6$  days in Group A and  $6.6 \pm 2.4$  days in Group B.

**Table 1:** Demographic Variables

Variables	Construct	Group-A	Group-B
		Modified Stoppa Method	Ilioinguinal Method
		F (%)	F (%)
Age	16-30	10 (33.3)	10 (33.3)
	31-45	13 (43.3)	15 (50.0)
	46-60	7 (23.4)	5 (16.7)
Gender	Male	22 (73.3)	21 (70.0)
	Female	8 (26.7)	9 (30.0)
Anatomical side	Left	19 (63.3)	17 (56.7)
	Right	11 (36.7)	13 (43.3)
Duration	≤ 7	16 (53.3)	19 (63.3)
	≥ 8	14 (46.7)	11 (36.7)

In table 2, the breakdown of operative time in minutes

based on different variables, such as age, gender, and surgical duration, is depicted. It provides the mean operative times and their corresponding standard deviations for both Group A and Group B, as well as p-values denoting the statistical significance of these variations. The data underscore the highly significant differences in operative times between the two groups across all age categories, genders, and surgical durations, consistently yielding p-values below 0.001.

**Table 2:** Stratification of different variables with regard to operative time (min)

Variables	Construct	Group A	Group B	p-value
		Mean ± SD	Mean ± SD	
Age	16-30	92.1 ± 10.3	122.3 ± 11.4	P<0.001
	31-45	98.5 ± 7.7	690.0 ± 297.4	P<0.001
	46-60	94.0 ± 6.1	121.4 ± 10.7	P<0.001
Gender	Male	95.3 ± 8.5	125.5 ± 10.3	P<0.001
	Female	95.2 ± 9.3	121.8 ± 11.4	P<0.001
Duration	≤ 7	95.1 ± 9.5	125.5 ± 10.6	P<0.001
	≥ 8	95.5 ± 7.9	122.6 ± 10.7	P<0.001

(SD: Standard Deviation)

In table 3, blood loss in millilitres (ml) is stratified based on various variables, including age, gender, and surgical duration. The table provides the mean blood loss and standard deviations in Group A and Group B, accompanied by p-values that denote the statistical significance of these variations. The data highlight noteworthy differences in blood loss between the two groups across all age categories, gender groups, and for surgical durations of 7 minutes or less. In the majority of cases, the p-values are below 0.001, indicating these significant differences. However, for surgical durations of 8 minutes or more, the p-value is 0.001, signifying significant distinctions as well.

**Table 3:** Stratification of different variables with regard to blood loss (ml)

Variables	Construct	Group A	Group B	p-value
		Mean ± SD	Mean ± SD	
Age	16-30	539.0 ± 176.6	1038.2 ± 339.8	P=0.001
	31-45	690.0 ± 297.4	1170.4 ± 399.8	P=0.001
	46-60	533.8 ± 93.4	1073.4 ± 173.4	P<0.001
Gender	Male	617.1 ± 260.6	1125.8 ± 369.8	P<0.001
	Female	564.8 ± 133.9	1073.6 ± 307.9	P<0.001
Duration	≤ 7	619.3 ± 255.6	1143.2 ± 333.0	P<0.001
	≥ 8	584.7 ± 210.9	1053.0 ± 381.9	P=0.001

(SD Standard Deviation)

## DISCUSSION

The treatment of acetabular fractures presents formidable challenges due to the intricacies associated with injuries to internal organs and the intricate nature of the fractures themselves. Nevertheless, this procedure carries substantial risks, including excessive blood loss, prolonged

