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ORIGINAL ARTICLE

A Comparison of Acetabular Fracture Management by the Ilioinguinal or the Modified Stoppa Approaches

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ABSTRACT

Background: This study compared the open reduction and internal fixation of acetabular fractures by the ilioinguinal and modified Stoppa approaches among patients presented to Zagazig University Hospitals from December 2019 to December 2021.

Methods: All patients were operated upon_from the second day to the thirteen-day after trauma. Spinal anesthesia was used for 4 patients, the rest by general anesthesia. Plain x- rays, Judet views, and CT scans were obtained for all patients. The reduction was graded on all 3 radiographic views using the scoring system published by Matta. Displacement greater than 3 mm on plain radiographic view indicated poor reduction. Displacement of 1-3mm or less was defined as a satisfactory reduction, and an anatomical reduction had 1mm or less displacement. Functional outcome was performed using the Modified Merle D'Aubigné score.

Results: The study included 40 patients with a mean age of 36.4 years (±10.9), divided into two groups. There was no statistically significant difference in the preoperative time delay between the_two groups (p= 0.772). The mean operation time and intraoperative blood loss were significantly higher among the ilioinguinal group than in the modified Stoppa group (all p<0 .001). The needed units were significantly higher in the Ilioinguinal group than in the modified Stoppa group (p= 0.005). The mean Merle d'aubigné score was 16.4 (±1.67) among the Ilioinguinal group and 16.6 (±1.53) among the modified Stoppa group, with no statistically significant difference between both groups.

Conclusions: The modified Stoppa approach may be an excellent alternative to the classic ilioinguinal approach in treating anterior acetabular fractures.

Keywords: modified Stoppa, Ilioinguinal, acetabular fractures, operations, surgical**.**

INTRODUCTION

Accurate classification of acetabular fractures is important for determining the proper surgical treatment because of the complex acetabular anatomy [1]. Various classification schemes have been suggested, but the Judet-Letournel classification system remains the most widely accepted classification [2,3]. Although radiographic examination provides essential information for acetabular classification, computed tomography, including multiplanar reconstruction, is helpful in the visualization of complex fractures [4]**.**

The treatment of displaced acetabular fractures is a complicated issue. The nonoperative management, which was previously used, has been criticized, primarily due to the failure to regain joint congruency and an increased occurrence of early hip osteoarthritis [5,6]. The importance of achieving anatomical reduction, sufficient internal fixation, and early joint mobilization has been emphasized. However, several factors affect the outcome, including the energy of the injury, radiographic fracture pattern, knowledge of local anatomy, duration of open reduction and internal fixation (ORIF), and selection of the optimal operative techniques [7]**.** Proper evaluation and surgical planning are necessary to achieve the primary goals of acetabular surgery: anatomic reduction of the articular surface with attention to careful soft tissue management, facilitating rapid postoperative recovery with early rehabilitation, and a long-term functioning hip joint [8]. Much progress has been made in treating acetabular fractures in the past 40 years, but the optimal operative techniques are still under scientific evaluation and critical discussion [9].

The choice of operative approach is dependent on the fracture type, direction of displacement, skin situation at the surgical incision site, and duration from the initial injury. Generally, the operative approaches to the acetabulum fractures can be classified into anterior, posterior, extensile, and combined approaches. Those fractures with the main anterior displacement are approached anteriorly, while those with the main posterior displacement are approached posteriorly. A combined or extended approach is used if the displacement involves both the anterior and posterior parts of the acetabulum [10].

The ilioinguinal and the posterior Kocher-Langenbeck approaches, with or without surgical hip dislocation, are the most commonly used operative approaches for treating pelvic and acetabular fractures [11]. In 1994, Cole introduced the modified Stoppa approach as an alternative to the ilioinguinal approach, allowing access to the entire pelvic ring through a single window which is performed by longitudinal division of the abdominal rectus, bone dissection through the inner surface of the pelvis, enabling to place implants beneath the pectineal line, as well as on the quadrilateral layer. In addition, to facilitate implants placement, this access does not directly address femoral vessels and nerves, lateral cutaneous nerve of the thigh, spermatic cord, or round ligament, thus reducing potential risks of iatrogenic neurovascular injuries, additional injuries to soft parts, the amount of bleeding and surgical time [12,13].

