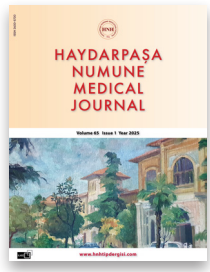
HAYDARPAŞA NUMUNE MEDICAL JOURNAL

DOI: 10.14744/hnhj.2025.47640
Haydarpasa Numune Med J 2026;66(1):52–57



hnhtipdergisi.com

ORIGINAL ARTICLE

Comparison of Functional Results After Surgical Treatment of Acute Patella Fractures Using a Tension Band With and Without Plaster Cast Application

Oktay Polat[1], Mert Kahraman Maraşlı[2], Mehmet Kuyumcu[1], Çagdaş Deniz Gündüz[3], Birkan Kibar[4]

[1]Department of Orthopaedics and Traumatology, İstanbul Sultanbeyli State Hospital, İstanbul, Türkiye
[2]Department of Orthopaedics and Traumatology, Kocaeli Gebze State Hospital, Kocaeli, Türkiye
[3]Department of Orthopaedics and Traumatology, Konya City Hospital, Konya, Türkiye
[4]Department of Hand and Upper Extremity Surgery, İstanbul Haydarpaşa Numune Training and Research Hospital, İstanbul, Türkiye

Abstract

Introduction: To compare the functional results obtained after treating the study groups comprising patients with patellar fractures who underwent modified anterior tension band (MATB) surgery with or without plaster cast application.

Methods: Fractures with >3-mm displacement between the fracture fragments and a step-off of >2 mm on the joint surface were surgically treated. Patients with patellar fractures who underwent MATB and were followed for at least 1 year were included in the study. The need for plaster cast application after surgery was decided based on the surgeon's preference. Of the 42 patients who did not receive plaster cast treatment (group 1), 28 were male and 14 were female, whereas of the 48 patients who received plaster cast treatment (group 2), 31 were male and 17 were female. Functional results were evaluated according to the Lysholm and Bostman scores.

Results: In group 1, the mean Lysholm score was 89.31±9.44, and the mean Bostman score was 25.83±3.81; in group 2, the mean Lysholm score was 90.67±9.2, and the mean Bostman score was 26.9±4.17. When Lysholm and Bostman scores were compared, the difference was not statistically significant (p>0.05). Bone union was achieved in all patients, and no statistically significant differences were found between the groups in terms of the incidence of complications (p>0.05).

Discussion and Conclusion: We found that plaster cast application after MATB had no effect on functional results.

Keywords: Fractue; patella; plaster cast; treatmant.

The patella represents the largest sesamoid bone in the human body. It has been estimated that patellar fractures account for approximately 1% of all fracture types that occur in the body.[1] Patellar fractures may occur as a result of direct, indirect, or combined forces. The subcutaneous and anterior position of the patella, coupled with the thin soft tissue cover around it, increases its exposure to direct impacts. The indirect mechanism typically occurs when the force exerted by the fully contracted quadriceps muscle exceeds the resistance of the knee joint during a sudden flexion of the knee.[2] The objective of the treatment is to reinstate the extensor mechanism and provide optimal joint alignment. In cases where there is >2mm stepping on the joint surface, >3mm separation between the fragments, or an inadequate exten-

Correspondence: Oktay Polat, M.D. Department of Orthopaedics and Traumatology, İstanbul Sultanbeyli State Hospital, İstanbul, Türkiye
Phone: +90 539 963 09 81 **E-mail:** dr.opolat89@gmail.com
Submitted Date: 09.02.2025 **Revised Date:** 25.09.2025 **Accepted Date:** 24.10.2025
Haydarpaşa Numune Medical Journal

sor mechanism, surgical treatment is considered an appropriate course of action.[3] The most frequently employed surgical technique for the treatment of patellar fractures is the tension band technique. In this technique, the stress force exerted by the extensor mechanism on the anterior region is converted into a compression force on the joint surface.[4] The standard tension band wire was constructed with looped stainless steel wires in the quadriceps and patellar tendons without K-wires.[5] Modified anterior tension band (MATB) technique is a combination of two parallel longitudinal Kirschner (K)-wires and a figure-of-eight formed by a knotted cerclage wire on the anterior side of the patella.[6,7] It is known that the use of a cast in the early postoperative period following some surgeries reduces pain, improves patient comfort, and reduces reduction loss. One might wonder whether the use of a postoperative cast, even if not necessary, would significantly affect patient comfort in the early postoperative period. The objective of this study was to evaluate the functional outcomes of patients with patellar fractures who underwent MATB surgery with or without the additional application of a plaster cast.