surgical time, and the potential for damage to the external iliac vessel and femoral nerve. This study investigated the treatment outcomes of utilizing the modified Stoppa approach in contrast to the ilioinguinal approach for the management of acetabular fractures. In terms of patient demographics, the majority of patients in our study were male, consistent with the findings of Andersen et al., who also noted a male predominance in both groups [9]. Elmadag et al., similarly reported a male majority [10]. The average age of participants in both groups was  $36.9 \pm 11.2$ , aligning with the results of Al Adawy et al., who reported a mean patient age of  $38.8 \pm 8.42$  [11]. In terms of the average operative time and blood loss, our study demonstrated a statistically significant distinction between the two groups, in alignment with the results presented by Yang et al [12]. Their study likewise reported a noteworthy difference in mean operative time and blood loss within both groups. Ponsen et al., noted comparatively lower blood loss and shorter surgical durations with the Stoppa approach [13]. The recent study has revealed significant disparities in operative times across both groups, encompassing all age categories, genders, and surgical durations. These findings are corroborated by Kilinc et al., who noted a substantial correlation between operative time and factors such as age, gender, and surgery duration [14]. Similarly, Cole et al., arrived at similar conclusions in their research [15]. Traditionally, orthopaedic surgeons have employed the ilioinguinal approach as the primary method for fixing anterior column fractures. Anterior acetabular fractures encompass a variety of types, including anterior wall and column fractures, T-type fractures, partial transverse fractures, or fractures that affect both the column and anterior column, as well as posterior hemi-transverse fractures [16]. In some cases, this approach may not provide complete access to the fracture site, necessitating indirect reduction techniques. In 1989, a new approach was introduced by surgeon Stoppa for repairing inguinal hernias using Dacron mesh. This innovative technique afforded excellent exposure to the true pelvis [17]. Recognizing the benefits of this exposure, the idea emerged to employ the Stoppa approach for fixing anterior acetabular fractures. Subsequent evaluations by multiple surgeons demonstrated superior outcomes when compared to the traditional ilioinguinal approach. The modified Stoppa approach stands out as a superior alternative, as it enables the reduction of impacted articular fragments in the weight-bearing region. This technique also reduces the necessity for bone grafts and is suitable for cancellous bone grafting, repairing bones with extended lateral exposure to the pelvic bone, and addressing dislocated joints. Hirvensalo et al., applied the modified Stoppa technique to 164 patients, with 84.1%

achieving good to excellent anatomical reduction, 9% rated as fair, and only 7% classified as poor [18]. In this study, 80% of participants achieved a Harris hip score of 75 or higher when assessed based on clinical and functional outcomes. Similar results were reported by Sagi et al., where 50 cases were evaluated post-surgery, and 92% of patients demonstrated excellent or good results in reducing acetabular fractures [16]. In this study, 60% required the lateral window approach to achieve the reduction of high anterior column fractures, while Anderson et al., reported a slightly lower success rate compared to the previous study, with an 82% anatomic reduction rate [9]. Variations in results may arise due to different inclusion criteria. Shazar et al., noted a statistically significant difference in achieving reduction rates [17]. In the ilioinguinal procedure, anatomical reduction was achieved in 54.2% compared to the Stoppa approach, which had an anatomical reduction rate of 79.4%. This study's findings suggest that the primary advantage of the modified Stoppa approach lies in its enhanced capability to address the posterior aspect of the fracture. In our study, we observed a significant reduction in mean operative time when employing the modified Stoppa method compared to the ilioinguinal method ( $95.3 \pm 8.6$  vs.  $124.4 \pm 10.6$  minutes;  $p < 0.001$ ). Furthermore, we noted that blood loss associated with the modified Stoppa approach was significantly lower than that associated with the ilioinguinal approach ( $603.2 \pm 232.5$  vs.  $110.2 \pm 347.9$  millilitres;  $p < 0.001$ ). These results are consistent with those reported by Kim et al. and Arora et al., who also demonstrated comparable outcomes in terms of operative time and blood loss. They described the Stoppa technique as a preferred choice over the ilioinguinal approach for addressing anterior acetabular fractures [19, 20].

## CONCLUSIONS

Based on the results obtained in this study, it can be inferred that the use of the modified Stoppa approach for the management of anterior acetabular fractures resulted in superior outcomes in relation to reduced blood loss and shorter operative duration when compared to the ilioinguinal approach. Additionally, further validation of our findings necessitates the conduction of extensive and multicentre randomized controlled trials.

## Authors Contribution

Conceptualization: MS

Methodology: MS, JHR, UNG, MAS, JK, MQ

Formal analysis: MS, JHR, UNG, MAS, JK, MQ

Writing-review and editing: MS

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

## Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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