



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Case Report

Modified cerclage and suture mesh fixation for comminuted patellar fracture – “Cobweb Technique”: A case report[☆]Sybill Sue Moser-De Mesa, Kristine Italia^{*}, Antonio Tanchuling Jr

Institute of Orthopedics and Sports Medicine, St. Luke's Medical Center, Quezon City, Philippines

ARTICLE INFO

Keywords:

Comminuted patellar fracture
 Cerclage fixation
 Suture fixation
 Suture mesh

ABSTRACT

Displaced comminuted patellar fractures necessitate surgical treatment to restore the function of the extensor mechanism of the knee. One of the main challenges in the fixation of comminuted fracture of the patella is achieving an anatomic articular reduction with a stable fixation to allow early mobilization and prevent knee stiffness. Various common surgical fixation methods necessitate the use of metallic implants. Due to its superficial location, hardware-related complications and re-operations are common after patellar fixation.

We present a case of a comminuted patellar fracture fixed using a modified cerclage and suture mesh fixation technique using high-strength braided nonabsorbable sutures. This provided a rigid fixation that allowed early range of motion while avoiding the risk of having symptomatic hardware.

Introduction

Fixation of comminuted patellar fractures poses a challenge in terms of achieving a rigid fixation and articular congruity. The most common technique for comminuted fractures is the use of cerclage wire circumferentially around the patella. This often requires prolonged immobilization, as the stability it provides cannot withstand the tension force of the quadriceps femoris applied on the patella during knee flexion [1]. Other options include modified cerclage wiring, plate fixation, headless compression screws with vertical wiring, miniplate augmented tension band wiring, suture reduction with Kirschner wire tension band, and patellectomy [2]. Due to the superficial location of the patella, implant irritation is a prevalent complication related to most of these techniques, with rates as high as 70 % [3]. Moreover, soft tissue irritation resulting from symptomatic hardware can also lead to infection [4].

We report a case of a comminuted patellar fracture fixed using the “Cobweb Technique” - a novel method of modified cerclage and suture mesh fixation utilizing high-strength braided nonabsorbable sutures.

[☆] Presented in:

- Annual Case Report Contest, Institute of Orthopedics and Sports Medicine, St. Luke's Medical Center, Quezon City, Philippines, 2021.
- Orthopaedic Innovations Contest, Philippine Orthopaedic Association Midyear Convention, Bacolod, Philippines, April 2023.

^{*} Corresponding author at: Institute of Orthopaedics and Sports Medicine, St. Luke's Medical Center, 279 E. Rodriguez Sr. Blvd., Quezon City, Philippines.

E-mail address: kritalia@stlukes.com.ph (K. Italia).

<https://doi.org/10.1016/j.tcr.2023.100963>

Accepted 18 October 2023

Available online 19 October 2023

2352-6440/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Case presentation

A 34-year-old male sought consult after a fall directly on his flexed left knee. He reported sudden severe pain and gross deformity of the left knee. He was unable to ambulate thereafter. On physical examination, the left knee had no open wounds but was noted to be swollen. The knee was ballotable, and crepitus was felt over the anterior aspect. He was unable to do active knee extension or straight leg raising.

Plain radiographs of the left knee revealed a comminuted fracture of the patella, with the superior pole displaced proximally (AO 34-C3) (Fig. 1).

Under spinal anesthesia, the patient was positioned supine with tourniquet applied on the most proximal aspect of the left thigh. Anterior midline incision over the left knee was made and carried through the subcutaneous tissue and fascia, exposing the fracture fragments. After evacuation of the hematoma, the fragments were gently reduced using tenaculum forceps. Articular reduction was checked by palpating the articular surface and confirmed via image intensifier.

A high-strength braided polyblend suture (FiberWire® No. 2, Arthrex Inc., Florida, USA) was sutured loosely and intermittently around the superior half of the patella passing through the patella-quadiceps tendon junction, forming three loops along the anterosuperior surface of the patella, leaving free suture limbs on the medial and lateral aspect (Fig. 2A). The same was done for the inferior patella, passing through the patella-patellar tendon junction (Fig. 2B). Another FiberWire® No. 2 suture was passed through the circumferential looped sutures, along the anterior surface of the patella and knotted (Fig. 2C). The medial and lateral suture ends were then tightened and locked after confirming articular congruity (Fig. 2D). Two figure-of-eight sutures through the quadriceps and



Fig. 1. Pre-operative plain radiographs of the left knee on A) anteroposterior and B) lateral views showing comminuted patellar fracture with significant displacement of the superior fragment and articular step-off.

