PATELLECTOMY FOR OSTEOARTHRITIS

A STUDY OF EIGHTY-ONE PATIENTS FOLLOWED FROM TWO TO TWENTY-TWO YEARS

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Eighty-one patients treated by patellectomy for osteoarthritis have been reviewed. Eighty-seven knees were examined with a mean follow-up period of six and a half years. Clinical and radiological assessment was carried out and the results have been analysed. A good result was achieved in 53 per cent, a fair result in 26 per cent and a poor result in 21 per cent. The overall result did not deteriorate significantly with time and the radiological appearance of the tibiofemoral joint deteriorated minimally. Pain before operation, radiological changes at the patellofemoral and tibiofemoral joints and the duration of immobilisation after operation were analysed against the end-result. The only factor before operation that indicated a good prognosis was a minimal radiological change at the tibiofemoral joint. Immobilisation for at least three weeks after operation appeared to be beneficial.

Total excision of the patella, as an elective operation, has been in the surgeon's repertoire for over seventy years. It was carried out as a natural evolution of the operative treatment of fractures of the patella. Heineck (1909), in his extensive review of the subject, found reports of thirteen cases of total patellectomy: five for fracture, four for tuberculosis, three for osteomyelitis and one for primary sarcoma. He stated that although the patella seemed unnecessary for locomotion, its removal was invariably followed by impairment of power and some functional loss. He concluded that patellectomy only deserved consideration in comminuted fractures and then as a measure of last resort. Faced with this authoritative report there was little change in surgical practice for some thirty years, although Ludloff (1925) carried out a patellectomy for chronic arthritis. In 1937 Brooke reported on his experimental and clinical work, suggesting that the patella in man serves no important function, and that the efficiency of the knee was increased with the absence of the patella. This report was reinforced by the full approval of Hey Groves after he had reviewed Brooke's cases and his experimental work. The popularity of patellectomy increased rapidly after this report.

Haggart (1940, 1947) reported on thirty cases of degenerative arthritis of the knee treated by patellectomy with good results over a follow-up period of seven years. Further reports from Haliburton and Sullivan (1958) and Geckeler and Quaranta (1962) revealed good results in over 75 per cent of cases. As more reports of the long-term results of patellectomy became available it became increasingly clear that the results were not always satisfactory and that significant

functional disability was present in some cases (West 1962; Insall 1967; Ellis 1968). There were also reports of the results after fracture indicating a significant number of imperfect results (Scott 1949; Duthie and Hutchinson 1958).

Experimental studies by Bruce and Walmsley (1942), Cohn (1944) and Garr, Moskowitz and Davis (1973) indicated that excision of the patella in rabbits led to the rapid onset of degenerative changes in the articular cartilage of the patellar surface of the femur and to degenerative arthritis of the tibiofemoral joint. Studies by DePalma and Flynn (1958) and DePalma, Sawyer and Hoffman (1963) in dogs showed that excision of the whole or part of the patella resulted in progressive abnormalities consistent with advanced hypertrophic arthritis. Unlike the changes in the rabbit, when severe they led to pain and dysfunction.

In spite of the large number of reports of the end-results of patellectomy, there have been few long-term clinical studies of this procedure for osteoarthritis of the patellofemoral joint (Debeyre, Levernieux and Patte 1962; Geckeler and Quaranta 1962; Thompson and Schweigel 1968). All authors were concerned about the long-term effects of joint nutrition, but were unable to find significant evidence of progressive joint degeneration attributable to patellectomy.

We decided to carry out a review of the experiences of the last twenty-five years at the Royal Orthopaedic Hospital in Birmingham to answer three questions. Do the overall results deteriorate with time? Do the radiological appearances of the tibiofemoral joint deteriorate with time? Are there any factors which affect the end-result?