Materials and Methods

A total of 90 patients who had undergone MATB surgery due to a diagnosis of patellar fracture were included in the study and examined retrospectively. Prior to their participation in the study, all patients were required to provide written and oral informed consent. The study was approved by the institutional ethics committee. Fractures exhibiting a displacement of >3mm between the fracture fragments and a step-off of >2mm on the joint surface were treated surgically. The study included patients with patellar fractures who underwent follow-up after MATB for a minimum of 1 year. Patients with concomitant trauma to the lower extremity, pathological fractures, or inadequate follow-up were excluded from the study. The decision regarding the necessity of a plaster cast following surgery was made at the discretion of the surgeon. In our clinic, some surgeons prefer to use a plaster cast, whereas others commence early motion.

Group 1 comprised 42 patients who did not receive plaster cast treatment; of these, 28 were male and 14 were female. Group 2 consisted of 48 patients who did receive plaster cast treatment; of these, 31 were male and 17 were female. The mean age of the patients was 45 years (range, 18–84). The injury was caused by a simple fall in 58 patients (64.4%), falling from a height in 15 patients (16.7%), sports in 5 patients (5.6%), and traffic accidents in 12 patients (13.3%). The mean follow-up period was 36.5 months (range, 18–52). In 44 patients (49%), the injury affected the right side, while in 46 patients (51%), it affected the left side. The classification of the fractures was made in accordance with the AO/OTA classification system. The mean time between injury and surgical intervention was 2.78 days (range, 1–5). According to the Gustilo–Anderson classification system, four patients had type 1 open fractures and six patients had type 2 open fractures. Patients with open fractures underwent surgical intervention on the same day. This involved irrigation, debridement, and fixation, and the wound was primarily closed. A comprehensive analysis of the patients is presented in Table 1.

Table 1. Evaluation of parameters between groups

	Group 1	Group 2	p
	Mean±SD	Mean±SD	
Age	45.05±17.27	45.19±17.01	[1]**0.969**
Follow-up time (month)	35.81±18.12	37.15±13.82	[1]**0.693**
Operation waiting time (days)	2.83±1.82	2.73±1.94	[2]**0.657**
Lysholm score	89.31±9.44	90.67±9.2	[1]**0.492**
Bostman score	25.83±3.81	26.9±4.17	[1]**0.213**
Knee extension lag	1.4±0.7	1.7±0.8	0.354
Knee flexion	137.2±14	135.4±17	0.458
Gender n (%)			
Male	28 (66.7)	31 (64.6)	[3]**1.000**
Female	14 (33.3)	17 (35.4)	
Side n (%)			
Right	15 (35.7)	29 (60.4)	[3]**0.033***
Left	27 (64.3)	19 (39.6)	
AO/OTA classification n (%)			
B1.1	6 (14.3)	5 (10.4)	
B1.2	0 (0)	2 (4.2)	
B2.1	6 (14.3)	9 (18.8)	[4]**0.496**
C1.1	16 (38.1)	15 (31.3)	
C1.2	12 (28.6)	17 (35.4)	
C1.3	2 (4.8)	0 (0)	
Trauma mechanism n (%)			
Simple fall	27 (64.3)	31 (64.6)	
Sport injury	2 (4.8)	3 (6.3)	[4]**0.949**
Traffic accident	5 (11.9)	7 (14.6)	
Fall from height	8 (19)	7 (14.6)	
Type of anesthesia n (%)			
General	16 (38.1)	19 (39.6)	[3]**1.000**
Spinal block	26 (61.9)	29 (60.4)	

[1]Student-t test, [2]Mann Whitney U test, [3]Continuity (Yates) correction, [4]Fisher Freeman Halton test, *p<0.05 SS: Standart deviation, AO: Arbeitsgemeinschaft für osteosynthesefragen, OTA: Orthopaedic trauma association