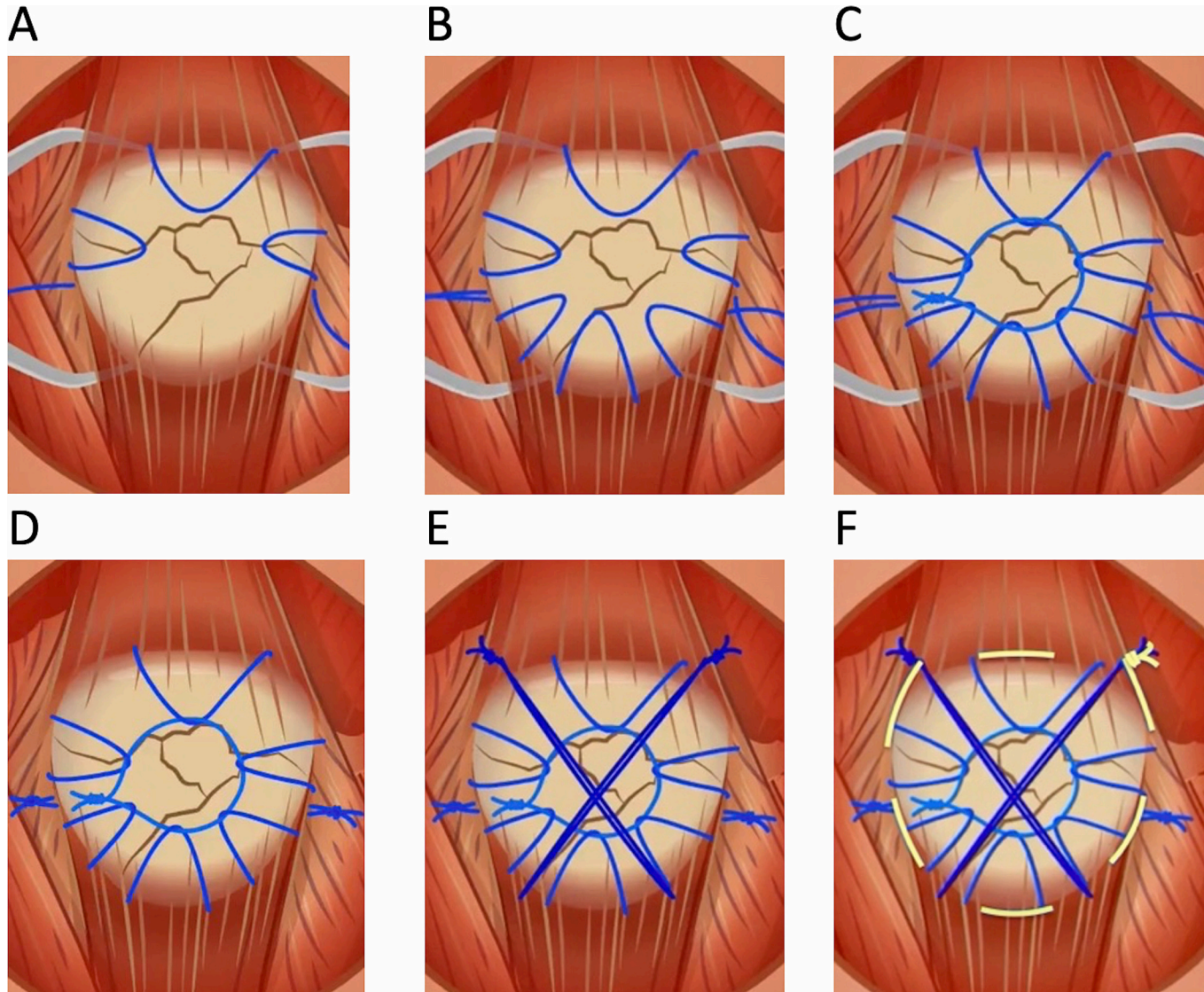


Fig. 2. Surgical technique. A) A FiberWire® No. 2 was sutured loosely and intermittently around the superior half of the patella passing through the patella-quadriceps tendon junction, forming three loops along the anterosuperior surface of the patella, leaving free suture limbs on the medial and lateral aspect. B) The same was done for the inferior patella, passing through the patella-patellar tendon junction. C) While maintaining the reduction, another FiberWire® No. 2 suture was passed through the circumferential looped sutures, along the anterior surface of the patella and knotted. D) The medial and lateral FiberWire® No. 2 suture ends were then tightened and locked. E) Two figure-of-eight sutures through the quadriceps and patellar tendon using Ethibond Excel® No. 2 sutures were added to augment the fixation. F) An additional FiberWire® No. 5 was placed circumferentially around the patella, serving as a cerclage.