PATIENTS AND METHOD

A review of the hospital records between 1946 and 1971 was carried out. One hundred and two patients who had had a patellectomy performed attended for personal review by the authors. Eighty-one of these patients had had the patellectomy for osteoarthritis and they are

Fig. 1

The follow-up period of the eighty-one patients, the overall average being six and a half years. Group I were followed for an average of three years and Group II for an average of ten and a half years.

discussed in detail in this paper. The age range was from thirty-four to seventy-seven years, with an average of sixty years. There were twenty-nine men and fifty-two women. A total of eighty-seven knees were examined, forty right and forty-seven left. All patients had had total patellectomy which had been carried out by a variety of techniques and by a number of surgeons at different levels of training.

Fig. 2

The four grades of radiological change for the tibiofemoral joint (Kellgren and Lawrence 1957): I, Doubtful; II, Minimal; III, Moderate; IV, Severe.

The follow-up period was from two to twenty-two years (Fig. 1). The patients were divided into two groups: the first comprised forty-seven knees with a follow-up time of two to five years and a mean of three years; the second comprised forty knees with a follow-up time from five to twenty-two years and a mean of ten and a half years.

Details were obtained from the records of the pain and range of movement before operation, of the predisposing factors and of the period of immobilisation after operation. Seventy-eight knees had had primary osteoarthritis, four had had a previous fracture, two a dislocation of the patella, two an unspecified injury and one a meniscectomy. The review assessment was carried out in two parts (Table I). First, the patient's subjective assessment of the end-result was recorded on a ten-point system, where 10 was a normal knee and 0 was complete failure requiring arthrodesis. Secondly, the surgeon's objective assessment was made, also on a ten-point system, where marks were deducted for pain, quadriceps weakness, loss of movement, radiological deterioration and restricted mobility. Anteroposterior, lateral and tangential radiographs of each knee taken before and after the operation were reviewed by one author, and radiological changes (Fig. 2) were classified into the four grades of Kellgren and Lawrence (1957).

Table I. The method of assessment where 10 is a normal knee and 0 is a complete failure.

<i>Patient's assessment</i>	0-10
Level requiring operation	5
Improvement	6-10
Deterioration	0-4
<i>Surgeon's assessment</i>	0-10
Pain	3
Loss of movement	3
Restricted mobility	2
Quadriceps weakness	1
Radiological deterioration	1

COMPLICATIONS

The complications in this group of patients were few. There were three wound infections which healed uneventfully, and nine patients required manipulation of the joint under anaesthesia. Four patients required further operations on the knee: one had an arthrodesis, two needed tibial osteotomies, and in the fourth patient trimming of femoral condylar osteophytes was carried out three times.

RESULTS

The overall results in the eighty-seven knees (Table II) showed little difference between the assessments by the patient and by the surgeon. There was a good result in 53 per cent, a fair result in 26 per cent and a poor result in 21 per cent.

Radiological deterioration. The radiological deterioration was assessed in sixty-nine knees (Table III). There was no change in forty-eight, one grade of deterioration

Table II. Assessments by the patients and by the surgeons of the results for the eighty-seven knees examined.

Points scored	Number of knees assessed by		Average result (per cent)
	Patients	Surgeons	
Good (8, 9, 10)	45	47	53
Fair (6, 7)	23	23	26
Poor (0-5)	19	17	21
Total	87	87	

in eighteen, and two grades of deterioration in three. There was only a slight tendency for radiological changes at the tibiofemoral joint to deteriorate with time. The patients with one and two grades of deterioration had a significantly longer mean follow-up time ($P < 0.05$) than those with no radiological deterioration, but the linear trend across all three groups was weak and not significant.

Immobilisation after operation. The duration of immobilisation was compared with the end-result, and it was apparent that the latter tended to deteriorate with a shorter time of immobilisation. However, this was not statistically significant when the patients were considered as one group. When the short-term and long-term follow-up groups were analysed separately, it was found that there was a marked difference in the

Fig. 3

The mean time of immobilisation after operation against the end-results for the forty-seven knees in the short-term follow-up group.

mean immobilisation time in the two groups. In Group I it was 3.0 weeks and in Group II 4.75 weeks, possibly indicating changes in surgical practice favouring shorter immobilisation. In the short-term follow-up group there was a significantly longer immobilisation time in those patients obtaining a good result (Fig. 3).