Surgical Technique

A dose of 1g intravenous cefazolin was administered to all patients 1 hour prior to the surgical procedure. A total of 35 patients underwent surgery under general anesthesia, while 55 patients were operated on under spinal anesthesia. The patients were placed in the supine position. All patients underwent surgery with the use of a pneumatic tourniquet. A longitudinal incision was made on the patella (Fig. 1a). The dissection was continued proximally from the quadriceps tendon to the patellar tendon distally. The fracture ends were cleaned and the joint was irrigated. Any clots and small bone fragments that could not be repaired were debrided, and reduction was achieved with the assistance of reduction forceps and confirmed using fluoroscopy (Fig. 1b). Two K-wires were placed in parallel alignment and advanced proximally or distally along the longitudinal axis of the patella, in close proximity to the joint surface (Fig. 1c). A cerclage wire was then passed and formed into a figure-of-eight shape around the K-wires on the anterior surface of the patella (Fig. 1d). Fluoroscopic control was then performed, reduction was checked, and the damaged retinaculum was repaired.

Patients in Group 1 were started on active and passive knee exercises and isometric quadriceps exercises to achieve knee flexion up to 30–40° after wound healing. Group 1 patients did not use any support products after surgery. Weight-bearing was allowed according to the patient's pain tolerance, and flexion was gradually increased after the first month. In Group 2, the affected extremity was immobilized, and the plaster cast (Fig. 2) was removed 6–8 weeks after surgery. The same exercise regimen as Group 1 was then initiated. A goniometer was used to assess knee movements. Functional results were evaluated using the Lysholm and Bostman scores, and pain was assessed using VAS scores. During follow-up, anteroposterior (AP) and lateral radiographs of the knee were obtained to evaluate union and implant placement (Fig. 3).

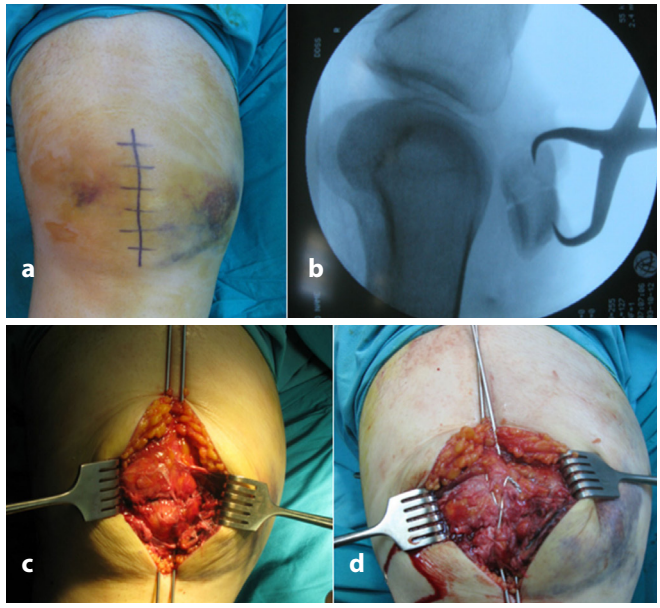


Figure 1. (a) A longitudinal incision was made on the patella. **(b)** Reduction was achieved with reduction forceps and confirmed fluoroscopically. **(c)** Two K-wires were placed in parallel and advanced along the longitudinal axis of the patella near the joint surface. **(d)** A cerclage wire was passed and formed into a figure-of-eight around the K-wires on the anterior surface of the patella.

Statistical Analysis

The Student's t-test was used to compare descriptive statistical values (mean, standard deviation, median, frequency, ratio) and normally distributed quantitative data. Pearson's chi-square test was used to compare

Figure 2. Postoperative affected extremity with the plaster cast.

