A New Reduction Technique for a Patellar Fracture

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Summary: We report 4 cases of patellar fracture with skin injury over the patella which were treated operatively immediately after onset with a new reduction technique using Ilizarov pins. This technique made it possible to perform early operative treatment even in the cases with skin injury over the patella which prevents conventional surgical approach.

Key words patella, Ilizarov pin, skin injury, tension device

INTRODUCTION

The patella bone is continually subject to tensile force, and treatment for a fracture in the patella requires rigid fixation with complete anatomical reduction of the fracture. Aggressive exposure is often needed to obtain anatomical reduction of the fracture, due to concomitant damaged subcutaneous tissues, damaged periosteum, and/or damaged attached musculature. Moreover, anatomical features of the patella make it vulnerable to direct trauma, and this often associated skin injury over the patella complicating early surgical treatment. Here report 4 cases treated successfully using a new surgical technique for a patellar fracture. This new technique can be performed immediately after onset of the fracture even in cases with skin injury over the patella.

TECHNIQUE

The fracture is evaluated using tomography prior to the operation. A fracture with fragments diastasis within 5 mm can be managed with this technique. The patient was placed in the supine position under regional or spinal anesthesia. No tourniquet is used. A 10-to-20 mm incision is made at the side of the patella, and tangential to fracture line, crossing the circumference of the patella, under fluoroscopic control. The incision is made where there is no skin injury. Ilizarov pin [1] is advanced into the patella along the tangential line from this incision and beyond into this side fragment of the patella. A second pin is advanced in the contra-direction, about 5 mm adjacent and parallel to the first. The fracture was reduced with these pins under fluoroscopic control. The Kirschner wire is inserted through the fracture site to fix the fracture temporarily. The use of Kirschner wire is optional and can be unnecessary in case of only minor diastasis. Then both pins are advanced together through both fragments until the rear head of the Ilizarov pin was firm against the surface of the patella edge (Figs 1 and 2a). Tensile force is then applied to both Ilizarov pins simultaneously using a tensioning device, until full secure reduction was achieved, under fluoroscopic view (Figs 1 and 2b). Then 2 screws were inserted from alongside Ilizarov pins. In early cases, we used two AO cancellous screws and a tapping process that tend to cause a gap between the fragments during tapping. In the two most recent cases, we have adopted two malleolar screws that require no tapping. Then the Ilizarov pins are removed. In a case with 3 or more fragments, this procedure is

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repeated across each fracture line, or across two fracture lines when a thin fragment was present between two larger fragments.

RESULTS

Four patients (one male and 3 female) with a mean age of 53.3 (range 36-62) years, had a closed patellar fracture with minor laceration or abrasion of the skin over the patella and were operatively treated using this technique. Each of the patients had entered our hospital immediately after onset and had no major associated injury. Each fracture had occurred as a result of a fall onto the knee from a standing position. The fracture pattern was comminuted in 2 cases, vertical in another, and inferior pole avulsion in the other. Skin injury over the patella was various according to each case, but did not reach the bone. The abrasion was washed out with large amount of normal saline and dressed, the laceration was washed out the same way and initial debridement and skin sutures were applied, immediately. Intravenous antibiotics were administered in each case. Each fracture was evaluated on plain anteroposterior, lateral, and axial radiographs and tomographs. The operation was performed within 3.8 (range 3 to 5) days after the fracture onset, under regional or spinal

Fig. 1. Anteroposterior schematic diagram of the Ilizarov pins and the directions tensile of pull (Fig. 2).