Prognostic factors. Various factors were considered to determine whether it was possible to predict a good result from the information available before operation.

Table III. The radiological deterioration in the sixty-nine knees for which radiographs were available before and after treatment, graded according to Kellgren and Lawrence (1957)

	Grades of deterioration		
	0	1	2
Number of knees	48	18	3
Mean duration of follow-up (years)	5.56	7.17	8.92

$P < 0.05$ for 1 and 2

The level of pain was divided into two grades, those with severe pain (sixty knees) and those with only moderate or mild pain (twenty-seven knees). It was found that there was no significant difference in the end-result in these two groups. The severity of the radiological change at the patellofemoral joint was recorded and compared with the end-result (Fig. 4), but no significant association was found. When the severity of the radiological change at the tibiofemoral joint was considered (Fig. 5), it was found that the knees with moderate (Grade III)

Fig. 4

The radiographs of a fifty-five-year-old woman who had Grade IV changes of the patellofemoral joint and Grade II changes at the tibiofemoral joint. Fifteen years later she had a good result assessed as eight points out of ten but the radiographs of the tibiofemoral joint showed a deterioration to Grade III.

Fig. 5

The radiographs of a forty-nine-year-old woman who had Grade II changes at the patellofemoral joint and Grade III changes at the tibiofemoral joint. Nine and a half years later she had a poor result (assessed as two points out of ten), the changes at the tibiofemoral joint having deteriorated to Grade IV.

and severe (Grade IV) radiological change before operation had significantly worse results ($P < 0.05$) from patellectomy.

DISCUSSION

There has been considerable difference of opinion over the functions of the patella and its importance in the mechanics of the knee. The views have been extreme from those of Brooke (1937) to those of Haxton (1945). The experimental work of Haxton showed that the patella improved the efficiency of knee extension by holding the patellar tendon away from the axis and therefore increasing the extending moment of the pull of the quadriceps. Haxton (1945) and Freehafer (1962) both suggested that the integrity of the quadriceps tendon was important and attention should be directed to its proper repair. This factor led to the development of

the vertical snatch technique (Haggart 1940). Some authors have suggested that the medial and lateral quadriceps expansion should be brought together firmly to reconstitute the quadriceps tendon.

The other factor important in tendon healing, especially when there has been a poor mechanical repair, is the duration of immobilisation. Burwell (1963) compared a group of twenty-four patients immobilised for an average of 4.7 weeks with a second group of thirty patients that were allowed immediate mobilisation of the joint after operation. The results suggested that those patients that were immobilised took longer to achieve a full range of movement. Similar findings were obtained in the present study. However, when assessed against the end-result, there was evidence that a period of three to four weeks of immobilisation was of benefit.

In this study only 53 per cent of the patients achieved a good result. Although up to 80 per cent of the patients could expect to gain some benefit, 47 per cent had either a poor result or considerable residual disability. There was no evidence from this study that the overall results deteriorated with time but there was a slight tendency for deterioration of the radiological changes at the tibiofemoral joint. These results are in broad agreement with others that have been published. There was no indication from the literature of any factors present before the operation that would indicate a good result after it. We were unable to find any factors related to the patellofemoral joints, but there was some evidence that a worse result could be expected with the more severe arthritic change at the tibiofemoral joint.

Assessment of the radiographs was carried out by a single observer on the criteria laid down by Kellgren and Lawrence (1957). They found that a single observer produced a satisfactory degree of accuracy in the assessment of osteoarthritis. However, the influence of personal bias could be reduced by two observers in consultation. This view was challenged by Clarke *et al.* (1975) who found that this system gave a considerable inter- and intra-observer error. They proposed a new system based on separate grading of the three compartments of the joint, achieved by comparing supine and erect films. Leach, Gregg and Siber (1970) emphasised the importance of films showing weight-bearing when making the diagnosis of osteoarthritis of the knee.

This survey suggests that only half the patients have significant improvement after operation and this would favour a conservative approach especially for those patients who will later have total joint replacement and need to have the extensor mechanism retained.

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