

Treatment of inferior patellar pole avulsion fractures with pole resection and patellotibial cerclage wire

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ABSTRACT

The ideal treatment for avulsion fractures of the inferior pole of the patella has not yet been identified. The options include internal fixation of the pole fragment and resection of the avulsed fragment along with the repair of patellar ligament to the patella. The purpose of the present study was to evaluate the result of pole resection with repair of patellar ligament with augmentation by Patellotibial cerclage. We retrospectively studied 13 of patients who had operative treatment of an avulsion fracture of the inferior patellar pole by pole resection with trans-osseous suture fixation of the tendon to the patella and reinforcement of ligament patella with Patellotibial cerclage wire. Thirteen patients who had had pole resection were followed for an average of 3 years. The average patellofemoral score (maximum, 100 points) was 88.8 points. Normal patellar height was found in thirteen patients. In patients who have sustained an avulsion fracture of the inferior patellar pole, the normal height of the patella can be maintained by transosseous suture fixation of the tendon to the patella and Patellotibial cerclage after pole resection. The present study indicates that Patellotibial cerclage can provide better clinical results and avoid prolong postoperative immobilization.

Keywords: Patellotibial cerclage, patella.

INTRODUCTION

The patella is the largest sesamoid bone of the human skeleton. It is integrated into the extensor apparatus and with its articular surface. It is also a component of the patellofemoral joint.

In most fracture classification systems, avulsion fractures of the inferior patellar pole fall into a separate category.¹⁻⁵ Such fractures account for 9.3% to 22.4% of all patellar fractures that are treated surgically.⁶ An avulsion fracture of the distal patellar pole results from a direct injury to the flexed knee and the at the same time forceful pull of the quadriceps muscle. The treatment of this type of fracture is complicated as it poses a special problem because of the structure of the injured patellar pole. An avulsion fracture with a single solid patellar pole fragment is best treated with fixation with use of a compression screw and cerclage wire.^{7,8} The patellar pole is often comminuted. The treatment of choice in these cases often has been removal of the patellar pole and repair of the patellar ligament.^{2,5,7,9,10} Some authors, however, have recommended preservation of the patellar pole by means of fixation with two cerclage wires.³ Internal fixation with a basket plate is an alternative method of treatment that, in contrast with other methods, allows for the preservation of the patella. The basket plate was designed for the treatment of comminuted distal patellar fractures by Smiljani in 1988 and was constructed in the Zagreb Department of Instrumentaria Research.¹¹ Internal fixation with the basket plate is stable enough to allow for mobilization and weight-bearing on the first postoperative day. The patient is allowed to bear full weight on the affected extremity during level walking. For walking uphill or downhill, crutches should be used to prevent loading of the flexed knee joint for six weeks.¹² But these plates are not readily available and are expensive.

The purpose of the present study was to study the long-term results of supporting the repair of the ligament patella by Pattelotibial cerclage after the pole resection.

MATERIALS AND METHODS

We retrospectively reviewed the records of 14 patients in whom an isolated avulsion fracture of the inferior patellar pole had been operatively treated at the Department of Orthopaedics at Nepal Medical College & Teaching Hospital, Kathmandu, Nepal, between 1999 and 2003. All fractures were displaced. Patients with fractures that extended beyond the pole and those with sleeve avulsions were not included. The fracture patella was exposed by anterior midline approach, all the fragments were managed with pole resection and transosseous suture fixation of the tendon to the patella according to the technique described by Saltzman *et al.*¹³ Then a hole was made just 2cm down and posterior to the tibial tuberosity and another hole was made in the remaining fragment of patella transversely. After the transosseous suture fixation of the tendon to the patella, a steel wire was passed through the patella and then passed through the hole made in tibia and was tighten sufficient to maintaining the height of Patella (Patellotibial cerclage). Wound was closed in after the repair of any tear in quadriceps expansion. Patients started passive motion exercises on the first postoperative

day and were encouraged to perform active flexion exercises of the knee in the prone position. Active extension exercises were allowed after the third postoperative week. The patients were encouraged to start bearing weight on the second postoperative day during level walking, and full weight-bearing without limitation was encouraged from the sixth week on.

The outcome of the procedure was assessed with use of the patellofemoral scoring system of Noyes *et al*¹⁴ as adapted by Saltzman *et al*¹³ to address problems of the patellofemoral joint.

The evaluation involved the completion of a questionnaire (maximum score, 45 points), a clinical evaluation (maximum score, 43 points), and a radiographic analysis (maximum score, 12 points). The overall score was rated as excellent (90 to 100 points), good (80 to 89 points), fair (70 to 79 points), or poor (< 70 points). The patellar height was determined according to the criteria of Blackburne and Peel.¹⁵ Lateral radiographs were made with the knee flexed by > 30° to prevent laxity of the patellar ligament. With this method, the normal patellar height index is 0.80. The final result (according to the patellofemoral scoring system) for patients with patella baja was compared with that for patients with a normal patellar position, without regard to the type of treatment.