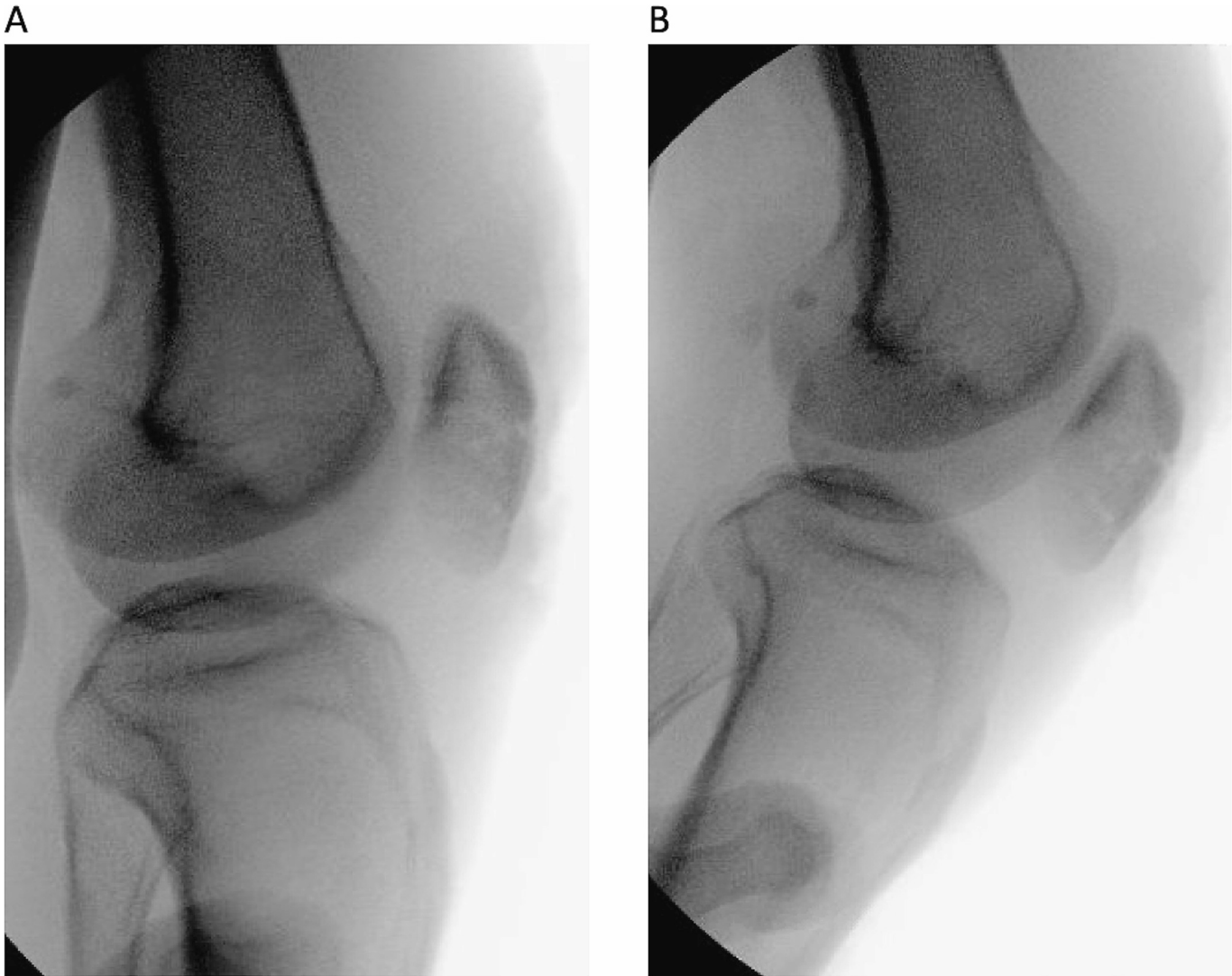


Fig. 3. Fluoroscopic image showing the maintenance of reduction on A) full extension and B) flexion.