An additional lateral iliac wing window is necessary to achieve this surgical task, along with the Stoppa approach. Jakob et al. (2006) and Anderson et al. (2010) described a modified approach using the Stoppa and iliac surgical window for the treatment of acetabular and pelvic ring fractures [7,14]. This approach became popular over the past decade for anterior column fractures and is suitable for most cases while providing excellent visualization of and access to the quadrilateral plate and parts of the posterior column [15].

Complications associated with acetabular fractures are common. General complications include thromboembolic disease, wound necrosis, and sepsis. More specific complications include (a) nerve injuries (sciatic nerve, femoral nerve, superior gluteal nerve, and lateral cutaneous nerve of the thigh, either during surgery or during trauma), (b) heterotopic ossification; factors that have been associated with the formation of heterotopic ossification include male gender, the use of an extensile approach or trochanteric osteotomy, or the presence of extensive cartilage injury, T-shaped fracture, or concomitant abdominal, chest, or head injury, and (c) arthritis which is the most common complication after surgical treatment of acetabular fractures [16].

We conducted this study to compare the open reduction and internal fixation of acetabular fractures by the ilioinguinal and modified Stoppa approaches among patients presented to Zagazig University Hospitals.

METHODS

We conducted the current study on patients with acetabular fractures associated with anterior column fractures presented to Zagazig University Hospitals who were treated by either the ilioinguinal or the modified Stoppa approaches. The study protocol was approved by the Ethics Committee of Zagazig University. The study was conducted in accordance with the Helsinki Declaration of 1964, as revised in 2013. Written consent was obtained from the included patients or their relatives if they were incapable of giving consent.

Inclusion criteria

We included patients with the following criteria: (a) aged between 16 and 60 years old, (b) presented with a fresh acetabular fracture (less than 3 weeks from the date of injury) that is considered pre-operatively to be treated through an anterior approach, such as anterior column fractures, anterior wall fractures, quadrilateral plate fractures, the anterior column with posterior hemitransverse fractures, associated both columns' fractures, transverse fractures, and T-type fractures, and (c) who were willing to participate in a strict follow-up and rehabilitation protocol

Exclusion criteria

We excluded patients with preexisting ipsilateral hip disease, which could interfere with the clinical and radiological evaluation of the results, patients with old acetabular fractures, and posterior wall fractures, and patients younger than 16 years old or older than 60 years old.

Initial Management

Primary Survey

All Patients were managed according to the Advanced Trauma Life Support Protocol (ATLS). Life-threatening situations were dealt with accordingly.

Secondary Survey

It included mode and date of trauma, as well as past medical history. Clinical examination and neurovascular assessments were performed.

Radiographs

Plain x- rays AP and Judet views and CT scans were obtained for all patients. All patients underwent 3D reconstruction.

Management after admission and preoperative preparation

DVT prophylaxis with Enoxaparin 40 mg SC/24 hours was considered and it was stopped 12 hours before surgery. Routine preoperative laboratory investigations included complete blood count, blood sugar, bleeding profile, and renal and liver functions for all patients. An electrocardiogram (ECG) was done for all patients above 40 years of age. All patients received 2 grams of 3rd generation Cephalosporin within one hour before incision.

Operative details

All patients were operated on from the second day to thirteen-day after trauma. Spinal anesthesia was used for 4 patients, and the rest by general anesthesia. The patient was positioned supine on a radiolucent table with a sandbag below the affected hip, with the knee flexed to relax the iliopsoas and external iliac/femoral neurovascular bundle. A Foley catheter was inserted for drainage of the bladder, bladder protection, and monitoring of fluid balance. An essential benefit of a urinary catheter was acting as an early indicator for urinary bladder injury. The surgical field included the entire abdomen, well above the iliac crests to below the palpable pubic bodies. The surgical exposure in the ilioinguinal and the modified Stoppa approaches was done following the steps described for each [20-22]. Operative time, blood transfusion, and intraoperative complications were considered. The iliac crest approach (lateral window) was utilized as an additional incision in all cases with the modified Stoppa approach (Group B) except in one case, which was fixed through the Stoppa approach only using anterior column screw.

