Comparison of minimally invasive percutaneous fixation versus open patella fracture fixation.

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Abstract

Background

The standard treatment for displaced patella fractures has historically been open reduction internal fixation (ORIF). There are certain disadvantages to this surgical strategy that could impact patient outcomes and prognosis. To get around these drawbacks, minimally invasive percutaneous fixation, or MIPF, was suggested. There haven't been many thorough studies done to establish whether MIPF is better than ORIF. Comparing the effectiveness of MIPF and ORIF for patella fractures was the goal of this investigation.

Objective

To determine the Comparison of minimally invasive percutaneous fixation versus open patella fracture fixation.

Methods

A cross-sectional study was conducted at Jinnah Hospital Lahore Pakistan, which was performed between September 2022 to October 2024, The total number of patients in our study were 100 who were patella fracture due to road accident or fall history. The number of Male patients were 65 and female were 35. We compared Minimally invasive surgery for patella fracture vs open surgery. For all patients, we did diagnostic tests X-Ray preoperative and postoperative. The doctor gave general anesthesia for the surgery. Surgery last from 45 minutes to 2 hours depend on surgical procedure. We also took detailed history from the patients about the signs and symptoms. Data was tabulated and analyzed by SPSS version 27.

Result

In a current study total 100 patients were enrolled. The minimum age of patients were 27 years and the maximum age of the patients were 52 years. The mean age were 38.20±7.047 years. The minimum BMI were 22 (Kg/m2) and the maximum were 34. The mean BMI were 27.50±3.489 (Kg/m2). The minimum minimally invasive surgery time of patients were 40 minutes and the maximum were 52 minutes. The mean of Minimally invasive surgery time (Min) were 45.70±4.108. The minimum open surgery time were 1 hour and the maximum were 2 hours. The mean of open surgery time were 1.35±0.479.

The frequency of the mechanism of injury of fall patients were 45 and its percentage were 45.0. The frequency of the mechanism of injury of traffic accident patients were 55 and the percentage were 55.0. The p-value were 0.044. The frequency of side of injury left side were60 and the right side were 40 patients. The frequency of type of fracture, lower pole fracture were 15, transverse fracture were 45 and vertical fracture were 40 patients.

Conclusion

We concluded that Minimally invasive percutaneous surgery (MIPS) is more favorable than Open surgery (OS) in terms of the pain score, knee range of motion, joint functionality, complications, and implant removal rate. Thus, Minimally invasive percutaneous surgery can be adopted as an alternative to open surgery.

Keywords: Minimally invasive percutaneous surgery (MIPS), Open surgery (OS), open reduction internal fixation (ORIF), X-Ray (XR).

Introduction

Patellar fractures comprise 0.5–1.5% of all types of bone fractures [1]. The most frequent kind of patella fracture is a transverse fracture, which frequently results in a functional impairment of the knee extensor mechanism [2]. When there is a step-like discontinuity on the articular surface greater than 2 mm or a fragment separation greater than 3 mm, surgery is advised [3]. Rigid internal fixation, morphological reduction of the articular surface, and reconstruction of the knee extensor mechanism are the goals of surgical treatment, which aims to prevent post-traumatic patellofemoral arthritis and enable earlier functional workouts of the knee joint [4-5].

Nowadays, techniques that combine the tension band principle with interfragmentary screw fixation have been shown to offer stronger fixation than the modified tension band construct alone, and they are increasingly being utilized to treat transverse patella fractures [6-7]. The majority of these procedures, however, are still carried out using an open technique that necessitates a lengthy skin incision and a significant dissection of soft tissues. This increases the risk of postoperative adhesions, prolonged disability (requiring time away from work), and unsightly scars [8].

