

Patellar fractures

A 30-year follow-up

Birgitta Edwards¹, Olof Johnell¹ and Inga Redlund-Johnell²

Forty patients who had had a patellar fracture during the years 1950-58 were reevaluated 30 years later. A clinical and radiographic examination was performed. Fourteen patients had subjective complaints. Two thirds of the patients who had more than 2-mm diastasis or 1-mm incongruity had complaints and reduced quadriceps strength. Radiographically, all the patients had a reduction in the lateral patellofemoral distance in the axial view with the greatest reduction in the knees with diastasis or incongruity of the fracture.

There is uncertainty concerning the degree of incongruity and diastasis of patellar fractures that can be accepted. There are several long-term follow-up studies (Nummi 1971, Boström 1972, Cargill 1975, Sanderson 1975, Levack et al. 1985), with the longest around 10 years (Boström 1972, Sanderson 1975), but the risk of development of arthrosis in the long run is largely unknown. We report a 30-year follow-up of 40 cases.

Patients and methods

The Department of Diagnostic Radiology, Malmö General Hospital, has saved all the radiographs from its start. All the films of knee fractures from 1950 to 1958 were reevaluated. All 40 patients with patellar fractures that were alive and still residing in Malmö were included in the study. The median age at the time of the accident was 36 (18-58) years; thus, all the older patients were not alive at the follow-up. The median age at follow-up was 66 (47-93) years.

Radiographic study

All the original radiographs were reevaluated; and the fracture type, diastasis, and incongruity of the joint surface were recorded.

Twenty-two patients had a transverse fracture, 4 patients a longitudinal fracture, and 10 patients a comminuted fracture. A minor avulsion without injury of the joint surface was detected in 4 patients. The patella had been removed in 1 patient with a transverse fracture and in 4 with a longitudinal fracture. According to the initial films, without a standing projection, no patient had arthrosis at the time of the accident.

Sixteen patients' fractures healed with a diastasis of more than 2 mm, and 9 patients had an incongruence of the joint surface of more than 1 mm; 5 patients had both a diastasis > 2 mm and an incongruence > 1 mm. Fifteen patients had neither diastasis nor incongruence.

In the follow-up study, films were taken of both knees including a frontal weight-bearing film to assess femorotibial arthrosis (Ahlbäck 1968). On the conventional anterior-posterior radiograph, sclerosis, cysts, and osteophytes were recorded. The same findings were recorded in the lateral view, and measurements were made of the patellofemoral distance, of the length of the patella, and of the patellar tendon. On the axial view of the patella, the smallest patellofemoral distance laterally and medially was measured (Figure 1).

Clinical examination

All the patients were examined and the complaints concerning the knee were recorded. The knee was examined according to the range of movement and stability. All the findings were compared with the

Lund University Departments of Orthopedics¹ and Diagnostic Radiology², Malmö General Hospital, S-214 01 Malmö, Sweden



Figure 1.

Side view:

- a = Smallest distance between articular parts of the patella and the femoral condyles.
- b = Patellar length.
- c = Patellar tendon length.

Axial view:

- a = Smallest distance between lateral articular parts of the patella and the femoral condyle.
- b = Smallest distance between medial articular parts of the patella and the femoral condyle.



Figure 2. The fracture occurred in 1956. The patient was 24 years old. Because of a diastasis of 1 cm, open reduction and osteosynthesis were performed. The figure shows the result 30 years later. The fracture is healed and on the injured side there is an increased patellar length and a concomitant decreased length of the patellar tendon.