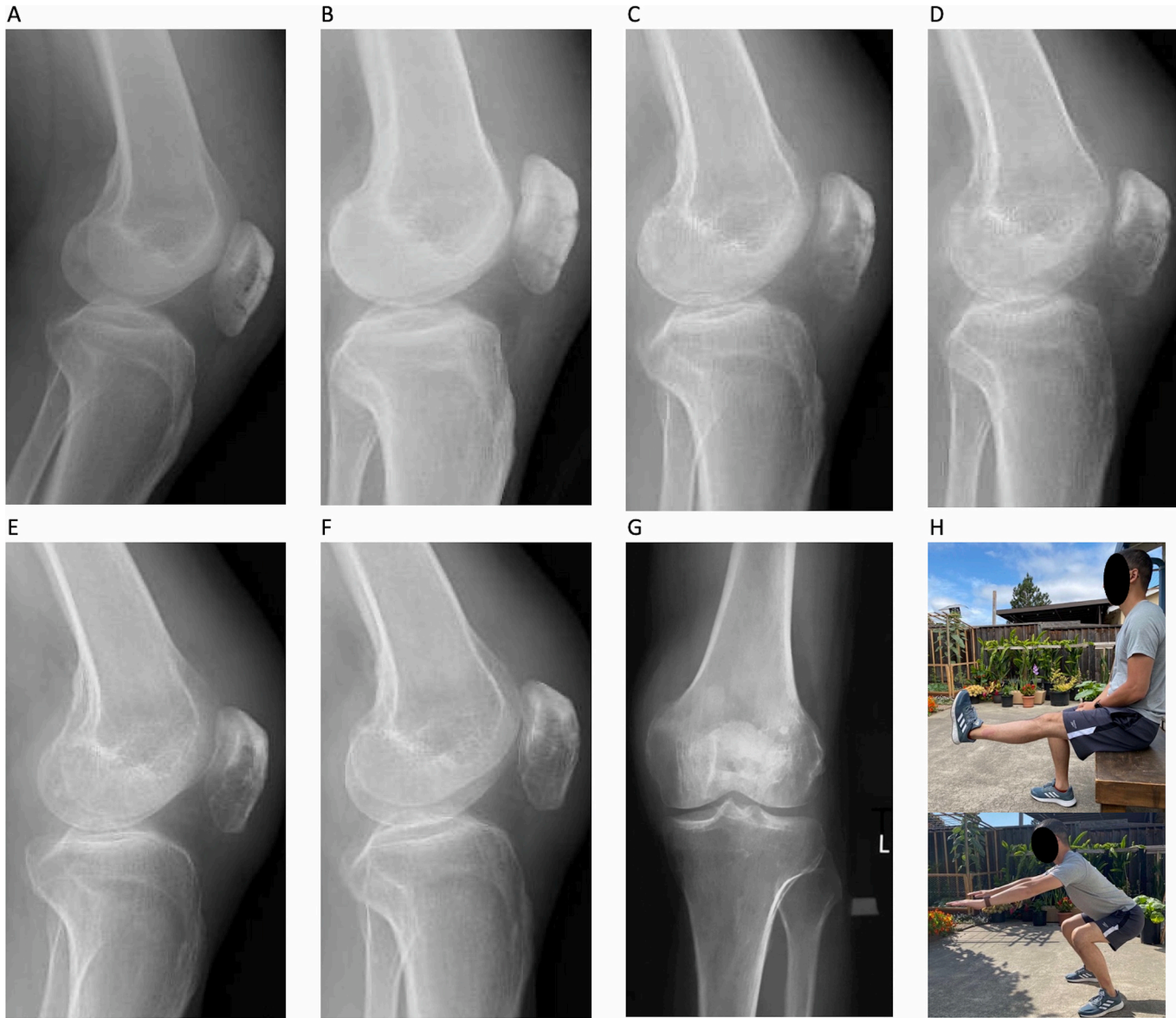


Fig. 4. Postoperative radiographs of the knee showing no loss of reduction and fracture healing: A) immediately after fixation, B) 2 weeks, C) 6 weeks, D) 3 months, E) 6 months, F–G) 9 months after surgery. H) Patient at 2-year follow-up showing full extension and can perform exercises like squats.

patellar tendon using braided polyester sutures (Ethibond Excel® No. 2, Ethicon Inc., New Jersey, USA) were added to augment the fixation (Fig. 2E). This combination of suture fixation created a suture mesh construct. An additional FiberWire® No. 5 was placed circumferentially around the patella, serving as a cerclage (Fig. 2F). The stability of the fixation was checked by performing range of motion under fluoroscopy (Fig. 3). There were no noted fragment displacement or gaps on final post-operative radiographs (Fig. 4A).

The patient was placed on knee immobilizer, which was maintained for one week. He was allowed to ambulate with full weight bearing while wearing the immobilizer as soon as tolerated. On postoperative day one, passive knee motion was allowed while active knee extension was restricted. At two weeks post-operatively, he was able to tolerate 80 degrees of flexion. Active-assisted full knee extension was also initiated. At one month postoperatively, he was able to fully extend the knee, flex up to 100 degrees, and ambulate independently without a knee immobilizer. Full knee flexion was achieved at three months postoperatively.

Repeat radiographs were obtained at two weeks, six weeks, three months, six months, and nine months after the surgery (Fig. 4B–G). Articular congruity was maintained throughout the follow-up period, with radiographic healing noted at three months. At final follow-up of two years postoperatively, the patient has a full range of motion and can do activities similar to his pre-injury level (Fig. 4H).

Discussion

Fixation of comminuted patellar fractures continues to pose a great challenge. Due to the relatively weaker trabecular bone of the patella and the presence of small fragments, obtaining a rigid fixation while achieving articular congruity is usually demanding [1]. For comminuted patellar fractures, cerclage using a stainless-steel wire is the most popular method of fixation described in the literature. These may be used in conjunction with other methods, such as modified tension band wiring and fragment-specific screw or pin fixation [5].

