



# Intraarticular Migration of Broken Patella Cerclage and Figure-of-Eight Wire

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## Abstract

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**BACKGROUND:** Breakage of the wire commonly follows the procedure performed for displaced patellar fractures; nevertheless, there have not been many reports about wire fragment migration. To the best of our knowledge, there were only six documented cases of wire fragment intraarticular translocation.

**CASE REPORT:** A 47-year-old male patient, with a history of patella fracture 3 years ago, was treated with cerclage and figure-of-eight wiring, presented with severe restriction of knee movements for the past 4 weeks. X-ray and fluoroscopy examination showed cerclage wire had broken at multiple sites with one broken piece migrated posterior intraarticularly. This case is unique due to the size of the migrated broken cerclage wire, which was about only length 1.5 cm and diameter 1.25 mm attached to posterior lateral condyle which prevented its further migration; otherwise, it could damage neurovascular structures. This intraarticular piece of wire was removed successfully with fluoroscopy support.

**CONCLUSION:** Increased time-lapse from the initial surgery, the comminution of the fragment fracture, wire shape and size, and the incorrect placement of wire are the risk factors of intraarticular migration. We should educate the patient about the risks of hardware failure and possible migration with all patients receiving bone fixation with wires, and we can offer elective hardware removal as an option.

## Introduction

There are various methods for the management of displaced patellar fractures, among them are tension band wiring, cerclage wiring, tension band wiring with cerclage wiring, and cerclage wiring with additional figure-of-eight wiring. Commonly, breakage of the wire follows the procedure, but there has not been any clear description about wire fragment migration [1], [2], [3]. To the best of our knowledge, there were only six documented cases of intraarticular translocation of wire fragment [3], [4], [5], [7], [8], [9].

## Case Report

A 47-year-old male reported a complaint of left knee pain for a month. The patient had sustained a displaced comminuted fracture of his left patella and tibial plateau following a fall 3 years ago. Cerclage wire with an additional figure-of-eight wire fixation technique

successfully performed, and the patient was recovering well. However, there was a lost to follow-up before the patella fracture had a union. The patient reported an excellent function of the left knee for the past 3 years and returned to his job without any pain or functional disability.

However, the patient started experiencing deep-seated pain within the right knee for the past 4 weeks. There was no recent history of any fall or trauma to the right knee. Clinical examination of the right knee revealed no patella or joint line tenderness. There was no effusion, and the cruciate and collateral ligaments were intact. Furthermore, there was no extensor lag and knee extension power was good. The range of motion of the knee was full at the point of clinical examination.

The previous radiograph of the left knee that taken 1 month before surgery has revealed a union of the patella fracture with the metal wires broken at several places (Figure 1). We saw that the inferolateral segment of the broken cerclage wire has migrated in front of the tibial tuberosity.

The patient underwent 2 times of surgery for removal of the patella wires because we only used an X-ray photograph 1 month ago, and we did not anticipate

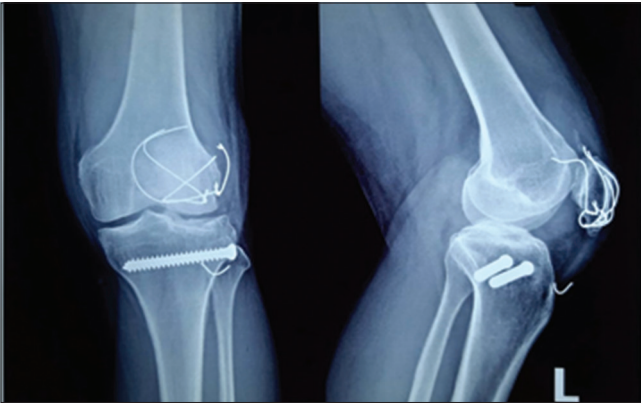


Figure 1: Previous radiograph at presentation demonstrated breakage and migration of K-wire in front of tibial tuberosity

the possibility of this fragment migrating. After the first surgery, from post-operative radiograph, there was still a small fragment of the wire that migrated to the posterior part. Thus, we had to do the second stage operation to take that wire because it could damage the surrounding neurovascular structures. We used fluoroscopy guiding to identify the precise location of the broken wire (Figure 2).

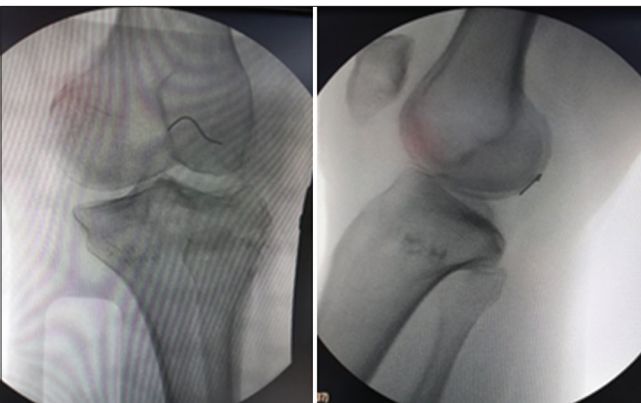


Figure 2: One small wire was left behind at the posterior lateral condyle (fluoroscopy)

We used a new posterior approach to remove this wire. After we identified the location under fluoroscopy, we must divide the hamstring muscles and make an incision of the posterior capsule to reach the wire (Figure 3a). At last, we found the migrated wire that was tiny with length 1.5 cm and diameter 1.25 mm, slim, tubular, and unthreaded shape and was hooked intraarticularly at the base of the posterior lateral condyle (Figure 3b).