Reduction and fixation

The technical tips used in the study regarding the reduction and fixation varied according to the fracture pattern. In high anterior column fractures, reaching the iliac crest, the reduction starts at the lateral window. This was identical for both approaches. The anterior column is then reduced to the pelvic brim, following Letournel's proximal to distal rule. It was done efficiently using both approaches. In the low anterior column/anterior wall, the reduction was made through the middle window of the ilioinguinal approach versus the Stoppa window. Fixation of the anterior column was done using an iliopectineal plate, inter-fragmentary screws, iliac wing plates, or anterior column screws. Extension to the contralateral side was done in cases of symphysis diastases. A spring plate was applied through either the middle window of the ilioinguinal approach or the Stoppa window to support a comminuted quadrilateral surface. This plate had to be perfectly bent to allow its free distal end to reduce and buttress the quadrilateral surface as accurately as possible. The infrapectineal plate was also used as an alternative to the spring plate. It was under-contoured and attached to a reduction clamp to protect the weak quadrilateral surface against clamp penetration. Screws were inserted proximally and distally while the reduction was maintained to allow maximum buttressing effect for the quadrilateral surface.

In some cases, a buttress screw was added to the plate to support the quadrilateral plate, a technique in which a pelvic reconstruction plate is placed over the pelvic brim to fix the anterior column/wall fracture. The plate was placed slightly protruding medially over the pelvic brim. A buttress screw was inserted through the plate rubbing on the inner surface of the quadrilateral plate. The plate and the screw can act as a buttressing force exerted on the quadrilateral plate or a quadrilateral buttress plate.

The two approaches differed in reducing and fixation of the posterior column. A large asymmetric clamp was spanned between the middle window and lateral ilium in the ilioinguinal approach. In the Stoppa approach, the oblique Matta clamp was applied from the quadrilateral plate to the pelvic brim, or a ball spike pusher was inserted, pushing the posterior column towards the pelvic brim. The posterior column was commonly fixed with screws. These screws were inserted respecting the orientation of the fracture line. If reduction of the posterior column was problematic from the anterior approach, a posterior approach was made in another session.

Postoperative management protocol

X-rays AP and Judet views were obtained postoperatively for all patients. The reduction was graded on all 3 radiographic views using the scoring system published by Matta. Displacement greater than 3 mm on plain radiographic view indicated poor reduction. Displacement of 1-3mm or less was defined as a satisfactory reduction, and an anatomical reduction had 1mm or less displacement. *Other items included (a)* Adequate fluid replacement and blood transfusion if indicated, (b) DVT prophylaxis: by Enoxaparin SC/24 hrs. to be started 12 hours postoperatively and continued for 4 weeks, (c) Pain relief by continued epidural infusion or by NSAIDs, (d) Antibiotics: 3rd generation IV Cephalosporins for

72 hours postoperative, (e) Catheter removal within the first 48 hours to avoid urinary tract infection, (f) Drains were removed after 48 hours or earlier if they drained less than 50 ml in the last 8-12 hours, (g) Suture removal after 14 days, and (h) Early postoperative complications were considered in both groups.

Postoperative mobilization protocol

Static quadriceps and ankle dorsiflexion exercises were started within 24 hours after the surgery. Passive and active knee exercises while in recumbent position commenced from day 2 postoperative. Once the pain had subsided, the patient started gait training on a walker or axillary crutches, without weight bearing on the affected side. Active flexion, extension, and abduction exercises while standing were encouraged. Physical therapy was directed towards regaining muscle strength and range of motion around the hip. Limitation of weight-bearing was continued for 8-12 weeks postoperatively. At 12 weeks, full weight-bearing ambulation was permitted only after fracture healing, evident by a clinical and radiological union. This was usually achieved in about 12 weeks. The patient was then advised to discard walking aids as he tolerated them gradually. Functional outcome was measured using the Matta modification of the Merle D'Aubigné score.