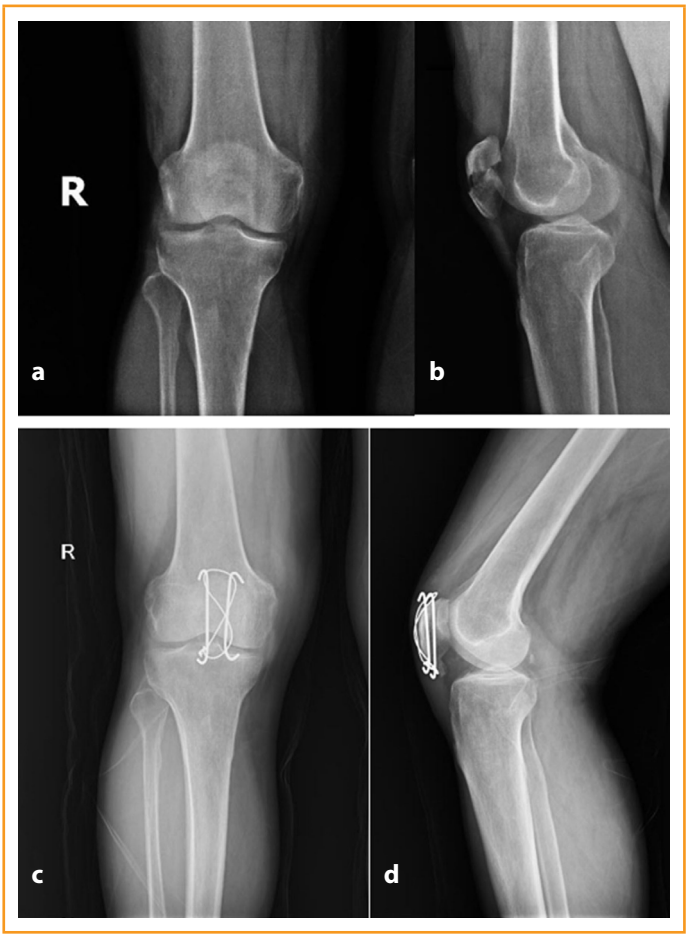


Figure 3. (a) AP radiographs of the knee with patella fracture. **(b)** Lateral radiographs of the knee with patella fracture. **(c)** Postoperative AP radiographs of the knee after surgery. **(d)** Lateral radiographs of the knee after surgery.

qualitative data. Statistical significance was accepted as $p<0.05$.

Ethics Approval and Consent to Participate

All procedures performed in the study were carried out in accordance with the ethical standards determined by the Clinical Research Ethics Committee of Ümraniye Training and Research Hospital. The study number is B.10.1.TKH.4.34.H.GP.0.01/104 and was approved by the committee on 15/08/2018, and is in compliance with the ethical principles of the 1964 Helsinki Declaration. Written informed consent was obtained from all patients participating in the study.

Results

Comparison of the groups in terms of mean age, trauma mechanism, sex, follow-up period, and duration of injury revealed no statistically significant differences ($p>0.05$). A significantly higher number of patients in Group 2 had right-sided involvement compared with Group 1 ($p=0.033$; $p<0.05$). According to the AO/OTA classification system, no statistically significant differences were observed between the two groups ($p>0.05$).

In Group 1, 16 patients underwent surgery under general anesthesia and 26 under spinal anesthesia. In Group 2, 19 patients underwent surgery under general anesthesia and 29 under spinal anesthesia. The difference in anesthetic approach between the groups was not statistically significant ($p>0.05$).

The mean Lysholm score for Group 1 was 89.3 (range, 75–100), and the mean Bostman score was 25.8 (range, 17–30). For Group 2, the mean Lysholm score was 90.6 (range, 80–100) and the mean Bostman score was 26.9 (range, 19–30). The mean extension lag in Group 1 was 1.4 (range, 0–5), while in Group 2 it was 1.7 (range, 0–5). The mean flexion in Group 1 was 137.2 (range, 115–150), and in Group 2 it was 135.4 (range, 120–150). When Lysholm and Bostman scores and knee motion were compared, no statistically significant differences were observed ($p>0.05$).

Group 1 included two patients with distal radius fractures and one patient with a radial head fracture. Group 2 included one patient with a distal radius fracture, one with a metacarpal fracture, one with an ulna shaft fracture, and one with a radial head fracture. Bone union was achieved in all patients. In Group 1, two superficial infections were treated with oral antibiotics and wound care, while two deep infections were treated with irrigation, debridement, and intravenous antibiotics. Implants were removed at a mean of 12.6 months due to K-wire migration in one patient and implant irritation in nine patients. In Group 2, three superficial infections were treated with wound care and oral antibiotics, and two deep infections were treated with irrigation, debridement, and intravenous antibiotics. Implants were removed at a mean of 14.9 months due to implant failure in one patient, implant fracture in one patient, and implant irritation in 10 patients. No statistically significant differences were found between the groups in terms of complication rates ($p>0.05$).

