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Case Report

A case report of patellar fracture treated by percutaneous strong suture technique

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ABSTRACT

Tension-band wiring with metal such as Kirshner wire or soft steel wire is commonly used for the treatment of patellar fractures. In recent years, metal-free surgery using a strong suture with high breaking strength has been reported to have excellent outcomes. We report a case of patellar fracture treated with a minimally invasive percutaneous strong suture. The patient is a 57-year-old salesman who fell at work, hit his knee, and came to our hospital complaining of pain. His range of motion was −15° in extension and 60° in flexion. His X-ray results showed a transverse fracture of the right patella with a 3-mm displacement, and surgery was performed 7 days post-injury. A small incision of 1 cm was made distally and proximally on the patella. Two 2.0-mm perforated K-wires were inserted from distal to proximal sides, and the wire was pulled out proximally with FiberWire® No. 2. The distal end of the FiberWire was pulled through the proximal incision via the anterior surface of the patella and finally fastened. The procedure was completed in 21 min. The patient did not use a brace since the operation day and was not restricted in terms of load or range of motion. He was able to walk without any assistance after 10 days and returned to driving and office work 14 days postoperatively. At the final follow-up, no symptoms of skin irritation were detected, and the patient did not require suture removal.

1. Introduction

Patellar fractures commonly occur and require surgery when bone fragments are separated by > 1–4 mm and displaced from the articular surface by > 2–3 mm [1]. The most common surgical treatment is tension-band wiring (TBW) using Kirschner wire (K-wire) and soft steel wire [2]. However, due to the thin subcutaneous tissue around the patella, skin irritation more frequently occurs postoperatively, and the percentage of patients who require wire removal due to pain or breakdown related to the metal used for fixation material is 32.8% [3]. In order to solve these problems, various non-metallic treatment methods have been reported as new techniques in recent years. In particular, the strong suture technique [4], using a strong suture such as Fiber Wire® (FW) with high strength and no metal as a fixation material, has been reported. This technique is superior to the conventional metal technique in terms of bone healing, but with lower complication and wire extraction rates [4,5]. We report a case of patellar fracture treated by percutaneous strong suture (PS) technique for patients who want to early reintegrate into society.

2. Presentation of case

A 57-year-old salesman who works in a company and walks around outdoors fell at work, hit his knee, and came to our hospital complaining of pain. There were no special notes on the patient's medical, family, surgical, or medication history. He had tenderness and swelling on the anterior surface of the patella and was positive for patellar luxation. The range of motion was −15° in extension and 60° in flexion, and X-rays showed a transverse fracture of the right patella with a 3-mm dislocation (Fig. 1a). In this case, the bone fragment was displaced by 3 mm, and we judged that it was suitable for surgery. In addition, the patient wanted to repair the dislocation and return to work as soon as possible, so we decided to perform the surgery with minimally invasive technique. Osteosynthesis with PS technique using FiberWire® No. 2 was performed on the 7th day post-injury. The patient was placed in supine position, without tourniquet, with the affected knee in 60° flexion (Fig. 2a). A 1-cm small incision was made distal and proximal patella, and blunt dissection was performed until superior and inferior poles of the patella were palpated (Fig. 2b). Using the image intensifier, after repositioning with bone holding forceps, two K-wires with 2.0-mm holes

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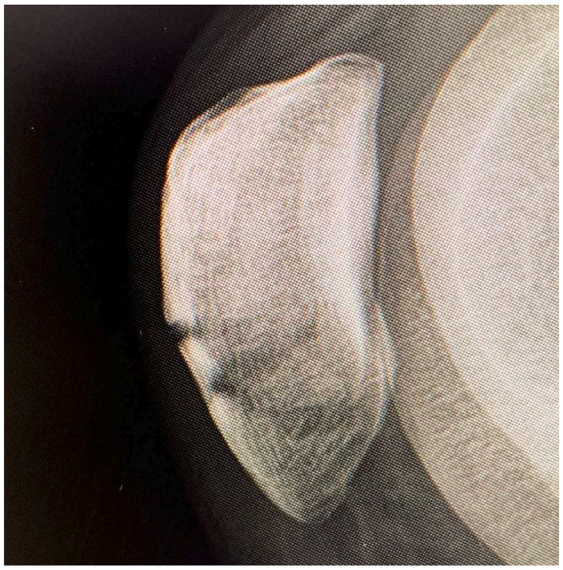
a



