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Functional Outcome of Transosseous Krackow Suture Repair for Lower Pole Patella Fracture

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ABSTRACT

Lower pole patella fractures, though relatively uncommon, present significant management challenges due to their impact on the extensor mechanism and the small, often comminuted nature of the fracture fragment. Traditional fixation methods such as tension band wiring and partial patellectomy have shown limitations, including implant-related complications and compromised functional outcomes. This prospective observational study aimed to evaluate the short-term functional and radiological outcomes of transosseous Krackow suture repair in lower pole patella fractures at a tertiary care center in Islamabad. Study was conducted at Combined Military Hospital (CMH), Rawalpindi, from January 2021- June 2023. A total of 105 patients (mean age 39.4 ± 12.6 years; 68.6% male) were treated surgically using non-metallic transosseous Krackow sutures. Patients were assessed at 2 weeks, 6 weeks, 3 months, and 6 months postoperatively for union rates, range of motion, Lysholm knee scores, and complications. Radiological union was achieved in 96.2% of cases within an average of 10.3 weeks. The mean L ysholm score at six months was 88.6 ± 7.9, with 92.3% of patients regaining flexion >120° and 95.2% achieving full extension. Complications were minimal (7.6%), including superficial infections, reoperations due to suture failure, and hardware irritation. These findings indicate that transosseous Krackow suture repair is a safe, effective, and minimally invasive technique for lower pole patellar fractures. It provides reliable fixation with excellent functional outcomes and a low complication profile, making it a viable alternative to traditional fixation methods, particularly in resource-limited settings.

INTRODUCTION

Patellar fractures constitute about one percent of all skeletal injuries, with the lower pole (inferior pole) patellar fracture including up to 1022 percent of patellar fractures (Chang et al., 2023; Raja et al., 2021; Kruse et al., 2022). These injuries are often caused by abrupt forceful quadriceps muscle contraction with a flexed knee or a direct trauma to the front of a knee (Sonkodi et al., 2021; Codorean & Codorean, 2023; Davis & Rizzone, 2021). Because the lower pole is invaded by the extensor machine, in most cases lower pole fractures are displaced and lead expectantly to the loss of active extension in which case surgical therapy is desirable to ensure the best patient outcome (Singer, 2021; Pellegrino et al., 2022).

The treatment of the infrapatellar patellar fracture is difficult because of the small size of the end fragment, comminution, and inadequate bone reserve to support hardware routes (Elkin et al., 2021; Rubinger et al., 2021). Conventional methods of fixation like tension band wiring and partial patellectomy have been linked to such complications as implant irritation, nonunion, and extensor lag (Liu et al., 2023; Xie et al., 2022). Partial patellectomy, a previously proposed standard treatment option in cases of seriously comminuted inferior pole fractures, has lost its prominence because of quadriceps strength loss and changed mechanics of the knee joint (Deng et al., 2021).

Newer forms of suture technique have become potential options, most prominently, the transosseous Krackow suture technique. This method is associated with the use of powerful non-absorbable points threaded through the patellar tendon and locked into position transosseously through the proximal patella (Lee, 2021; McLaughlin & El Hassan, 2022). Its benefits include low demand of hardware, low risk of implant complications, and the maintenance of the anatomy of the patellar (Meng et al., 2023; Daun & Davis, 2023; Ornaghi Jr et al., 2023). This approach has good functional reported outcomes, early rehabilitation, and high union rates, mostly in younger, active patients (Musahl et al., 2022; Cohen et al., 2022).

Nonetheless, contrary to the increasing attention, there is limited data on the functional outcome and complication rate of the Krackow suture repair on the lower pole of patella fractures in the South Asian populace. The purpose

of the study is to assess the immediate clinical and radiological results of transosseous Krackow suturing fixation of lower pole hairline patella fractures among patients who report to a tertiary care center. This study aims to provide meaningful evidence to base surgical decision-making in this sub-group of patellar fractures by evaluating important outcome parameters such as union rate, range of motion, Lysholm score and profile of complications.