Sun et al. [1] proposed a modified cerclage wiring fixation for comminuted patellar fractures using stainless steel wires, which they pertained to as “wire mesh”. They used three stainless steel wires to create two suture loops around the superior and inferior poles of the patella, then fixed by one wire to connect the reserved loops together. All 38 patients had excellent to good functional outcomes at 36 months postoperatively, with radiographic union at a mean of three months, and without any hardware complications or reoperations [1].

Traditional fixation methods for the patella utilizing metal implants can result in symptomatic hardware. This includes prominent implants, broken wires, and soft tissue irritation and/or infection arising from wire loops [1,3,4]. This increases the risk for reoperations, which may lead to patient dissatisfaction [6].

The use of non-absorbable sutures for patellar fracture fixation was developed to reduce hardware-related complications. In a study by Camarda et al. [4], FiberWire® 5 sutures were used as modified tension band wiring (a combination of figure-of-eight tension band and cerclage) for transverse and comminuted fracture patterns. No fixation failure was noted; however, two out of 17 subjects presented with loss of reduction (less than 4 mm) but all had good to excellent functional outcomes on final follow-up [4]. Another study was done comparing complication rates of metal fixation, pure suture fixation, and hybrid fixation (combined suture and metal fixation) for comminuted patellar fractures [7]. They found that re-operation rates due to soft tissue irritation were significantly higher when using metal fixation (43.9 %) compared to suture fixation (15.4 %). For the suture fixation group, re-operation was mainly due to subsequent fragment displacement [7]. Moreover, biomechanically, non-absorbable sutures such as Ethibond Excel® 5 and FiberWire® 2 have significantly greater loads to failure compared to a 1.2 mm monofilament stainless steel wire [8,9].