RESULTS

The average age was 35 years (range, 24 to 48 years) for the 14 patients who were treated with transosseous suture fixation of the tendon to the patella with Patellotibial cerclage reinforcement. In these patients, 8 fractures resulted from fall and 6 from car accidents. All tendon repairs that were performed following pole resection healed. The average time between the accident and the final evaluation was 3 years. At the time of the final follow-up, the average patellofemoral score was 94.1 points (Table-1). The score was excellent for 10 patients and good for one. Nine patients were free of pain. Four patients had occasional pain. Three patients who had participated in trekking before the injury returned to the same after the injury. The level of work activity remained unchanged for 11 patients and was occasionally reduced for 2. When the active range of motion of the involved knee was compared with that of the uninvolved knee, 12 patients showed full flexion and 1 lacked 15° of full flexion. The patellar height was assessed radiographically with use of the method of Blackburne and Peel.¹⁵ Normal patellar height was found in 10 patients. The patellar heights were distributed around the normal value; the average height was 0.78, the mean patellofemoral score was 82.9 points for all patients with patella baja and 94.7 points for all patients with a normal patellar position ($p = 0.008$). The internal fixation devices were well tolerated and easily removed from all the patients after an average of six months.

DISCUSSION

We retrospectively studied 14 patients who had had operative treatment of an isolated displaced avulsion fracture of the lower patellar pole. The present study did not include patients with comminuted fractures that extended beyond the patellar pole or patients with sleeve avulsions. The results were comparable with regard to the number of patients, the age of the patients, and the type and cause of the injury. In review of the literature, we found no studies that separately evaluated different methods of treatment of only avulsion fractures of the patellar pole and no studies that compared the results of internal fixation with those of patellar pole resection. Neumann *et al*⁶ evaluated the long-term results for 135 patellar fractures that had been treated operatively between 1973 and 1989. Only fifteen of those fractures had been treated with partial patellectomy. Pelzl¹⁰ evaluated the results for 64 patients with comminuted fractures. Twenty-eight of the fractures had been treated with partial patellectomy, which was performed in the cases in which a solid proximal fragment formed at least two-thirds of the patellar size. Neither those studies nor other, similar studies evaluated avulsion fractures of the patellar pole separately.^{1,2,6,7,10,13,16} Saltzman *et al*¹³ evaluated the results of pole resection, but that study did not include only avulsion fractures but rather included all fractures for which partial patellectomy had been performed.

Our study group was small for statistical evaluation. The small size of our study group was related to the fact that these fractures are rare, accounting for only 9.3% to 22.4 % of all patellar fractures that are treated surgically.⁶ All the patient in present series were available for evaluation, which was good compared with those in other reports in the literature, in which a final evaluation was possible for only 58.0% to 70.0% of patients with similar patellar fractures.^{6,13} The age of the patient and the type and cause of the injury had no effect on the final outcome. This observation corresponded with those in other reports on the outcome of partial patellectomy.^{9,13} All fractures and all ligamentous repairs healed eventually.

The purpose of the present study was to evaluate and to compare the long-term results of transosseous suture fixation of the tendon to the patella after pole resection with Patellotibial cerclage. For functional evaluation, we used the patellofemoral scoring system described by Saltzman *et al*¹³ is the only available system which provides a numerical evaluation of the functional results of treatment of patellar fractures.

We found the final patellofemoral score ($p = 0.013$), the mean score was 88.8 points and all of the results were either excellent or good. At the time of the final follow-up assessment, a normal patellar height was established

in ten patients. These results also corresponded with those in the study by Saltzman *et al*¹³ who reported a low number of patients with normal patellar height after pole resection.

A possible explanation for the worse functional outcome for the patients managed with pole resection in the study by Saltzman *et al*¹³ could be the lower position of the patella, leading to shortening of the extensor mechanism. As a result of this shortening, compression forces in the patellofemoral joint increase, perhaps leading to cartilage damage.³ In contrast, retaining the inferior patellar pole preserves the functional length of the extensor mechanism. A better functional outcome for patients with a preserved patellar position was also suggested when we compared the results for all patients who had patella baja with those for all patients who had a normal patellar position, without regard to the type of treatment.

Six weeks of immobilization in a plaster cast following patellar pole resection is known to have harmful effects on the involved knee joint and muscles. Immediate postoperative mobilization and early full weight-bearing on the affected joint are two important advantages conferred by transosseous suture fixation of the tendon to the patella and reinforcement of the ligamentum patella with Patellotibial cerclage wire, the advantages of preservation of the functional length of the extensor mechanism and the normal height of the patella.

The study group in the present study was small, the results of the present study demonstrated that maintaining normal patellar height was beneficial and that stable fixation that permitted immediate mobilization of the joint and early full weight-bearing could contribute to a better functional outcome in the treatment of avulsion fractures of the inferior patellar pole.

In patients with an avulsion fracture of the inferior patellar pole, the normal height of the patella can be maintained after pole resection by Patellotibial cerclage. A tilt of the remaining patella should be avoided in all cases. Reinforcement of the patellar ligament repair with Patellotibial cerclage allows early mobilization thereby avoiding stiffness of the joint. The present study indicates that internal fixation with use of a steel wire can provide better clinical results.

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Table-1: Patient Evaluation According to the Patellofemoral Rating System

Criterion
Pain (10 points)
Swelling (5 points)
Giving way (5 points)
Movement (15 points)
Work (10 points)
Effusion (6 points)
Active range of motion (12 points)
Extension lag (4 points)
Patellofemoral compression pain (3 points)
Atrophy (8 points)
Isokinetic quadriceps strength (10 points)
Radiographic analysis (12 points)
Total (100 points)