Fig. 2. Pictures at operation are in the right column and concomitant plain radiographs are in the left column. a) before tensile force was applied, and b) after tensile force was applied.
NEW TECHNIQUE FOR PATELLAR FRACTURE

TABLE 1
Features of the four patients with a patellar fracture

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex, Age (Yrs)</th>
<th>Side</th>
<th>Types</th>
<th>Skin Injury</th>
<th>Skin Injury Healed (days)</th>
<th>Anesthesia</th>
<th>Implants</th>
<th>Splint (days)</th>
<th>W.B. (days)</th>
<th>ROM 3m Later</th>
<th>Screw Removal (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F, 58</td>
<td>R</td>
<td>i.p.a.</td>
<td>Laceration</td>
<td>14</td>
<td>Spinal</td>
<td>2 Cs(s)</td>
<td>14</td>
<td>17</td>
<td>Full</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>F, 36</td>
<td>R</td>
<td>Comm.</td>
<td>Abrasion</td>
<td>10</td>
<td>Spinal</td>
<td>Cs &amp; Ms</td>
<td>14</td>
<td>17</td>
<td>Full</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>F, 62</td>
<td>R</td>
<td>Vertical</td>
<td>Abrasion</td>
<td>15</td>
<td>Regional</td>
<td>2 Ms</td>
<td>10</td>
<td>14</td>
<td>Full</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>M, 57</td>
<td>R</td>
<td>Comm.</td>
<td>Abrasion</td>
<td>12</td>
<td>Spinal</td>
<td>2 Ms</td>
<td>8</td>
<td>14</td>
<td>Full</td>
<td>12</td>
</tr>
</tbody>
</table>

M: male; F: female; R: right side; i.p.a.: inferior pole avulsion; W.B.: start of weight bearing; m: months
Cs: cancellous screw; Cs(s): small cancellous screw; Ms: malleolar screw

Anesthesia. In three cases performed under spinal anesthesia, arthoroscopy was performed to examine the associated internal knee injury with no traumatic finding. Regional anesthesia was applied in one case at the patient’s request. Each fracture was reduced by our new technique, and fixed with cancellous or malleolar screws. A plaster splint was applied in each case, for an average of 11.5 (range 8 to 14) days. Passive range-of-motion exercises, together with quadriceps setting exercises, were performed immediately after removing the splint. Weight bearing was permitted partially at an average of 15.5 (range 14 to 17) days after the operation, and was gradually increased week by week. The skin injury was healed within an average of 12.8 (range 10 to 15) days after the fracture onset. The imaging features of these cases are summarized in Table 1.

DISCUSSION

Bostrom [2] postulated that undisplaced or minimally displaced fractures could be treated non-operatively with good results. However, Edwards et al. [3] countered that even 2 mm diastasis or a 1 mm incongruity could lead to permanent symptoms and complaints with reduced extensor mechanism. As the patella is continually subject to tensile force, it is necessary to employ rigid internal fixation, such as tension-band wiring, Magnuson wiring, modified tension band wiring, or interfragmental screws [4-6], for a successful operative treatment. An immediate internal fixation makes it possible to start early range-of-motion exercises, and provides good results [4-7]. As the conventional operative procedure requires open reduction exposing the patella by a skin incision over the patella, it should be delayed until the surface wound is healed in cases with abrasion or laceration to the skin. The anatomical location of the patella makes it vulnerable to direct trauma, and most patellar fractures resulting from direct trauma have some kind of skin injury which prevents immediate operative treatment. Even in a case with no skin injury, direct trauma to the anterior knee causes soft tissue damage around the patella especially in the anterior region. The technique we have developed and presented here has several advantages; it requires only a small skin incision at the side of the knee where abrasion or laceration hardly occurs by a fall onto the knee, and it not require aggressive soft tissue stripping for a fracture reduction which in turn helps prevent any damage to the vascularization of the fracture site. These advantages have made it possible to perform early internal fixation even for a case presenting a minor skin injury over the patella. However, careful evaluation of the degree of any skin injury and of the fracture pattern is required, because the technique must be applied specifically for each fracture [1,8,9].

We have employed 2 screws to stabilize the fragments in principle. The stability of fixation methods have been tested experimentally by Weber et al. [6] and the most secure fixation was found to use a modified tension band and intracortical technique. These techniques are not available for our technique presented here. However, fixation with 2 screws is sufficient for a transverse fracture having adequate bone stock [10]. We have successfully managed 4 fractures, 3 of which had at least 2 large fragments, with normal bone strength, the remainder was an avulsion fracture, also with normal bone strength, and all four cases showed excellent results.

REFERENCES