Discussion

The main emphasis of this study was whether a cast is necessary after MATB surgery. The primary objectives in the management of patellar fractures are restoration of the extensor mechanism, anatomic reduction of the articular surface, and early joint mobilization to prevent knee stiffness and quadriceps atrophy. In this study, we compared patients treated with MATB fixation followed by either cast immobilization or early mobilization with-

out a cast. Both groups achieved satisfactory functional outcomes, with no statistically significant differences in Lysholm and Bostman scores, range of motion, or complication rates.

Most surgeons use different postoperative immobilization periods, and there is no consensus regarding the necessity and duration of immobilization.[8] The concern is joint stiffness on one side and nonunion or loss of reduction on the other. Most studies on patella fracture surgery focus on surgical techniques and materials.[8] However, research on the optimal immobilization period after MATB is limited. Although MATB allows early movement due to its biomechanical mechanism, postoperative immobilization is still commonly practiced.[8] According to our findings, plaster cast immobilization after MATB surgery does not improve union rates or clinical scores.

MATB converts tensile forces on the anterior patella into compressive forces across the articular surface and remains the gold standard for displaced transverse fractures. Reported union rates range from 90% to 100%.[1,9–11] Consistent with these data, union rates were similar in our two groups, indicating that cast immobilization provides no additional benefit for fracture healing.

Traditionally, cast immobilization was considered necessary to protect fixation and promote fracture healing.[12] Weber et al.[6] suggested that cerclage wiring alone may not allow early mobilization and recommended prolonged postoperative immobilization. However, prolonged immobilization is associated with joint stiffness, cartilage degeneration, and muscle atrophy.[13–15] The similar ranges of motion in our groups support that routine cast immobilization is unnecessary when stable fixation is achieved.

Mean Lysholm and Bostman scores were high in both groups, indicating satisfactory functional recovery. Similar results were reported by Yang et al.[16] and Huang et al.[17], who noted that functional outcomes after tension-band fixation are largely independent of postoperative immobilization protocols when stable fixation is obtained.

After patellar surgery, complications such as infection and venous thromboembolism may occur, as well as treatment failure requiring secondary surgery.[8] Although immobilization after MATB is often preferred due to concern about nonunion or reduction loss, knee stiffness is a major functional complication of prolonged immobilization. Early physiotherapy reduces this risk and avoids additional procedures such as manipulation under anesthesia.[18] The most common complications in our study were symptomatic implant irritation and infection. Implant-related soft tissue irritation is a known disadvantage of MATB, reported in 30%–60% of cases.[19–21] Several patients required implant removal, mostly due to soft tissue irritation, and the incidence was similar between the groups. Early mobilization did not increase complication rates, indicating that postoperative casting offers no protective benefit.

This study has limitations. First, the retrospective design introduces selection bias because cast use depended on surgeon preference. Second, the sample size may be insufficient to detect small functional differences. Third, long-term outcomes such as patellofemoral osteoarthritis were not evaluated due to limited follow-up. Prospective randomized controlled studies with longer follow-up are needed.

Conclusion

Immobilization after MATB surgery does not improve early patient comfort or functional outcomes. No significant differences were found in range of motion, extension lag, or union. Therefore, routine cast application after MATB surgery is unnecessary.

Ethics Committee Approval: This study was approved by the Umraniye Training and Research Hospital (Date: 15.08.2018, Decision no: 2018/KK/104).

Informed Consent: Written informed consent was obtained.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

Use of AI for Writing Assistance: None declared.

Authorship Contributions:

Concept: O.P., M.K.M., M.K., Ç.D.G., B.K.; Design: O.P., M.K.M., M.K., Ç.D.G., B.K.; Supervision: O.P., M.K.M., M.K., Ç.D.G., B.K.; Resource: O.P., M.K.M., M.K., Ç.D.G., B.K.; Materials: O.P., M.K.M., M.K., Ç.D.G., B.K.; Data collection and/or processing: O.P., M.K.M., M.K., Ç.D.G., B.K.; Analysis and/or interpretation: O.P., M.K.M., M.K., Ç.D.G., B.K.; Literature review: O.P., M.K.M., M.K., Ç.D.G., B.K.; Writing: O.P., M.K.M., M.K., Ç.D.G., B.K.; Critical review: O.P., M.K.M., M.K., Ç.D.G., B.K.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Melvin JS, Mehta S. Patellar fractures in adults. J Am Acad Orthop Surg 2011;19:198–207. [CrossRef]
2. Carpenter JE, Kasman R, Matthews LS. Fractures of the patella. Instr Course Lect 1994;43:97–108.
3. Yang KH, Byun YS. Separate vertical wiring for the fixation of comminuted fractures of the inferior pole of the patella. J Bone Joint Surg Br 2003;85:1155–60. [CrossRef]
4. Egol K, Howard D, Monroy A, Crespo A, Tejwani N, Davidovitch R. Patella fracture fixation with suture and wire: you reap what you sew. Iowa Orthop J 2014;34:63–7.