The standard of care for displaced patella fractures has historically been open reduction internal fixation (ORIF). However, there are a number of drawbacks to this surgical strategy that could affect its clinical results. A lengthy recovery period, significant soft tissue compromise at the fracture site, the need for a lengthy incision for direct vision, the possibility of devascularization of individual bone fragments, and significant blood loss related to the dissection are some of these [9-10-11]. Studies have often documented complications such infection, delayed wound healing, discomfort, or wire breakage [12–13], with up to 60% of people experiencing symptomatic hardware [14–15]. When there is diastasis or fragment separation of more than 3 mm, osteochondral fracture with intra-articular loose bodies, displacement or articular step-off of more than 2 mm, or an altered extensor mechanism, surgery is recommended [16–17]. Despite their

relative rarity, patella fractures present orthopedic surgeons with constant challenges in terms of firm fixation, correct anatomical reduction, and wound management following surgery [18–19]. To lessen the aforementioned disadvantages, minimally invasive percutaneous fixation, or MIPF, has been suggested in recent decades. Using cannulated screws, Kirschner wires, pins, or other implants placed percutaneously, this indirect or limited open reduction approach involves tiny incisions and offers complete stability [20]. Numerous variations of this surgical technique have been proposed. While most studies have recommended doing the procedure with the aid of arthroscopy and fluoroscopy, some have proposed new fixation techniques. The lack of study on MIPF's advantages, drawbacks, and biomechanical characteristics has prevented it from being widely used to date. Physician interest in adopting MIPF may be hampered by the absence of a comparison between MIPF and ORIF, and strong proof of MIPF's superiority is required [21].

MATERIALS AND METHODS

A cross-sectional study was conducted at Jinnah Hospital Lahore Pakistan, which was performed between September 2022 to October 2024, The total number of patients in our study were 100 who were patella fracture due to road accident or fall history. The number of Male patients were 65 and female were 35. We compared Minimally invasive surgery for patella fracture vs open surgery. For all patients, we did diagnostic tests X-Ray preoperative and postoperative. The doctor gave general anesthesia for the surgery. Surgery last from 45 minutes to 2 hours depend on surgical procedure. We also took detailed history from the patients about the signs and symptoms. Data was tabulated and analyzed by SPSS version 27.

Inclusive criteria: Included all patients who have Patella fracture.

Exclusive criteria: We excluded pregnant women and children.

Results

Table 1: Mean Age, BMI, Minimally invasive surgery time and Open surgery time of all the enrolled patients (*n=100*)

Variables	Minimum	Maximum	Mean±SD
Age (Years)	27	52	38.20±7.047
BMI (Kg/m2)	22	34	27.50±3.489
Minimally invasive surgery time (Min)	40	52	45.70±4.108
Open surgery time (Hours)	1	2	1.35±0.479

In a current study total 100 patients were enrolled. The minimum age of patients were 27 years and the maximum age of the patients were 52 years. The mean age were 38.20±7.047 years. The minimum BMI were 22 (Kg/m2) and the maximum were 34. The mean BMI were 27.50±3.489 (Kg/m2). The minimum minimally invasive surgery time of patients were 40 minutes and the maximum were 52 minutes. The mean of Minimally invasive surgery time (Min) were 45.70±4.108. The minimum open surgery time were 1 hour and the maximum were 2 hours. The mean of open surgery time were 1.35±0.479.