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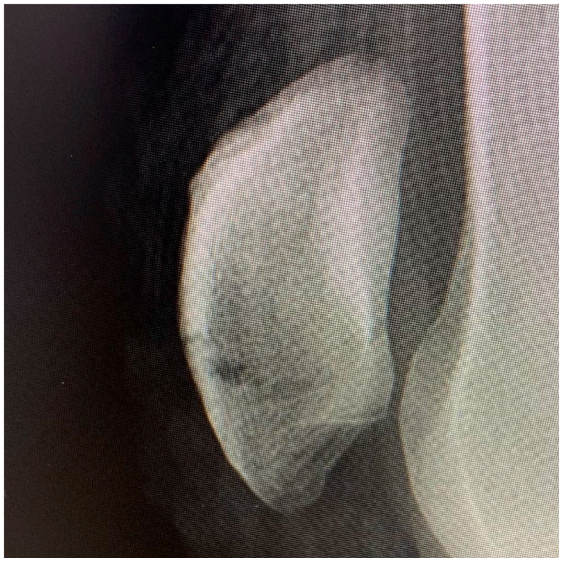

Fig. 1. X-rays.
1a Preoperative X-ray.
1b post-operative X-ray.

are inserted in a distal to proximal direction, parallel to medial and lateral sides of the patella (Fig. 2c). FiberWire® No. 2 was passed through the hole at the posterior end of the K-wire (Fig. 2d), and the K-wire tip was pulled out proximally using pliers and a hammer and guided into the bone tunnel (Figs. 2e and 3a). The Mosquito Kerry was inserted through the proximal cut and reached the distal cut while creating a subcutaneous tunnel in front of the patella, and the distal end of the FiberWire was grasped (Fig. 2f). This procedure was also performed at another FiberWire (Fig. 3b). The FiberWire with both ends protruding from the proximal cut was clamped with a single knot, and full extension and deep flexion were repeated while applying tension. After confirming the restoration position using the image intensifier, the final fixation (Figs. 2g and 3c, d) was performed (Fig. 1b). The operative time was 21 min, and the blood loss amount was small. On the day after the surgery, the patient was allowed to walk with full load without using a brace and to practice unrestricted range of motion, and rehabilitation was started. The patient was discharged 10 days postoperatively with a range of motion of −5° of extension and 105° of flexion and the ability to walk unaided. The patient returned to driving and office work 14 days postoperatively. At 1.5 months postoperatively, the bone had healed and the range of motion was 0° of extension and 125° of flexion, and at 2.5 months, the patient had achieved full range of motion. During the final follow-up, the patient was very satisfied and did not have any skin irritation symptoms and did not require suture removal (Fig. 4a, b, c). This article has been reported in line with the SCARE criteria, and written informed consent was obtained from the patient forthe use and publication of data for academic purposes [6].

3. Discussion

TBW [2] is the standard technique for the treatment of transverse patellar fractures, and complications due to the metal fixation material, such as poor fastening due to deflection of the soft steel wire, skin damage due to wire tearing or soft tissue irritation, infection, and discomfort, may occur. Moreover, 15% of patients have been reported to require internal fixator removal [7]. Under these circumstances, the strong suture method, which does not use metal for fixation, has been reported to have fewer complications and shorter hospital stay than the TBW method, and the effectiveness of FiberWire® as a fixation material has been clinically demonstrated [8,9]. In a basic study, the maximum breaking load at the time of patellar osteosynthesis was equal for soft steel wire and FiberWire® No. 2, but higher for FiberWire® No. 5 [10]. This technique is advantageous due to its tension-band principle, high strong suture strength, and ease of operation, which minimizes the development of the subcutaneous tissue. In addition to the fact that this technique is very minimally invasive, with only two wounds of approximately 1 cm, the lack of metal implantation prevents discomfort due to soft tissue irritation and allows early rehabilitation with minimal pain. In addition, the range of motion training is often restricted for about 4 weeks postoperatively [1]. However, rehabilitation could be performed without range-of-motion restriction in this case due to good fixation, and early recovery of activities of daily living and return to society were achieved. Therefore, this is an effective and economically advantageous technique because it can be performed using only common materials, such as perforated K-wire and strong suture. However, this technique has some caveats. In particular, careful judgments on procedure indications should be made. In patients contraindicated for percutaneous repair, such as when the injury has been long, high degree of comminution, or complete loss of bone contact with a extensive ruptured patellar retinaculum, osteosynthesis alone may not be sufficient for fixation, and a normal skin incision may be appropriate. In common with the TBW method, the K-wire should be firmly inserted near the center of the patella to prevent bone socket disruption by strong suture. Therefore, a small incision should be made above the patella and fix the quadriceps tendon as close to the bone surface as possible without involving the soft tissues. However, further experiences should be acquired using the normal strong suture technique, as it takes some time to become accustomed to using a strong suture with a minimal skin incision.