Our proposed “Cobweb Technique” for comminuted patellar fracture fixation aims to achieve a rigid fixation while minimizing the risk of soft tissue irritation associated with metal implants. We modified the technique described in Sun et al. [1] by using all-suture fixation with two additional loops and augmentation of the construct using two figure-of-eight sutures and cerclage suture fixation. This was rigid enough to permit early passive range of motion of the knee without displacement of the fragments. This minimizes the risk of developing knee stiffness that may translate to poor functional outcomes.

Future directions of research for this fixation technique should include studying outcomes involving a larger number of subjects with a longer follow-up and having a comparative group utilizing traditional cerclage fixation using metal implants.

Conclusion

This novel modified suture cerclage fixation may be an effective alternative for fixation of comminuted patellar fractures. Proposed advantages include providing rigid fixation that allows early mobilization of the knee, with decreased risk of symptomatic hardware.

Source of funding

None.

CRediT authorship contribution statement

Sybill Sue Moser-De Mesa: Writing – original draft, Visualization. **Kristine Italia:** Writing – review & editing, Supervision, Visualization. **Antonio Tanchuling:** Conceptualization, Methodology, Resources, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Y. Sun, K. Sheng, Q. Li, D. Wang, D. Zhou, Management of comminuted patellar fracture fixation using modified cerclage wiring, *J. Orthop. Surg. Res.* 14 (1) (2019), <https://doi.org/10.1186/s13018-019-1385-5>.
- [2] S. Huang, C. Zou, G.R. Kenmegne, Y. Yin, Y. Lin, Y. Fang, Management of comminuted patellar fractures using suture reduction technique combined with the modified Kirschner-wire tension band, *BMC Surg.* 23 (1) (2023), <https://doi.org/10.1186/s12893-023-02153-w>.
- [3] J. Gupta, E.A. Harkin, K. O'Connor, B. Enobun, N.N. O'Hara, R.V. O'Toole, Surgical factors associated with symptomatic implant removal after patella fracture, *Injury* 53 (6) (2022) 2241–2246, <https://doi.org/10.1016/j.injury.2022.03.028>.
- [4] L. Camarda, A. La Gattuta, M. Butera, F. Siragusa, M. D'Arienzo, FiberWire tension band for patellar fractures, *J. Orthop. Traumatol.* 17 (1) (2016) 75–80, <https://doi.org/10.1007/s10195-015-0359-6>.
- [5] D.S. Hambright, K.C. Walley, A. Hall, P.T. Appleton, E.K. Rodriguez, Revisiting tension band fixation for difficult patellar fractures, *J. Orthop. Trauma* 31 (2) (2017) e66–e72, <https://doi.org/10.1097/BOT.0000000000000686>.
- [6] M. Edoardo, D.D. Andrea, C. Silvia, et al., Fixation of patella fractures with metallic implants is associated with a significantly higher risk of complications and re-operations than non-metallic implants: a systematic review and meta-analysis, *Int. Orthop.* 46 (12) (2022) 2927–2937, <https://doi.org/10.1007/s00264-022-05565-0>.
- [7] G.K.H. Shea, K. Hoi-Ting So, K.W. Tam, D.K.H. Yee, C. Fang, F. Leung, Comparing 3 different techniques of patella fracture fixation and their complications, *Geriatr. Orthop. Surg. Rehabil.* 10 (2019), 2151459319827143, <https://doi.org/10.1177/2151459319827143>.
- [8] P.B. Wright, V. Kosmopoulos, R.E. Coté, T.J. Tayag, A.D. Nana, FiberWire® is superior in strength to stainless steel wire for tension band fixation of transverse patellar fractures, *Injury* 40 (11) (2009) 1200–1203, <https://doi.org/10.1016/j.injury.2009.04.011>.
- [9] S.E. Westberg, Y.P. Acklin, S. Hoxha, C. Ayranci, S. Adeeb, M. Bouliane, Is suture comparable to wire for cerclage fixation? A biomechanical analysis, *Should. Elb.* 11 (3) (2017) 225–232, <https://doi.org/10.1177/1758573217735323>.