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Partial Patellectomy: A Series of 17 Patients

KEYWORDS

partial patellectomy, comminuted patella fracture, tension band wiring

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ABSTRACT The purpose of the study is the evaluation of partial patellectomy in 17 patients with displaced comminuted patella fractures from a total of 146 fractures. Surgical restoration of the knee extension mechanism was supplemented by tension band wired from the patella to the tibial tubercle. The average follow-up period was 26 months. The Cincinnati evaluation form, knee x-ray measurements and isokinetic testing was used for the evaluation of all patients. Eleven patients showed very good to excellent results, whereas six patients showed poor to moderate results.

Using magnetic tomography we were able to detect osteoarthritic changes at an early stage. Under given circumstances, partial patellectomy can produce satisfactory outcomes, such as early mobilization and full kinetic recovery within 3 months.

2. INTRODUCTION

Even today, the treatment of comminuted patella fractures is a point of much controversy. For a long time, total patellectomy was the chosen therapy for the treatment of such fractures (Brooke, 1937; Duthie & Hutchinson, 1958; Khong & Pillay, 1967), but very soon Kaufer (1971) expressed doubts about this method. Today, the preferred therapies are partial patellectomy (Anderson, 1935) and osteosynthesis with tension band (Marya, Bhan & Dave, 1987). The results of partial patellectomy have since been paralleled with the results obtained using osteosynthesis (Matejcic, Puljiz, Elabjer, Bekavac-Beslin & Ledinsky, 2008; Dietz, 2009; Della Rocca, 2013). However, non-satisfactory results of partial patellectomy, have also been documented, mainly due to the premature development of patellofemoral arthropathy (Duthie & Hutchinson, 1958; Hung, Lee, Leung, Chan & Nicholl, 1993).

The purpose of this study is the evaluation of a series of patients with a variety of clinical and visual representation criteria who had comminuted fractures of the patella, and mostly of the lower patella pole, which couldn't withstand other osteosynthetic method and were treated with the method of partial patellectomy.

3. MATERIALS AND METHODS

Between November 2000 and February 2009 we treated 146 skeletally mature patients with patella fractures (Figure 1). Seventeen of those patients were treated with partial patellectomy. These consisted of 11 comminuted fractures and 6 radial fractures, all of which had a large central osseous piece. The classification of the fractures was made using the AO/OTA classification system (Ziegler & Regazzoni, 1992; Dietz, 2009). The age of the patients was between 28-68 years old (47.41 ± 9.36) for the 10 women (W) and 7 men (M) who were included in the study. All patients were Caucasians. We followed clinical progress and re-evaluations for an average of 38 months. The causes of injury were mainly falls ($n=10$), automobile accidents ($n=4$), work-related accidents ($n=2$) and finally sports related accidents ($n=1$). Fifteen of the patients underwent surgery within the first 24-hour period, and the remaining two within 48 hours.

3.1 Surgical technique

The fracture was approached by an anteromedial lengthwise incision of the knee. The lateral and medial retinaculum on both sides were usually ruptured. Following that, a careful removal of all surrounding polar fragments took place, in order to ensure that no bone particles were left behind, checking the condition of the articular cartilage at the same time. With the use of a surgical knife, remaining pieces of bone on the patellar tendon were removed. In two cases of radial fracture, the two main central parts were osteosynthesized using a pair of K wires. The patellar tendon was then sutured to the patella with an ethibond NN1 suture and pulled out with an entrance point very close to the articular surface, exiting from the front upper surface of the patella on a fully extended knee. A stainless steel wire of 1mm diameter was then inserted via a transverse/side tibial tubercle opening, which upon penetrating/crossing the tendon was then tunneled to the upper pole where the two wires end. The stability of this system was checked at 30°, 60° and 90° of flexion. Finally, the lateral and medial retinaculum of the patella and the capsule were sutured and the joint closed (Figure 2). Light immobilization was provided with Robert-Jones bandaging. All patients were encouraged to engage in non-static quadriceps exercises from the first post operative day.

3.2 Follow-up procedure

On the third post operative day the passive movement/exercise system (CPM) was applied. Patients were discharged with instructions for a continuation of non-weighted physiotherapy.

Fifteen patients followed the above program, whereas 2 patients with accompanying skin and soft tissue complications had a splint applied. The onset of mobilization for these 2 patients was delayed by a week.

The patients were examined at regular intervals of 1, 3, 6 and 12 months and subsequently once a year.

For the clinical and x-ray evaluations, the Cincinnati/Noyes evaluation scales (Crenshaw & Wilson, 1954) was preferred as the best way of rating patellofemoral findings. The results were therefore characterized as follows: 90-100 excellent, 80-89 good, 70-79 as moderate and fewer than 70, as poor.

The x-ray examinations included the usual anteroposterior (AP) and lateral (L) radiograph and Merchant's tangent radiograph. Insall-Salvati ratio was used for the assessment of patellar height. Muscle atrophy was observed with measurement of the perimeter of the quadriceps muscles using the healthy muscle as a comparison. Six patients also underwent an MRI knee tomography.

3.3 Statistical analysis

Because of the small amount of patients, we used the method of descriptive statistics.