Table 1. Radiographic findings at 30-year follow-up of 40 patellar fractures. Measurements recorded in millimeters, mean SD

	Patellar length	Patellar tendon length	Patellofemoral distance			Patellar osteophytosis	
			Medial	Lateral	Central	Minor	Definite
All injured knees	56 4	46 10	5.1 1.2	5.2 1.3*	5.0 1.7	22	5
> 2 mm diastasis (n 16)	57 3*	45 8*	5.1 1.6	4.6 1.1**	4.4 1.8*		
> 1 mm incongruence (n 9)	57 3	45 8	4.4 1.5*	4.3 0.7**	3.2 1.6***		
No displacement (n 15)	56 3	47 8	5.5 1.9	5.7 1.0	5.5 1.1		
Uninjured knee	54 4	51 9	5.4 1.2	5.7 1.2	5.2 1.3	8	1

Difference from normal knee: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table 2. Clinical findings in 40 injured knees in comparison with uninjured knees. Mean percentage SD

	Quadriceps strength (%)	Diminished range of motion (n)	Subjective complaints (n)	Hamstring strength (%)
All knees	95 15	7	14	90 22
> 2 mm diastasis (n 16)	88 14*	1	9	88 13*
> 1 mm incongruence (n 9)	88 17*	2	6	87 16*
Patellectomy (n 5)	56 23**	2	3	75 18**
No displacement (n 15)	102 16	1	3	100 20

* $P < 0.05$, ** $P < 0.01$.

opposite healthy knee. The muscular strength was determined by using Cybex II, the extension and flexion strength in the knee measured, and the measurements expressed as a percentage of the healthy side. This measurement was not possible to perform in 2 patients with poliomyelitis.

Results

The patellar length was increased and the patellar tendon length diminished in patients with an original diastasis (Table 1, Figure 2). The lateral patellofemoral distance was diminished in patients with diastasis and incongruence. Radiographically, a nonunion of the fracture was found in only 1 patient, but the fragments were not separated.

Femorotibial arthrosis was present in 4 injured knees and in the uninjured knee in 2 patients, where one of those had had juvenile rheumatoid arthritis and had secondary arthrosis only in the nonfractured knee.

The strength of the thigh muscle was diminished in patients with a diastasis (Table 2). After patellectomy the muscle strength was only half of that of the uninjured knee, and two thirds of the patients in this group expressed subjective complaints.

Discussion

The majority of the patients managed very well 30 years after a fracture of the patella. Our results confirm other follow-up studies. 3-11 years after a patellar fracture Sanderson (1975) found the best results when the reduction of the fracture had been exact. Nummi (1971) found patellar arthrosis in half of his patients after 2 years, and recommended surgery if the patellar fracture had a diastasis of more than 2 mm. Boström (1972), who had a 9-year follow-up of the patients in his study, recommended nonoperative treatment in fractures with a diastasis of less than 4 mm and a step smaller than 3 mm. He also reported an enlargement of the patella in accordance with our study. Levack et al. (1985) had a 6-year follow-up, and recommended precise reduction or otherwise a consideration of patellectomy.

The posttraumatic increase in the length of the patella was noticed by Bennet as early as 1922. This increase is accompanied by a decrease in the length of the patellar tendon. It is thus irrelevant to exclude a patella alta or diagnose a patella baja in patients with an earlier fracture of the patella.

In conclusion, the treatment of the 1950s seems fair. However, we have observed a slightly worse outcome in fractures with > 2 mm diastasis; this agrees with experimental studies of injured knee cartilage. Another finding was that, even though cartilage had been damaged, there had been no further arthrosis in knees with good alignment — injured cartilage has healing properties.

References

- Ahlbäck S. Osteoarthritis of the knee. A radiographic investigation. *Acta Radiol (Diagn)* (Stockh) 1968;(Suppl 277):7-72.
- Bennett G E. Operation for hypertrophied patella. *J Bone Joint Surg* 1922;4:593-9.
- Boström Å. Fracture of the patella. A study of 422 patellar fractures. *Acta Orthop Scand* 1972;(Suppl 143):1-80.
- Cargill A O. The long-term effect on the tibiofemoral compartment of the knee joint of comminuted fractures of the patella. *Injury* 1975;6(4):309-12.
- Levack B, Flannagan J P, Hobbs S. Results of surgical treatment of patellar fractures. *J Bone Joint Surg (Br)* 1985;67(3):416-9.
- Nummi J. Fracture of the patella. A clinical study of 707 patellar fractures. *Ann Chir Gynaecol Fenn* 1971;(Suppl 179):1-85.
- Sanderson M C. The fractured patella: a long-term follow-up study. *Aust N Z J Surg* 1975;45(1):49-54.