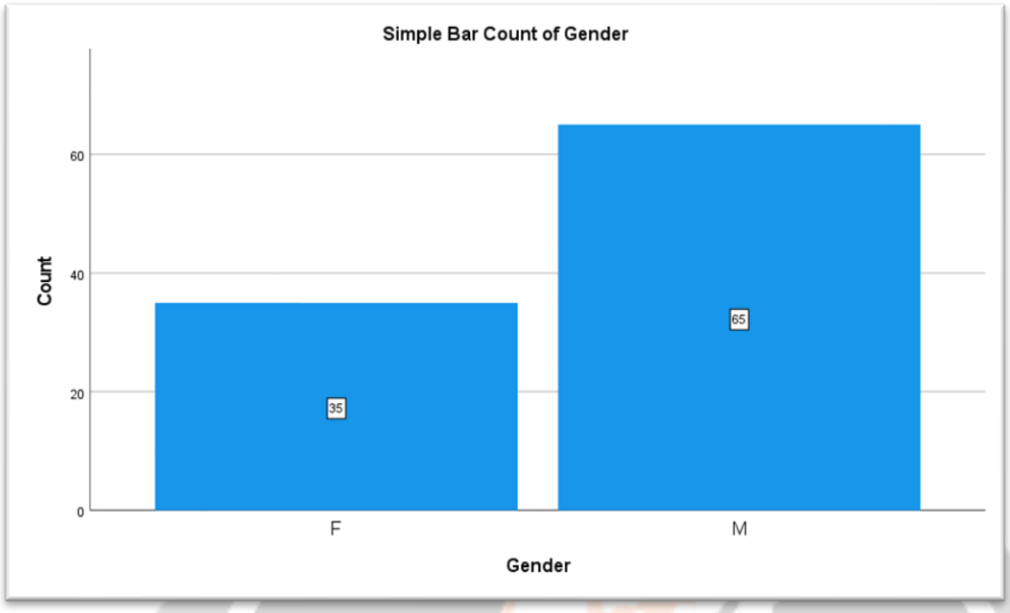

Figure 1: Bar chart of gender distribution.

In Figure 1, we did a gender distribution, we can see the male and female patient frequency in the above bar chart.

Figure 2: Preoperative radiographs, The radiographs demonstrated the displaced transverse fracture of the patella. The fracture line was near the proximal one-third of the patella.

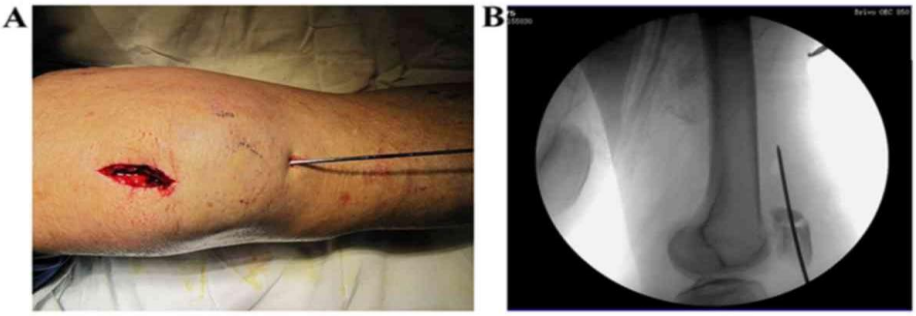

Figure 3: Fracture reduction and temporary fixation. (A) A K-wife for temporary fixation following the reduction. (B) A C-arm fluoroscopy was used to confirm the anatomical reduction of the articular surface.

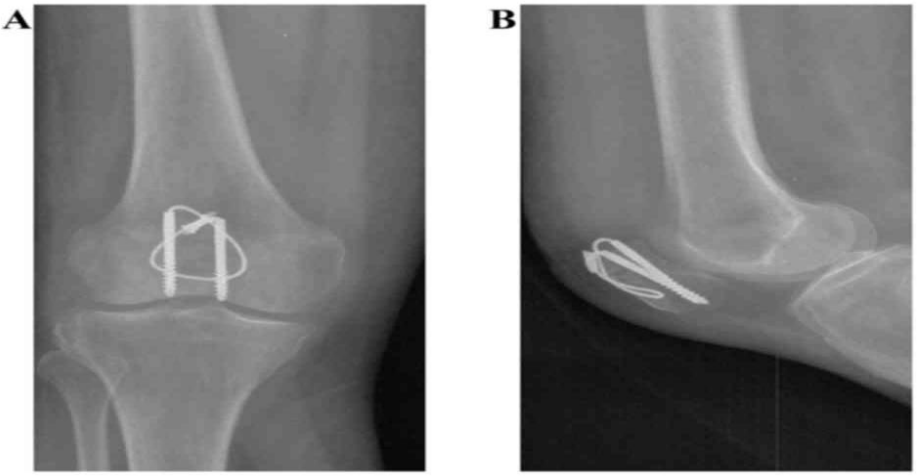

Figure 4: Postoperative radiographs 8 weeks after surgery. (A) A postoperative radiograph. (B) A postoperative lateral radiograph demonstrating the anatomical reduction.