5. Hsu KL, Chang WL, Yang CY, Yeh ML, Chang CW. Factors affecting the outcomes of modified tension band wiring techniques in transverse patellar fractures. Injury 2017;48:2800–6. [CrossRef]
6. Weber MJ, Janecki CJ, McLeod P, Nelson CL, Thompson JA. Efficacy of various forms of fixation of transverse fractures of the patella. J Bone Joint Surg Am 1980;62:215–20. [CrossRef]
7. John J, Wagner WW, Kuiper JH. Tension-band wiring of transverse fractures of patella. The effect of site of wire twists and orientation of stainless steel wire loop: a biomechanical investigation. Int Orthop 2007;31:703–7. [CrossRef]
8. Sayum Filho J, Lenza M, Tamaoki MJ, Matsunaga FT, Belloti JC. Interventions for treating fractures of the patella in adults. Cochrane Database Syst Rev 2021;2:Cd009651. [CrossRef]
9. Carpenter JE, Kasman R, Matthews LS. Fractures of the patella. JBJS 1993;75A:1550–61. [CrossRef]
10. Levack B, Flannagan JP, Hobbs S. Results of surgical treatment of patellar fractures. J Bone Joint Surg Br 1985;67:416–9. [CrossRef]
11. Lazaro LE, Wellman DS, Sauro G, Pardee NC, Berkes MB, Little MT, et al. Outcomes after operative fixation of complete articular patellar fractures: assessment of functional impairment. J Bone Joint Surg Am 2013;95:e96:1–8. [CrossRef]
12. Boström A. Fracture of the patella. A study of 422 patellar fractures. Acta Orthop Scand Suppl 1972;143:1–80. [CrossRef]
13. Baid M, Narula S, Manara JR, Blakeney W. Evolution in the management of patella fractures. J Clin Med 2024;13:1426. [CrossRef]
14. Agarwala S, Agrawal P, Sobti A. A novel technique of patella fracture fixation facilitating early mobilization and reducing re-operation rates. J Clin Orthop Trauma 2015;6:207–11. [CrossRef]
15. Preobrazenski N, Seigel J, Halliday S, Janssen I, McGlory C. Single-leg disuse decreases skeletal muscle strength, size, and power in uninjured adults: A systematic review and meta-analysis. J Cachexia Sarcopenia Muscle 2023;14:684–96. [CrossRef]
16. Yang TY, Huang TW, Chuang PY, Huang KC. Treatment of displaced transverse fractures of the patella: modified tension band wiring technique with or without augmented circumferential cerclage wire fixation. BMC Musculoskelet Disord 2018;19:167. [CrossRef]
17. Huang S, Zou C, Kenmegne GR, Yin Y, Lin Y, Fang Y. Management of comminuted patellar fractures using suture reduction technique combined with the modified Kirschner-wire tension band. BMC Surg 2023;23:251. [CrossRef]
18. Steinmetz S, Brügger A, Chauveau J, Chevalley F, Borens O, Thein E. Practical guidelines for the treatment of patellar fractures in adults. Swiss Med Wkly 2020;150:w20165. [CrossRef]
19. Hoshino CM, Tran W, Tiberi JV, Black MH, Li BH, Gold SM, et al. Complications following tension-band fixation of patellar fractures with cannulated screws compared with Kirschner wires. J Bone Joint Surg Am 2013;95:653–9. [CrossRef]
20. Bickel S, Jensen KO, Klingebiel FK, Teuben MPJ, Pfeifer R, Pape HC, et al. Clinical and functional outcomes of locked plating vs. cerclage compression wiring for AO type C patellar fractures- a retrospective single-center cohort study. Eur J Trauma Emerg Surg 2024;50:2975–85. [CrossRef]
21. Peng J, Zou M, Qiu Z, Li C, Hao L. Managing complications in patellar fracture surgery: tension band wiring challenges and innovations. Int J Surg 2024;110:5997–9. [CrossRef]