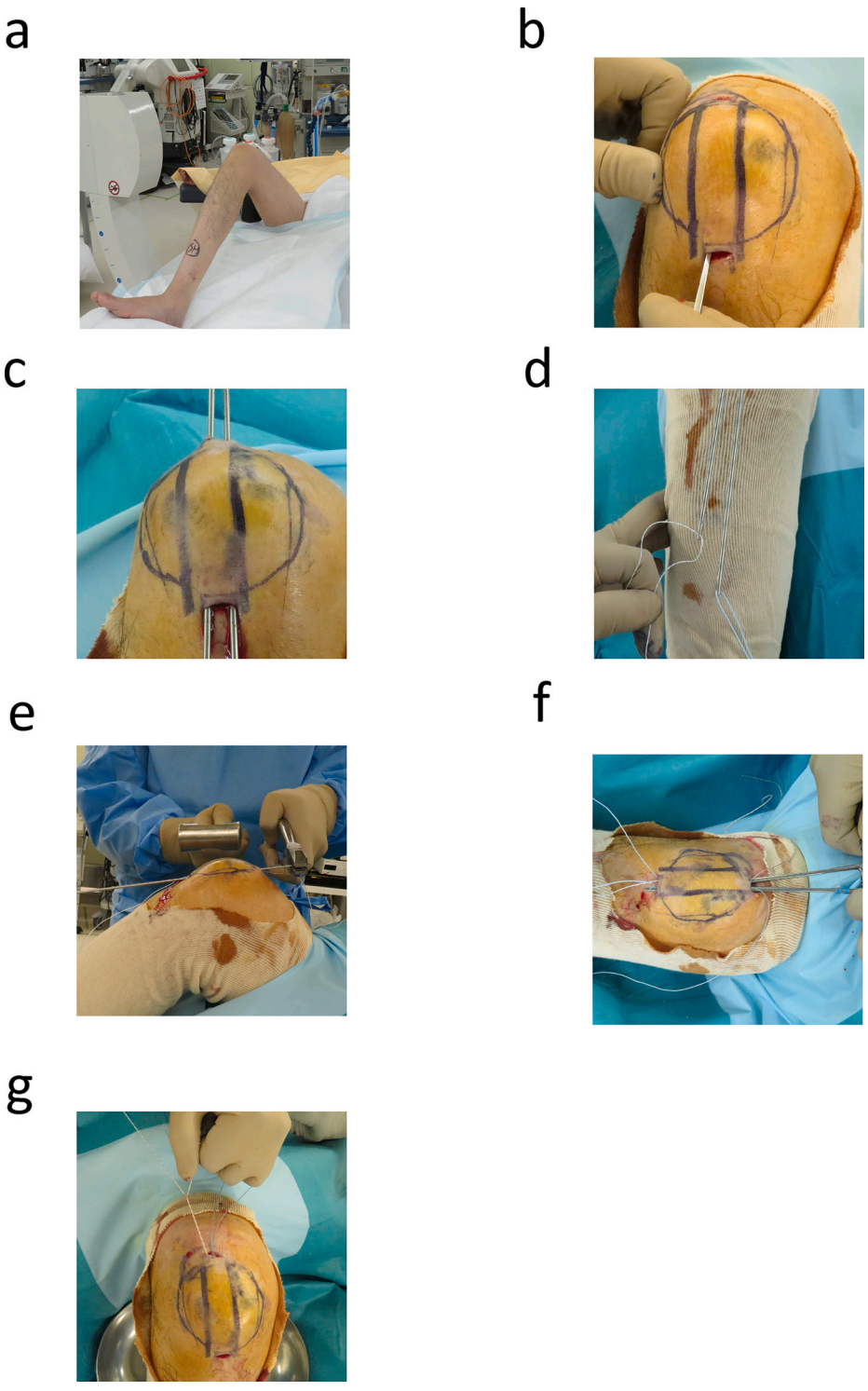

Fig. 2. Procedure of the percutaneous Strong Suture method.
2a Flexion (60°) is the basic position.
2b Small skin incisions distal and proximal to the patella.
2c Two K-wires inserted in parallel.
2d Thread the FiberWire through the hole in the K-wire.
2e K-wire pulled out proximally.
2f Guide the distal end of the FiberWire proximally.
2g Fastening.