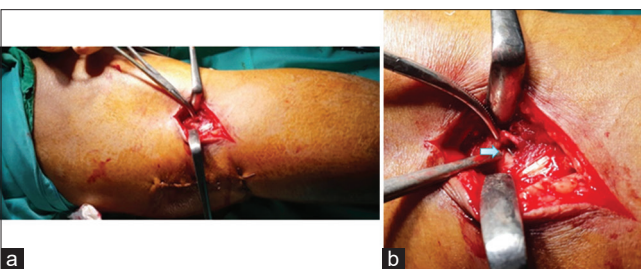


Figure 3: (a) Posterior approach of the left knee. (b) The wire was found attached intraarticularly to posterior lateral condyle

The patient was discharged 1 day following surgery, and his wound healed in 2 weeks. Symptoms

of knee pain and locking knee resolved completely following the surgery, and the patient was able to resume work in 2 weeks.

## Discussion

From the previous study, there were very few studies that reported cases of wire fragment translocation after patellar fracture fixation. Whereas, the broken wires in the patellar fracture can migrate intraarticularly [3], [9] to the popliteal fossa<sup>1</sup> and even to the heart [2]. Biddau *et al.* reported a rare case of migration of patella cerclage wire into the heart. The fragment might pass through the blood circulation [2]. Two cases of extraarticular patella wire migration to the popliteal fossa were reported by Choi *et al.* [1]. It is important to remember that the posterior section of the knee is close to the neurovascular bundle, so nerve irritation can occur when the broken wire fragment migrates to this area [1]. In particular, we found only six cases of intraarticular migration of a patella wire in the literature [3], [4], [5], [8], [9] (Table 1). Unfortunately, we only found a little information on one case from Chen *et al.*

The migration of K-wires is well established. K-wires have a strong tendency to pass through the path of their insertion as a result of their slim, tubular, and unthreaded shape. The free fragments from the breakage of the wire then easily travel through the smallest resistance pathway [6].

According to Wang *et al.* [4], without a fracture gap, it is unlikely that the wire can travel intraarticularly because the wire fragment needs to penetrate a substantial amount of soft tissues, such as the thick retinaculum, before entering the knee joint. However, it is not impossible. In most cases, the nonunion site is repopulated by fibrous scar tissue that aligns intimately with the pseudarthrosis line, building a forceful barrier. However, a dynamic gap without fibrous tissue has opened up an unexpected portal for the broken wire's entry into the knee joint [4].

An exciting finding showed a case of intraarticular migration without nonunion and Chen *et al.* [3] hypothesized that the too-posterior-placement of the cerclage wire around the patella could be the root cause. That area contained no or very little soft soft-tissue buttress. Hence, when the wire broke, its fragment could pierce through the joint capsule easily [3]. In our case, the broken wire might migrate through the knee joint because the placement of the cerclage wire around the patella was too posterior.

Sammy [10] suggested that the difference between the patient's age in the entire wire group and the broken wire group was not statistically significant. However, there was a statistically significant difference

**Table 1: Six cases of intraarticular migration of a patella wire**

S. No.	Authors	Demographic	Type of fracture	Type of fixation	Time duration after surgery	Symptoms and duration	Size of the wire	Location of the broken wire	Possible risk factor for intraarticular migration	Surgical treatment	Approach used
1	Chen <i>et al.</i>	Unknown	Unknown	Circumferential wiring	Unknown	Unknown	Unknown	Unknown	Improper surgical technique and incorrect choice of fixation	Unknown	Unknown
2	Sharma <i>et al.</i>	51-year-old male, Indian origin	Comminuted fracture of patella	Modified tension band wiring with cerclage and figure-of-eight wiring	15 months ago	Deep-seated pain within knee with restriction of movements for the last 4 weeks	Length: 4.5 cm, diameter: unknown	At the base of anterior cruciate ligament until posterior compartment of knee	Activity level and age, improper surgical technique, and incorrect choice of fixation	Arthroscopic examination, removal of implant by open incision under fluoroscopy	Anteromedial and anterolateral portal for arthroscopic examination and midline anterior knee incision for removal of implant
3	Wang <i>et al.</i>	61-year-old male, Chinese origin	Comminuted fracture	Modified tension band wiring with figure-of-eight wiring	8 years ago	Deep-seated pain and intermittent locking within the knee for the last 2 weeks	Unknown	Medial and posterolateral compartment of the knee joint	Activity level and age, nonunion gap, improper surgical technique, and incorrect choice of fixation	Arthroscopic examination, removal of implant by open incision	Midline anterior and posterolateral knee incision
4	Hsu <i>et al.</i>	32-year-old, male	Unknown	Cerclage wiring	14 years ago	Progression medial side knee pain (exacerbated by applying a varus force) and swelling for unknown duration	Unknown	Intraarticular medial compartment of the knee joint and extraarticular posterolateral of proximal tibia	Unknown	Removal of implant by arthroscopic	Anteromedial portal
5	Hsu <i>et al.</i>	42-year-old, female	Unknown	Cerclage wiring	3 months ago	A sudden onset of left knee swelling and stiffness for 3 months	Unknown	Intraarticular retropatellar space	Unknown	Removal of implant by arthroscopic	Anteromedial portal
6	Tamaki <i>et al.</i>	75-year-old man	Transverse fracture	Tension band wiring with figure-of-eight and cerclage wiring	2 years ago	The wire had perforated the skin anteriorly	Unknown	Intraarticular into the posterior septum of knee joint	Activity level and age, lost to follow-up, improper surgical technique	Removal of implant by arthroscopic	Anteromedial and posteromedial portal