Postoperative visits

The patient was discharged 24 hours after drain removal and after ensuring the commencement of ROM exercises. During the 14-day visit, sutures were removed, and hip exercises while standing were performed. At the 6-week visit, x-rays were repeated for follow-up, and follow-up ROM of the ankle, knee, and hip joints was performed. At the 3-month visit, x-rays were repeated for follow-up, a clinical assessment was done, and weight-bearing was started. At the 6-month visit, x-rays were assessed, and the functional outcome was performed using the Modified Merle D'Aubigné score **(Table 1)**. Modified Merle D'Aubigné score depends on evaluating 3 individual scores, which are Pain, Range of motion, and Ambulation. The 3 individual scores are summed to the final clinical score, according to which the clinical results are classified as excellent (18) points, good (15, 16, or 17) points, fair (13 or 14) points, or poor (<13) points.

Statistical analysis:

Data normality was assessed, and the continuous data were presented as mean ± SD for parametric data. We presented the qualitative data in frequencies and percentages. Chi-squared test ($\chi2$) was used to assess the association between two or more qualitative variables. For comparing quantitative variables between two groups, the Student-t-test was used for parametric data. A significant difference was considered when the p-value was less than 0.05. All analyses were performed using Statistical Package of Social Science (SPSS) version 22 (SPSS Inc., Chicago, Illinois, USA).

RESULTS

Characteristics of the included population

The study included 40 patients with a mean age of 36.4 years (±10.9), divided into two groups. The Ilioinguinal group included 20 patients (13 male and 7 female), with a mean age of 37.8 years (±12.6), while the Modified Stoppa group included 20 patients (14 male and 6 female), with a mean age of 35 years (±9.09). The most common mechanism of injury was MVA motor vehicle accident (n= 25.0, 62.5%), and most patients had no associated injury (n= 24.0, 60.0%). Only one patient in the Modified Stoppa group had sciatic nerve injury, as shown in **(Table 2)**. There were no statistically significant differences between both groups in terms of age, sex, mechanism of injury, associated injury, and NV insult (all p>0.05).

Operative Data

As shown in **(Table 3)**, the mean preoperative time delay was 6 days (±2.27) among the ilioinguinal group compared with 5.75 days (±3.08) among the modified Stoppa group. There was no statistically significant difference between both groups (p= 0.772). The mean operation time and intraoperative blood loss were significantly higher among the ilioinguinal group than in the modified Stoppa group (154 ± 27 versus 104 ± 21.4 minutes, p<0 .001) and (728 ± 155 versus 415 ± 126 ml, p<0 .001), respectively. Regarding intraoperative blood transfusion, 47.4% of the Ilioinguinal group required two units, and 42.1% required three units. The needed units were significantly higher in the Ilioinguinal group than in the modified Stoppa group (p= 0.005).

Complications, Matta radiological score, and Merle d'aubigné score

None of the included patients had intraoperative complications, and only one patient had an infection and iliac wound dehiscence after a modified Stoppa operation. Regarding the Matta radiological score, it was anatomical in 8 patients (40.0%), satisfactory in 11 patients (55%), poor in only one patient after the Ilioinguinal approach, and it was anatomical in 14 patients (70.0%), satisfactory in 6 patients (30%), and poor in none of the included patients after the Modified Stoppa approach.

The mean Merle d'aubigné score was 16.4 (±1.67) among the Ilioinguinal group and 16.6 (±1.53) among the modified Stoppa group; it was excellent in 19 patients (47.5%), good in 18 patients (45.0%), and fair in 3 patients (7.5%). There were no statistically significant differences between both groups in terms of intraoperative complications, postoperative complications, Matta radiological score, and Merle d'aubigné score (all p>0.05), **(Table 4)**.