4. RESULTS

4.1 Subjective evaluation:

Using the Cincinnati evaluation scale in the 3 months re-evaluation, 7 patients showed excellent results (41%), 4 showed good results (23.5%), 4 showed moderate results (23.5%), and 2 showed poor results (12%). These results showed a significant improvement at 6 months.

At 6 months reevaluation ten patients (59%) reported knee discomfort, 8 of which after medium exertion, 2 with continuous pain and reduction of activity. Three patients (18%) complained of knee swelling and a certain amount of movement restriction while working, taking part in sports, or during everyday activities. At the last follow-up examination, 3 patients (18%) complained of a "giving way" sensation.

4.2 Objective evaluation

Range Of Motion (ROM): For 14 patients ROM was above 90% of the norm at a very early stage (3 months examination). This resulted till the end of the evaluation period. For 2 patients, the final ROM was 80-90% and for 1 patient less than 70%, who also had a 10% loss of extension and an obvious limp.

Muscle atrophy: Three patients had quadriceps atrophy at 1 and 3 months re-evaluation.

Grind Test: From the total of 17 patients that were examined, 8 patients (47%) showed a positive patella pressure point.

4.3 X-Ray Evaluation

X-rays showed that in 10 patients (59%) patellofemoral arthropathy was present at an early stage or already established (3 and 6 months re-evaluation). In 6 of these patients medial compartment arthropathy (35%) was also observed, and in 2 in both compartments (12%).

In the Merchant position, 4 knees showed a post operative change of the patellar pulley relationship (3 months). Of those, during re-evaluations, 1 showed improvement, while the other 3 developed osteoarthritic changes (17, 5%).

Insall-Salvati ratio: Patella tendon's length/ patella's length (AB) = 0.9 (mean value).

Six patients with moderate and poor results after 6 months underwent an MRI examination, which showed development or established osteoarthritic changes. Moreover, slight ossification of the quadriceps tendon presented in 2 patients.

4.4 Complications

In the immediate complications were included 2 superficial infections, which were treated successfully with antibiotics. No wire breakage was observed within the immediate post operative period. Fourteen "silent" breaks resulted after the first 3 months, although exact breakage time could not be ascertained (Figure 3).

5. DISCUSSION

Despite the results of a previous study that suggested that 20-25% of patella fractures undergo partial patellectomy (Hung et al., 1993), in our series, only 11.6% of patella frac-

tures underwent this procedure.

The use of tension band wiring as a safety measure for early mobilization has not made the method more popular and widely used. Although many authors (Nummi, 1971; Akeson, Amiel, Abel, Garfin & Woo, 1987) had some good results in the past, then came the research of Marder, Swanson, Sharkey and Duwelius (1993) creating an atmosphere of discouragement for the method. Our findings corroborate the above controversies with 64% of good or excellent results.

In a further analysis of the results, we noticed that in knees undergoing only partial patellectomy using the method of reinforcement with tension band wiring, mobility was quickly achieved, as was the recovery of muscle strength which was both quick and complete. According to Akeson et al. (1987), immobilization is a negative effect for all joints and especially for the cartilage. Therefore, the beneficial influence of early mobilization on the cartilage was also added to the advantages in our research findings.

The reduction of muscle strength in total patellectomy reaches 50% (Watkins, Harris, Wender, Zarins & Rowe, 1983), whereas only 15% in partial patellectomy (Saltzman, Goulet, McClellan, Schneider & Matthews, 1990).

For the development of osteoarthritic changes, the results of our series are comparable to those of Saltzman et al. (1990) in which, nevertheless, the early mobilization was not introduced. It would seem that early mobilization does not play a role in producing osteoarthritic changes. Probably, the nature and position of cartilage is a significant factor in the development of secondary changes (Hung et al., 1993).

While investigating other factors which predispose towards osteoarthritic changes, we have not taken into account the size and placing of the patella abutment. Attempts have already been made by many authors (Goodfellow, Hungerford & Zindel, 1976; Aglietti, Insall & Cerulli, 1983; Huberti & Hayes, 1984) to map patella pressure points on a pulley at varying flexion degrees. Undoubtedly, the low positioning of the patella and the partial resection contribute to the increase in patellar pressure and quite possibly these changes account for the development of secondary osteoarthritic changes similarly indicated by another study (Hampson & Hill, 1975). This phenomenon was also observed in our series and is in accordance with the Marder et al (1993) study which also adds that patellofemoral contact can be relieved by a frontal abutment positioning despite the prevailing current options (Duthie & Hutchinson, 1958). In our study, posterior positioning was used with only 64% satisfactory results.

6. CONCLUSION

In conclusion, if the above conditions, in relation to the large abutment size, placement and anterior tendon placement on the abutment are met, then partial patellectomy gives satisfactory results. Otherwise an attempt of osteosynthesis should be made, maintaining the patella. In any case, disorders of the articular surface <2mm are acceptable with satisfactory results.



Figure 1. Preoperative CT scan which demonstrates the patellar fracture with an interior bone fragment which attaches to the quadriceps tendon.



Figure 3. Breakage of the wire



Figure 2. Surgical treatment with the use of tension band wiring for the remaining piece of the patella.

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