for the duration from fracture fixation to implant removal between the two groups. The risk of wire breakage might increase with time after patellar tension band wiring. Elevated risk of wire breakage was found in a group of patients with removal procedure at more than or equal to 12 months from their initial fixation. The longer duration was related to a further increase in the relative risk. The tension-band and cerclage wires inside the quadriceps and patellar tendons are subjected to repetitive loading and strain even after the fracture has fused. Therefore, the risk for wires' breakage will likely to increase if not removed as time goes by. However, this risk is not related to the patients' age upon fracture fixation [10].

The risks factor of intraarticular migration broken wire, in this case, is the duration of the implanted wire since the initial surgery, the comminution of the fragment fracture, wire shape and size, and the placement of wire from previous surgery. In this case, the duration of the implanted wire since the initial surgery was 3 years. The comminution of the fragment fracture possible to made nonunion site, dynamic gap, and opened up an unexpected portal for the broken wire's entry into the knee joint. The placement of wire from previous surgery was too posterior from the patella itself and was not following the technique

recommended by AO. The following area contained no or very little soft soft-tissue buttress. When the wire broke, its fragment could pierce through the joint capsule easily. The migrated fragment of wire was tiny with length 1.5 cm and diameter 1.25 mm (1.5 cm), and the piece was hooked intraarticularly at the base of the posterior lateral condyle to prevent further migration. Otherwise, it could cause damage to surrounding neurovascular structures. In our patient, chronic knee pain for 3 months prompted the patient to seek medical attention. The intraarticular wire was mobile in the joint and produced pain knee symptoms intermittently.

The patient had to undergo operation 2 times because we only used X-ray photograph 1 month ago, and we did not anticipate the possibility of this fragment migrating. For the second stage operation, we had to make a new posterior incision and split the hamstring muscle and cut the posterior capsule to identify this piece.

Several recent techniques have developed to reduce the risk of complications related to conventional tension band wiring using K-wires and metal wires. Berg suggested the technique of tension band wiring through cannulated screws instead of K-wires [11]. Qi *et al.* improved this technique using bioabsorbable

cannulated screws with a braided polyester suture [12]. Braided polyblend sutures and metallic ring pins were used by Yotsumoto *et al.* to treat transverse patellar fractures [13]. They claimed that the ring pins and braided polyblend suture would not travel from the reduction site so that it can decrease the complications related to metallic materials. However, until now, the conventional tension band wiring proposed by the AO Foundation is still the most considerably used despite a lower complication rate using the novel techniques mentioned.

Patients with wire breakage frequently refuse the removal surgery, moreover, when they do not feel any symptom. Unfortunately, our case was lost to follow-up because it was asymptomatic. The patient usually asked for wire removal surgery only when there was a complaint of pain over his knee.

From this case, we can learn about the risk factors of intraarticular migration broken wire of patella, the importance of the latest radiograph before removal of implant to anticipate the possibility of the migrating fragment, doing a careful fixation with cerclage or tension band wiring proposed by the AO Foundation and long-term gradual follow-up. We should explain to the patients the possibility of critical complications because they can migrate to the neurovascular bundles in the popliteal fossa<sup>1</sup> and the heart through the venous system [2]. Once the wire breakage happened, the patient should be strongly advised to have the removal procedure. We must anticipate the harmful effects of intraarticular migration of wires. Joint tenderness, locking symptoms, higher risks of infection, and early degenerative joint disease are the complications, we need to pay attention to [4].

## Conclusion

Increased time-lapse from the initial surgery, the comminution of the fragment fracture, wire shape and size, and the incorrect placement of wire from previous surgery are the risk factors of intraarticular migration. We should discuss and educate the patient about the risks of hardware failure and possible migration with all patients receiving bone fixation with wires, and we can offer elective hardware removal as an option. Furthermore, when radiological examination observes any wire breakage, particularly in the presence of nonunion, the patient should be verily counseled to undergo wire removal procedure as soon as possible.

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