METHODOLOGY

The study was a prospective observational study that was undertaken at the Combined Military Hospital (CMH) Rawalpindi, between January 2021 and June 2023. In the study design, 105 patients diagnosed with lower pole patella fractures received an informed consent form and institutional review board ethical approval to participate in the post-fracture study. Skeletally mature patients aged between 18 and 65 years with isolated, displaced lower pole patella fractures that can be repaired by sutures were included according to the inclusion criteria. The exclusion criteria were patients with mid-pole fractures comminuted type, patients with open injuries, the previous knee surgery, and ligamentous injuries.

All patients underwent operative fixation using the transosseous Krackow suture technique. Under spinal or general anesthesia and following standard aseptic preparation, a midline longitudinal incision was made over the anterior knee to expose the fracture site. The inferior pole fragment was mobilized and debrided of hematoma. Non-absorbable, high-strength sutures (No. 2 FiberWire or equivalent) were passed through the distal patellar tendon using the Krackow technique and then directed transosseously through longitudinal tunnels drilled in the proximal patella fragment. Fracture reduction was confirmed, and the sutures were tensioned and tied securely to achieve anatomical alignment. Postoperative management included early mobilization with a hinged knee brace, and weight-bearing as tolerated based on clinical assessment.

Patients were followed at regular intervals postoperatively—2 weeks, 6 weeks, 3 months, and 6 months—for clinical and radiographic evaluation. Functional outcome was assessed using the Lysholm Knee Scoring Scale and range of motion (ROM) measurements, while complications such as infection, implant irritation, or reoperation were recorded. Data were analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation, while categorical data were presented as frequencies and percentages. Paired t-tests and chi-square tests were used to evaluate pre- and post-operative differences, with a p-value of <0.05 considered statistically significant.

RESULTS

A total of 105 patients with lower pole patella fractures were included in the study. The mean age of the patients was 39.4 ± 12.6 years (range: 19–64), with a male predominance (n=72; 68.6%) compared to females (n=33; 31.4%). The most common mechanism of injury was a fall on a flexed knee (n=61; 58.1%), followed by road traffic accidents (n=32; 30.5%) and direct trauma (n=12; 11.4%). The right knee was involved in 59 patients (56.2%) and the left in 46 patients (43.8%).

All patients underwent transosseous Krackow suture repair. The mean surgical time was 62.5 ± 9.4 minutes. The average hospital stay was 2.8 ± 0.9 days. Radiological union was achieved in 101 patients (96.2%) within an average of 10.3 ± 2.1 weeks. Four patients (3.8%) had delayed union but eventually achieved satisfactory healing with conservative measures.

The functional outcome, assessed by the Lysholm Knee Score at 6 months postoperatively, showed a mean score of 88.6 ± 7.9, indicating good to excellent outcomes in the majority. Range of motion improved significantly over follow-up, with 92.3% of patients regaining full extension and flexion beyond 120° by the final assessment. Complications were observed in 8 patients (7.6%): superficial infection (n=3), symptomatic hardware irritation (n=2), reoperation due to suture failure (n=2), and one case of hypertrophic scar formation.

Table 1

Demographic and Clinical Characteristics of Patients (n=105)

Variable		Value
Mean Age (years)		39.4 ± 12.6
Gender	Male	72 (68.6%)
	Female	33 (31.4%)
Side of Injury	Right	59 (56.2%)
	Left	46 (43.8%)
Mechanism of Injury	Fall on flexed knee	61 (58.1%)
	RTA	32 (30.5%)
	Direct trauma	12 (11.4%)
Mean Surgical Time (min)		62.5 ± 9.4
Mean Hospital Stay (days)		2.8 ± 0.9

Table 2

Radiological and Functional Outcomes

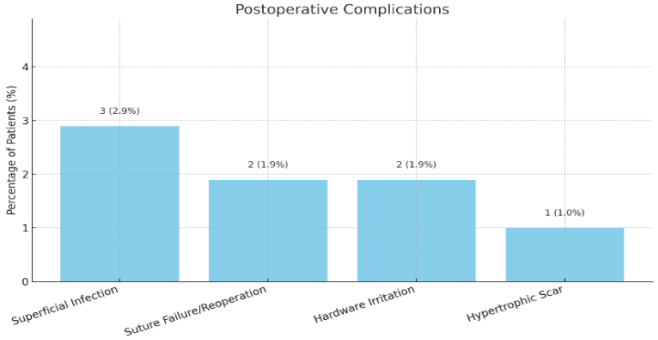
Outcome Parameter	Mean ± SD / Frequency (%)
Radiological Union Achieved	101 (96.2%)
Time to Union (weeks)	10.3 ± 2.1
Lysholm Score at 6 Months	88.6 ± 7.9
ROM > 120° at 6 Months	97 (92.3%)
Full Extension Achieved	100 (95.2%)