Table 1: Modified Merle D'Aubigné score

Number of points	Pain	Range of motion	Ambulation
6	None	Flexion greater than 90	Normal
5	Slight or intermittent; normal activity.	Flexion 70 - 90	No cane; slight limp after long-distance working.
4	Pain after ambulation; easy walk of ½ hour or more.	Flexion 50 – 70	Limp; long-distance with cane or crutch.
3	Moderately severe; walking no more than 20 min.	Flexion 30 - 50	Significant limp; cane permanently.
2	Severe; ambulation limited to 10 min.	Flexion less than 30	Very limited; two canes.
1	Severe; prevents ambulation	Very restricted	Bedridden

Table 2: Demographic data of the included patients (n= 40)

		Ilioinguinal (N=20)	Modified Stoppa (N=20)	Total (N=40)	p-value
Age (years)	**Mean ± SD**	37.8 ± 12.6	35 ± 9.09	36.4 ± 10.9	0.417
Sex	**Female**	7.0 (35.0%)	6.0 (30.0%)	13.0 (32.5%)	0.736
	Male	13.0 (65.0%)	14.0 (70.0%)	27.0 (67.5%)	
Mechanism of injury	**FFH**	3.0 (15.0%)	1.0 (5.0%)	4.0 (10.0%)	0.395
	MVA	13.0 (65.0%)	12.0 (60.0%)	25.0 (62.5%)	
	Pedestrian	4.0 (20.0%)	7.0 (35.0%)	11.0 (27.5%)	
Associated Injury	**Yes**	10.0 (50.0%)	6.0 (30.0%)	16 (40%)	0.374
	No	10.0 (50.0%)	14.0 (70.0%)	24.0 (60.0%)	
NV Insult	**No**	20.0 (100.0%)	19.0 (95.0%)	39.0 (97.5%)	0.311
	Sciatic nerve injury	0.0 (0.0%)	1.0 (5.0%)	1.0 (2.5%)	

MVA= Motor Vehicle Accident; FFH = Falls from height

Table 3: Operative data among the studied groups (n= 40)

		Ilioinguinal (N=20)	Modified Stoppa (N=20)	Total (N=40)	p-value
Preoperative time delay (days)	**Mean ± SD**	6 ± 2.27	5.75 ± 3.08	5.88 ± 2.67	0.772
	2	1.0 (5.0%)	4.0 (20.0%)	5.0 (12.5%)	0.469
	3	2.0 (10.0%)	0.0 (0.0%)	2.0 (5.0%)	
	4	2.0 (10.0%)	4.0 (20.0%)	6.0 (15.0%)	
	5	4.0 (20.0%)	3.0 (15.0%)	7.0 (17.5%)	
	6	3.0 (15.0%)	2.0 (10.0%)	5.0 (12.5%)	
	7	3.0 (15.0%)	2.0 (10.0%)	5.0 (12.5%)	
	8	2.0 (10.0%)	1.0 (5.0%)	3.0 (7.5%)	
	9	1.0 (5.0%)	2.0 (10.0%)	3.0 (7.5%)	

	10	2.0 (10.0%)	0.0 (0.0%)	2.0 (5.0%)	
	11	0.0 (0.0%)	1.0 (5.0%)	1.0 (2.5%)	
	13	0.0 (0.0%)	1.0 (5.0%)	1.0 (2.5%)	
Operation Time (minutes)	Mean ± SD	154 ± 27	104 ± 21.4	129 ± 35	< .001
Intraoperative blood loss (ml)	Mean ± SD	728 ± 155	415 ± 126	571 ± 211	< .001
Intraoperative blood transfusion (units)	0	0.0 (0.0%)	2.0 (10.0%)	2.0 (5.1%)	0.005
	1	2.0 (10.5%)	10.0 (50.0%)	12.0 (30.8%)	
	2	9.0 (47.4%)	7.0 (35.0%)	16.0 (41.0%)	
	3	8.0 (42.1%)	1.0 (5.0%)	9.0 (23.1%)	

Table 4: Intra- and postoperative complications and scores among the studied groups (n= 40)