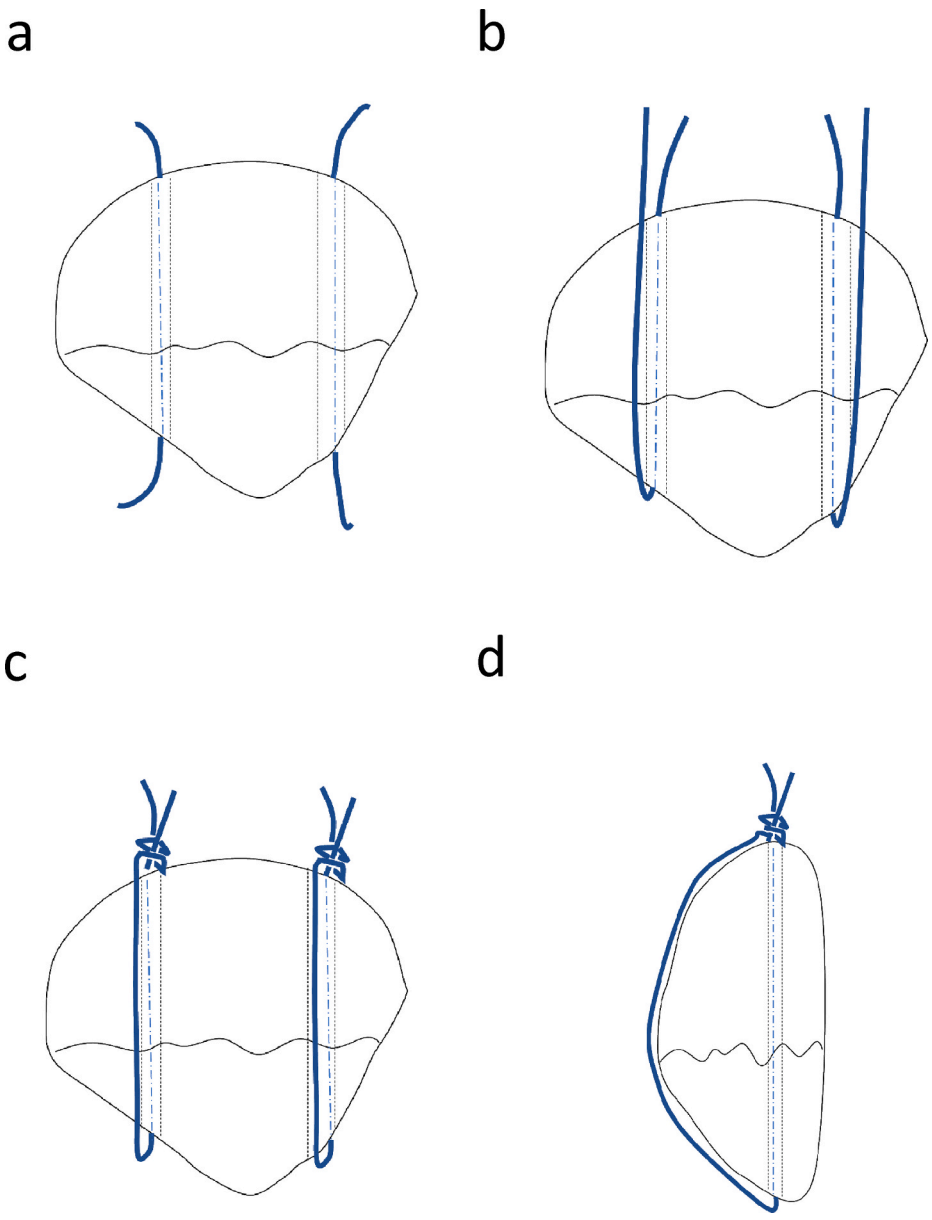

Fig. 3. Procedure of the percutaneous strong suture method (Schema).
3a FiberWire through the bone tunnel.
3b FiberWire with proximally guided ends
3c Fastening sutures (front view).
3d Fastening sutures (side view).

4. Conclusion

In this case, osteosynthesis for a patellar fracture was performed using the PS method, and the patient recovered good joint function in the early stages, eventually becoming symptom-free and not requiring wire removal.

Ethical approval

The ethical approval was not required for this case report.

Sources of funding

All authors declare that there is no funding regarding this case report.

Author contribution

Shinnnosuke Hada MD, Ph.D: study concept, data collection, data interpretation, and writing the paper.
Muneaki Ishijima MD, Ph.D: Study concept and design.
Yoshimasa Tomita MD: Study concept and design.

Consent

Consent Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

a

b

c

Fig. 4. Status at last follow-up.
4a X-ray.
4b Wound.
4c Range of motion.

Research registration

Not applicable.

Guarantor

Shinnnosuke Hada MD, Ph.D.

Provenance and peer review

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Declaration of competing interest

All authors declare that there is no conflict of interest regarding this case report.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.102810.

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