Table 2: Frequency and Percentage of Gender (n=100)

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
F	35	35.0	35.0	35.0
M	65	65.0	65.0	100.0
Total	100	100.0	100.0	

In the above table 2, the frequency of Female patients were 35 and the percentage were 35.0. The cumulative percent were the same 35. The frequency of male patients were 65 and the percentage were 65.0. Total number of patients were 100 (100 %) in our study.

Table 3: Patient characteristics of enrolled patients (n=100)

Variables	Frequency	Percentage	P-Value
Mechanism of Injury			
Fall	45	45.0	0.044
Traffic Accident	55	55.0	
Side of Injury			
Left	60	60.0	
Right	40	40.0	
Type of fracture			
Lower pole fracture	15	15.0	
Transvers Fracture	45	45.0	
Vertical fracture	40	40.0	
Symptoms			
Swelling	25	25.0	0.03
Swelling and Pain	75	75.0	
Anesthesia			
General Anesthesia	99	99.0	
Local Anesthesia	1	1.0	
Diagnostic test			
X-Ray before and after Surgery	100	100.0	
Minimally Invasive surgery recovery			
Fast recovery, minimal blood loss, minimal scar,	100	50.0	
Open Surgery Recovery			
Late recovery, More blood loss, Large scar	100	50.0	

The current study included a total of 100 patients with Patella fracture whose characteristics are summarized in Table 3. The frequency of the mechanism of injury of fall patients were 45 and its percentage were 45.0. The frequency of the mechanism of injury of traffic accident patients were 55 and the percentage were 55.0. The p-value were 0.044. The frequency of side of injury left side were60 and the right side were 40 patients.

The frequency of type of fracture, lower pole fracture were 15, transverse fracture were 45 and vertical fracture were 40 patients.

The frequency of symptom of swelling were 25 and swelling and pain were 75. The P-value were 0.03. The frequency of general anesthesia were 99 and its percentage were same 99.0 and local anesthesia were 1.

The frequency of diagnostic test X-rays before and after surgery were 100. The frequency of minimally invasive surgery whose recovery fast, with minimal blood loss and minimal scar were 50. The frequency of patients who did open surgery who recovered late, with more blood loss and large scars were 50.

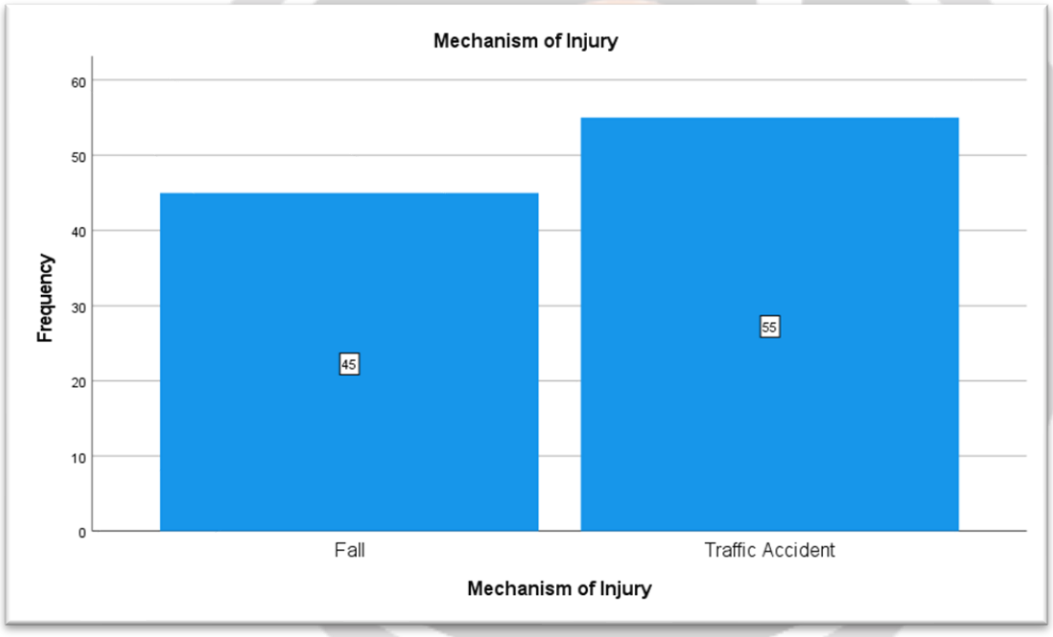

Figure 5: In Figure 2, we can see the mechanism of fall and traffic accident patients.

