TECHNICAL NOTE

Modified tension band technique for patella fractures


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Summary The use of tension band wire technique for patella fractures fixation is a well-established technique. However, the standard technique, which involves using two Kirschner wires through the patella, can cause problems with prominent hardware, and difficulty capturing the change to figure of eight wire. Here we describe a modified technique using four Kirschner wires, which allows each wire to be bent, and well-impacted in order to avoid these problems. The basic surgical technique, and our case series are reviewed.

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Introduction

A century ago, a report of 1100 patella fractures clearly established operative internal fixation as the standard of care for displaced fractures of the patella [1]. In the 1950s, the technique of tension-band wiring was first described, and later biomechanical studies showed it to be superior to intra-osseous wire suture [2,3]. This technique was quickly adopted as the standard of care by the Arbeitsgemeinschaft fur Osteosynthragen/Association for the Study of Internal Fixation [2,4]. The effectiveness of this technique has also been widely confirmed clinically [5—9]. The treatment of patella fractures with two vertical Kirschner wires and an anterior figure of eight technique, tension band wire technique, has become an accepted standard of care in the treatment of displaced fractures of the patella [4,10—12].

However, the use of this technique is known to be associated with complications, namely prominent hardware with the need for hardware removal [13]. The prominence of hardware in tension band wire techniques in general has been well documented, and can even be associated with wound complications [14—16]. The use of compression screws with figure of eight wires has been advocated not only for biomechanical reasons, but also because of the lower profile of the hardware [17,18]. Other authors have also proposed alterations to the standard technique, with a bending of the wire both proximally and distally, to address these issues [19].

We have found a technique of using two superior to inferior wires, and two inferior to superior wires, all crossing the fracture, capturing the figure of eight wire, and well buried, to be an effective alternative to traditional the AO/ASIF tension band wire technique in the treatment of patella fractures. Here we describe the surgical technique, and our clinical experience with this technique.

Surgical technique

Use of a radiolucent table facilitates imaging with a large image intensifier. A bump under the buttock on the affected side is helpful.
A tourniquet cuff is applied to the proximal thigh. Either a longitudinal or a transverse incision can be used. After exposure of the fracture margins, the fracture is then reduced and provisional fixation is undertaken with appropriate reduction forceps. In comminuted fractures it is usually possible to reconstruct proximal and distal segments with provisional fixation with K wires and reduction forceps. Occasionally screws can be used for definitive stabilization of comminuted fragments.

Longitudinal K wires are then driven across the fracture site, with two wires being driven from proximal to distal and two being driven from distal to proximal. All K wires are placed parallel to each other and perpendicular to the fracture line. Care is taken to ensure that the wires do not penetrate the articular surface. When advancing the wires they are driven to the opposite pole of the patella and then pulled back approximately 1 cm (Fig. 1). This facilitates later impaction of the wires once they have been bent. It may be prudent at this point to use the image intensifier to verify the reduction and wire placement.

Once the four K wires have been placed a figure of eight wire is passed. The transverse limbs of the figure-eight wire should be as close as possible to the respective pole of the patella. Two twists are made in the figure-eight wire, one on
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Figure 3  Appearance of hardware at the end of the procedure.

each vertical limb, to prevent asymmetric tightening. The twists are pulled to tighten the wires and then turned to take up the slack, as the pull is released, to remove any slack in the wires. Both twists are made simultaneously or alternate small adjustments are made in each until the appropriate tension is generated in the figure of eight.

The longitudinal K wires are then bent 180 degrees as close as possible to their entry points into the patella. The excess wire is then cut leaving 2 to 4 mm of a hook (Fig. 2).

The bend in each wire is then turned such that the hook is directed posteriorly. This will ensure that the figure of eight wire will be captured. The tendon at the point of entry of the longitudinal wire should be split for several millimetres and with the tendon retracted the bent wire is advanced with a punch until it is flushed with the bone (Fig. 3). Ensuring that there is no tendon captured by the bend in the wire and engaging the bone with the bend reduces the risk of wire backout. The same procedure is carried out with all four K wires.

The final position is verified clinically and radiologically (Fig. 4). The non-bent ends of the wires should not protrude beyond the bone and must not penetrate the articular surface.

The usually present retinacular rents, medially and laterally, are repaired and then the wound is closed in layers.

Post-operatively the knee is placed in an immobilizer. The patient is allowed full-weight bearing in the immobilizer and is permitted to come out of the immobilizer for non-resisted range of motion exercises. The immobilizer is discontinued at 6 weeks and activity is progressed based on clinical and radiologic assessments.

The tension band wire is removed only in patients with significant hardware related symptoms and not generally for at least 6 months from the date of surgery.

Case series

Between January 2003 and December 2008, 31 patients at our institution with patellar fractures were treated with the modified (four wire) tension band wire technique. There was a trend toward the more frequent use of the cannulated screw technique in simple transverse fractures later in the series, and 14 of the modified tension band wire technique groups had additional hardware placed — screws, cerclage wires or extra K wires.

Four of the patients with this technique had hardware removed for irritation despite satisfactory post-operative radiographic results. It has been our experience that hardware removal is required less frequently with this technique than with the traditional AO/ASIF tension-band wiring technique. One patient had a major reinjury causing failure of fixation requiring revision fixation, with a successful outcome. One patient had a non-union without failure of hardware, and was revised to compression screws at 7 months post-operative with subsequent union.

Figure 4  Post-operative lateral (A) and AP fluoroscopy (B) views.
Conclusions

The use of this modified tension band wire technique for the fixation of displaced fractures of the patella combined the biomechanical benefits of the traditional AO/ASIF tension band wire technique, without the issues associated with prominent and unbent Kirschner wires. We have found it to be a useful technique as part of the treatment of comminuted and simple fractures of the patella.

Conflict of interest statement

None.

References