		Ilioinguinal (N=20)	**Modified Stoppa (N=20)**	**Total (N=40)**	**p-value**
Intraoperative complications	**No**	20.0 (100.0%)	20.0 (100.0%)	40.0 (100.0%)	1
Postoperative complications	**Infection, Iliac wound dehescence**	0.0 (0.0%)	1.0 (5.0%)	1.0 (2.5%)	0.31
	No	20.0 (100.0%)	19.0 (95.0%)	39.0 (97.5%)	
Matta radiological score	**Anatomical**	8.0 (40.0%)	14.0 (70.0%)	22.0 (55.0%)	0.13
	Poor	1.0 (5.0%)	0.0 (0.0%)	1.0 (2.5%)	
	Satisfactory	11.0 (55.0%)	6.0 (30.0%)	17.0 (42.5%)	
Merle d'aubigné score	**Mean ± SD**	16.4 ± 1.67	16.6 ± 1.53	16.6 ± 1.58	0.70
	Excellent	9.0 (45.0%)	10.0 (50.0%)	19.0 (47.5%)	0.82
	Fair	2.0 (10.0%)	1.0 (5.0%)	3.0 (7.5%)	
	Good	9.0 (45.0%)	9.0 (45.0%)	18.0 (45.0%)	

DISCUSSION

Rives et al. [17] and Stoppa et al. [18] first described the preperitoneal abdominal approach to managing groin hernias. Hirvensalo et al. [19] and Cole and Bolhofner [20] have modified this approach to manage acetabular fractures. It begins with making a cutaneous incision 2cm above the symphysis pubis, then midline splitting of the rectus abdominus, and retracting muscular, neurovascular, and urological structures [20]. This provides good exposure to the intrapelvicular aspect of the hip joint and acetabulum. It also visualizes the pelvic ring, facilitating improved reduction and stabilization [20]. The anatomical reduction rate in the ilioinguinal approach reaches 45% to 74%, while the modified Stoppa approach reaches 59% to 82% [21-23].

In our study, we included 40 patients with acetabular fractures. We divided them into two equal groups managed with the ilioinguinal or modified Stoppa. We aimed to compare these approaches' outcomes in terms of intra-operative parameters, postoperative complications, radiographic outcomes using the Matta radiological scoring system), and clinical outcomes using the Merle d'aubigné scoring system).

Patients' demographics were first evaluated. There was no statistically significant difference between both groups in terms of mean age (P= 0.417), gender (P= 0.736), mechanism of injury (P= 0.395), and associated injury (P= 0.374). In the published studies comparing the two approaches, the male to female ratio was high [17,18,20,24-28]. In our study, the male to female ratio was also high (males accounted for 65.0% of the Ilioinguinal group and 70.0% of the Modified Stoppa group). However, the age range was significantly different (10-88 years) [22,29,30-38] except for Al Adawy et al., which was almost similar (36.8 ± 8.42 (range 20-73) years) [24]. In addition, our study showed a mean age of 37.8 ± 12.6 among the ilioinguinal group compared with 35 ± 9.09 among the modified Stoppa group. The most common mechanism of injury in the literature was a road traffic accident (RTA), then FFH [34-36]. In contrast, the most common mechanism in our study was MVA (65.0% of the Ilioinguinal group and 60.0% of the Modified Stoppa group).

Preoperative time delay ranged from 0 to 30 days in most previous studies [22,29,30-38]. In contrast, the mean time was 4.83 ± 3.74 days in the Dailey et al. study [39] and was 6 ± 2.27 days among the ilioinguinal group compared with 5.75 ± 3.08 days among the modified Stoppa group in our study. Many factors were affecting the preoperative time delay in our study. The most crucial factor was the delayed presentation of the patient to our hospital after injury. Then, the unavailability of blood transfusion units and the long waiting list for the operating theatre also led to further delays.

Regarding the mean operation time, in Anderson et al. [22], the surgical time ranged from 3 h to 8 h 48 min (including the time of reviewing postoperative radiography). Overall, the minimum surgical time was as short as 80 min, and the maximum was as long as 568 min [9,22,32-37,40]. In our study, the mean operation time was longer among the ilioinguinal group than in the modified Stoppa group (154 ± 27 versus 104 ± 21.4 minutes, P<0 .001).