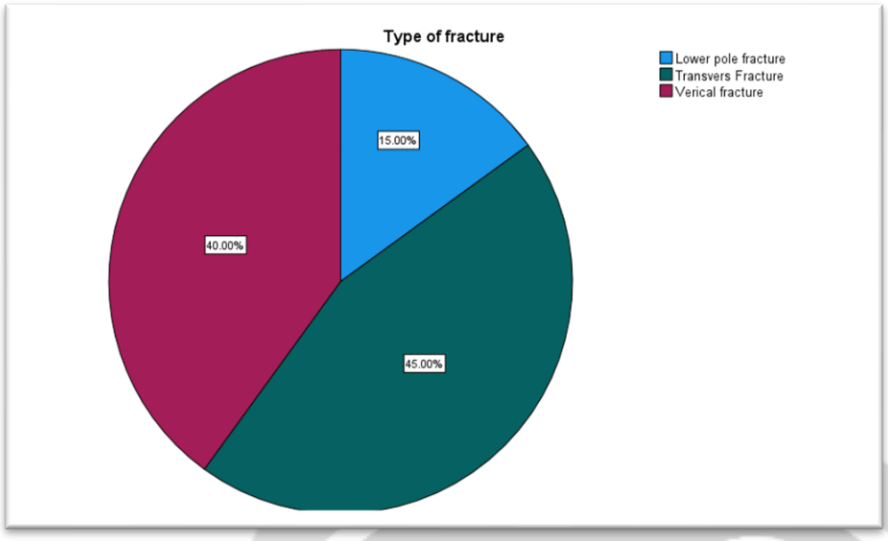

Figure 6: The pie chart of Types of fracture, Transverse fracture is shown in green color, Vertical fracture is shown in red color and lower pole fracture is shown in blue color.

Discussion

The minimally invasive procedure is now a modern trend in the medical field. It not only reduces operative trauma but also has more favorable clinical outcomes [22]. According to our findings, MIPF resulted in less discomfort and greater extension angles with patella fractures throughout the first three months of follow-up. Additionally, it was linked to long-term (at least two years) positive knee flexion angles and functional ratings. The benefits are similar to these in many clinical studies and series [23–24]. Our data showed no significant difference in surgical times between MIPF and ORIF. This conclusion may be the result of several circumstances. First, because surgeons cannot see the fracture site directly from where they incise, MIPF for patella fractures is technically challenging [25–26]. The majority of research have not provided an explanation for the difference between MIPF and ORIF with regard to uncomfortable hardware or discomfort. According to Gosal et al. [27], the K-wire prominence is linked to unpleasant hardware. Because of the K-wire's smooth surface and twisting and bending technique, other research has shown that discomfort is secondary to implant migration or loosening. There are connections between the difficulties. Experience with surgery has shown that excessive traction is applied to the soft tissue around our kneecap both before and after ORIF, preventing wound dehiscence. In contrast to MIPF, stretched skin is more likely to experience uncomfortable discomfort, irritation, and delayed wound healing [28]. Regardless of its static or dynamic dimension, interfragmentary screw fixation combined with the tension band principle offers greater stability from a biomechanical standpoint than either screws or modified tension band wire alone. We can learn more about how fixation devices may lower the risk of problems during MIPF because this type of fixation is accompanied by increased compression and resistance against the distraction force [29–30].

CONCLUSION

We concluded that Minimally invasive percutaneous surgery (MIPS) is more favorable than Open surgery (OS) in terms of the pain score, knee range of motion, joint functionality, complications, and implant

removal rate. Thus, Minimally invasive percutaneous surgery can be adopted as an alternative to open surgery.

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