Table 3

Postoperative Complications

Complication Type	Number of Patients (%)
Superficial Infection	3 (2.9%)
Suture Failure/Reoperation	2 (1.9%)
Hardware Irritation	2 (1.9%)
Hypertrophic Scar	1 (1.0%)
Total	8 (7.6%)

Figure 1



The findings indicate that transosseous Krackow suture repair in lower pole patella fractures is a promising surgical procedure in terms of promising union and excellent functional outcomes with an otherwise favorable complication rate.

DISCUSSION

The current study shows that transosseous Krackow suture repair is an effective and safe method of surgically managing lower pole patellar fractures, especially with regard to the restoration of functional results and obtaining high rates of union. Our results, where 96.2% of patients demonstrated radiological union and found a mean Lysholm score of 88.6 at six months, align with the available literature that points out the benefits of choosing suture-based fixation instead of tension band wiring or even partial patellectomy (Chouhan et al., 2021; Anract et al., 2020). Though these traditional methods are popular they have been linked with complications like irritation of hardware, weakness of the quadriceps and the extensor lag, which are apparently overcome by the Krackow method.

The preservation of the patellar anatomy as well as the absence of metallic implants that characterize this technique represent an important strength of this technique which lowers the cumulative risks of glass prosthesis associated with either irritation related to a metal synthetic or secondary reposition due to a malposition of the glass prosthesis. Hardware symptoms were unusual (1.9%) in our cohort but probably secondary to suture knots or local reaction in preference to the more traditional metallic devices and demonstrates the advantages of non-metallic and high strength suture. In addition, a lower complication rate of 7.6%, which includes superficial infection and reoperation in only 2 cases due to suture failure, justifies the safety and reproducibility of this technique in as far as it is performed in a standardized model.

Functionally, the majority of patients in this study regained full extension and near-complete flexion (>120°), suggesting excellent restoration of the extensor mechanism. Early mobilization protocols and stable fixation likely contributed to these favorable outcomes. The average time to union of approximately 10.3 weeks is also in line with previous studies that advocate for early rehabilitation as a key factor in functional recovery (Chang et al., 2021).

The demographic profile—predominantly male patients in their late 30s to early 40s—reflects the typical high-energy trauma patterns seen in this population, including falls and road traffic accidents. While this may limit generalizability to elderly or osteoporotic patients, it also underscores the need for fixation methods capable of withstanding early mobilization in active individuals.

The short follow-up makes our study as well just one of the limitations of our study since the long term outcomes of the study include residual quadriceps weakness or development of patellofemoral arthritis which might not be captured by the short-term period of the study. Also, the study was prospective but there was no control group, no comparison can be possible with other methods of fixation. Additional future randomized control trials must compare Krackow suture repair to other modalities to support clinical-decision making structures.

Finally, our results indicate that transosseous Krackow suture repair is a biomechanically solid, secure procedure that can be safe and functionally successful treatment of lower pole patella in terms of minimal complications and encouraging results in the short-term follow-ups. The method is especially useful in resource-limited environments where cost-effective and implant-sparing alternatives would be preferable.

CONCLUSION

Findings of this study confirm that transosseous Krackow repairs of lower pole patella fractures are methodologically sound and superior in terms of function in the repair of lower pole patella fractures. This method adequately recovers the extensor mechanism with low rates of complications (7.6%) and with a high radiological union rate (96.2) and high Lysholm scores. The lack of metallic parts is a potential boon since it could prevent any implant-related irritation, and remove the necessity of a hardware-removal surgery, which is particularly well suited in younger, physically active patients, as well as resource-limited settings. The method can also save original native patellar anatomy, and this improves the long-term functioning of the joints. Although the short-term outcomes are encouraging, it still needs to be proved by a larger randomized study with longer follow up duration that it is indeed effective in the long run and to compare its results with other established fixation systems. Nevertheless, the transosseous Krackow procedure has high clinical perspective in modern orthopedic practice.

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