The intraoperative blood loss ranged between 100-5000 ml in 10 studies that we have cited [9,22,24,31-37]. Casstevens et al. [35], Laflamme et al. [34], Dailey et al. [39], and Al Adawy et al. [24] reported mean blood loss of 1270 ml, 1376 ± 608 ml, 1159.73 ± 1072.5 ml, and 856.5 ± 194.2 in 10 patients, 21 patients, 112 patients, and 20 patients respectively. Our findings were also within that range with statistically significant differences between the two groups (more among the ilioinguinal group than the modified Stoppa group: 728 ± 155 versus 415 ± 126 ml respectively, p<0 .001). Nevertheless, Elmadağ et al. [37] found no statically significant difference between the two groups in terms of blood loss (ilioinguinal group: median blood loss 1170 ml; modified Stoppa: 1110 ml, P=0.168). In addition, we observed that the intra-operative blood transfusion was higher in the ilioinguinal group than in the modified Stoppa group (ilioinguinal group: 47.4% required 2 units, 42.1% required 3 units; the modified Stoppa group: 50% required 1 unit, 35.0% required 2 units).

Regarding intra-operative complications, injury of corona Mortis, obturator artery, external iliac vein, and superior gluteal artery was rarely reported in the literature [31]. Nevertheless, none of the included patients in this study had intraoperative complications. Regarding postoperative complications, Elmadage et al. [37] reported a mean complication rate of 31% in the ilioinguinal group (6 patients) and 23% in modified stoppa group (4 patints) (P > 0.05) [41]. Moreover, a meta-analysis of 5 studies, with 186 patients in the modified Stoppa group and 219 in the ilioinguinal group- Hao Wu et al. [23] reported no statistically significant difference between the two groups (P=.34; 95% CI: 0.28–1.55) even inthe sub-group analysis of postoperative infection, vascular insult, and nerve insult (P=.62, P=.60, and P=.76, respectively). We met in agreement with these findings. In addition, only one patient had an infection, iliac wound dehiscence, following the modified Stoppa approach (P=0.311).

Sagi et al. [21] reported an excellent reduction rate in 92% of patients with anterior column fractures, while Shazar et al. [33] reported a 79.4% reduction rate. The meta-analysis of Hao Wu et al. [23] concluded better reduction quality in favor of the modified Stoppa approach (P=.03; 95% CI: 1.08–3.39). Our results showed no statistically significant difference between the groups (anatomical reduction in 14 patients (70.0%), satisfactory in 6 patients (30.0%) in the modified Stoppa group; and anatomical reduction in 22 patients (55.0%), satisfactory in 17 patients (42.5%), and poor in only one patient after the Ilioinguinal approach); (P=0.128).

Regarding Merle D'Aubigné's scoring system of clinical outcome in patients treated with modified Stoppa, Sagi et al. reported Merle D'Aubingné's score as; excellent in 36%, good in 55%, and poor in 10% of patients [21]. Moreover, in four studies of 133 patients, it reached excellent in 58 patients, good in 59 patients, fair in 8 patients, and poor in 8 patients [9,29,34,42,43]. However, a meta-analysis of Elmadage et al. [40], Hammad et al. [32], and Ma K et al. [25] with a total number of patients, 65 in the modified Stoppa group and 72 in the ilioinguinal group revealed no statistically significant difference between the two groups (P=.63; 95% CI: 0.35–1.87) [23]. Our study also agrees with these findings (The mean score was 16.4 ± 1.67 among the Ilioinguinal group and 16.6 ± 1.53 among the modified Stoppa group; P=0.695).

Our study is one of the few studies comparing the two approaches regarding almost all the variables (preoperative, intra-operative, and postoperative data were recorded). The basic demographic data of both groups are comparable (all P> 0.05), making the comparison more realistic. The surgeons are familiar with the techniques of both approaches, achieved almost no intra-operative complications. However, our study is limited by the relatively small sample size (40 patients) and the short follow-up period.

CONCLUSION

Our study suggests that the modified Stoppa approach may be an excellent alternative to the classic ilioinguinal approach in treating anterior acetabular fractures. It decreases intra-operative blood loss and reduces needed intra-operative blood transfusion units in less operative time than the ilioinguinal approach. We recommend further research on a larger scale of patients comparing the two approaches to the various types of acetabular fractures.

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