FRACTURE OF THE PATELLA TREATED BY TOTAL EXCISION

A LONG-TERM FOLLOW-UP

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Thirty-one patients have been reviewed four and a half to thirteen years after total excision of the patella for fracture. This operation did not give the uniformly excellent results previously reported by some authors. The type of incision used was unimportant in the long term. Immobilisation in plaster-of-Paris for any period between one and eight weeks after operation had no adverse effect on the long-term results. There was no correlation between the amount of calcification or ectopic bone formation found in the patellar tendon and the degree of function or discomfort in the joint. There was no evidence that osteoarthritis is an inevitable sequel to patellectomy in man. Maximal recovery of knee function may take up to three years after patellectomy. In this series 22 per cent of patients had excellent results, 39 per cent good results and 39 per cent poor results, according to defined criteria. The implications of these findings are discussed.

There has been controversy in the literature over the long-term morbidity after total patellectomy for fracture. Brooke (1937) reviewed thirty patients. He reported "a rapid and smooth post-operative recovery taking two or three weeks". This was followed by "a complete recovery of function such that a labouring man could return to full work within four to six weeks of operation". Eight of these patients were seen personally by Hey Groves who confirmed the findings. As a result of this and further experimental work, Brooke concluded that "the patella serves no important function in man. In its absence the efficiency of the knee joint is, if anything, increased both as regards rapidity of movement and power". Watson-Jones (1945) reported similar excellent results in all the patients that he reviewed five years and more after patellectomy for linear or comminuted fractures.

Haxton (1945) and later Jensenius (1951), on the basis of experimental work, showed that the patella was not without importance in the knee joint and was responsible for improving its efficiency. Moreover, Bruce and Walmsley (1942) and Cohn (1944) showed conclusively in rabbits that degenerative changes always occurred in the articular cartilage of the knee after patellectomy, though without obvious change in gait or joint efficiency. In consequence they urged caution in excising the patella.

Fairbank (1945) found that the results of patellectomy for fracture were anything but perfect. Scott (1949) analysed a questionnaire on seventy-one patients. He found considerable disability in most patients and only 5 per cent reported a normal knee.

This controversy stimulated a long-term follow-up of patients with fractures of the patella treated by

patellectomy at the Norfolk and Norwich Hospital from January 1963 to March 1971, which forms the basis of this report.

MATERIAL

Fifty-nine patients were called for review but only thirty-seven attended. Six patients were excluded from the survey. Four of these had sustained a significant injury to the knee before patellectomy; one had suffered a recent cerebro-vascular accident and one had pathological changes in the other knee, thus rendering its use as a control invalid.

The thirty-one patients remaining had been followed up for four and a half to thirteen years, with an average of 7.7 years. Their ages ranged from sixteen to sixty-nine years with an average of forty-one years. Sixty-eight per cent were male and thirty-two per cent female. The average age in males was thirty-eight years and in females forty-seven years. Sixteen fractures were of the left patella and fifteen of the right.

All patients were operated on within five days of injury. A number of surgeons performed the operations. All patients had total patellectomy with repair of the patellar tendon and of the retinacula if they were ruptured. All patients were treated after operation in a plaster-of-Paris splint and thereafter by mobilisation with intensive physiotherapy.

All fractures were the result of direct violence; three were compound and were operated on within eight hours of injury. Twenty were displaced comminuted fractures; five were comminuted without separation of the fragments and three were transverse fractures with wide separation of the two poles. The original radiographs of three patients were not available.

METHOD

Each patient was personally interviewed and examined to compare the injured knee with the normal knee. Particular attention was paid to symptoms of aching, pain, swelling and stiffness. Patients were asked about giving way of the joint, limp, and difficulty with stairs. In addition, their ability to ride a bicycle, participate in sport or dance was ascertained. Finally, the patient's own assessment of the knee was noted.

In the examination specific attention was paid to the type of incision used, joint stability and range of movements. Quadriceps muscle bulk was assessed by comparing the mid-thigh circumference of the injured and normal limbs. The measurements were made at equal distances above the tibial tubercles on the two legs. Quadriceps power was measured by asking the patients to extend each knee against a spring balance starting from 90 degrees of flexion. The patient sat on an examination couch with the balance attached from an ankle to the bar of the couch. The best of three balance readings was taken from each limb for comparison. Similar measurements of muscle bulk and quadriceps power were obtained from forty control patients between the ages of sixteen and seventy. From these the normal variation to be expected between right and left legs was determined.

Assessment of results—Patients were graded into *excellent*, *good* or *poor* groups according to the following criteria. In an *excellent* result there was no pain, swelling, aching or stiffness, no restriction of activity, no giving way, and no limitation of movement. Muscle bulk and quadriceps power were within the normal range. The patient was delighted with the result. In a *good* result there was no pain or swelling but there might be occasional aching or stiffness. There was slight weakness and slight restriction of activities. There was no giving way and no limitation of movement. Muscle bulk and quadriceps power were slightly below the normal. The patient was satisfied with the result. In a case with a *poor* result there might be pain, swelling or a marked feeling of weakness. There was marked restriction of activities, with a history of giving way, and some limitation of movement. Muscle bulk and quadriceps power were well below the normal. The patient was not satisfied with the result.

If patients did not qualify on any one of these points they were automatically put into the next group down.

Assessment of the normal values for muscle bulk and quadriceps power—From the forty normal patients it was shown that there can be up to a 3 per cent difference in the muscle bulk between the two thighs. It is not necessarily the dominant leg that has the greatest muscle bulk.

Similarly it was shown that there can be up to a 20 per cent difference in the power between the right and left quadriceps muscles. Again it is not necessarily the dominant leg which has the greater power.

These two figures of 3 per cent and 20 per cent were taken as the normal values when comparing the operated with the opposite knee. Patients within these percentages were considered for Group I. Patients outside the normal limits but within a 5 per cent difference for muscle bulk and a 30 per cent difference for quadriceps power were considered for Group II. Percentage differences greater than these caused the patient to be placed in Group III.

RESULTS

In the thirty-one cases the result was excellent in seven (22.6 per cent), good in twelve (38.7 per cent) and poor in twelve (38.7 per cent).

The average age and period of follow-up for each group are shown in Table I.

Osteoarthritis—In no patient was there clinical evidence of osteoarthritis in either knee. In one patient there was minimal radiological evidence of arthritic change in the injured knee. This was symptomless and the joint was graded as excellent.

Calcification in patellar tendon—Calcification or ectopic bone formation in the patellar tendon was crudely graded from radiographs as: considerable, moderate and slight or none. There was no correlation between the amount of these deposits seen and the overall assessment of the joint (Table II).

Incision—A variety of incisions was used: transverse, vertical mid-line, medial and lateral parapatellar. In some cases the incision followed the compound wound. There was no complication directly related to any of the incisions used, and no correlation between the type of incision and the ultimate grading of the patient.

Type of fracture—Only twenty-eight original radiographs were available for review. Table III shows the types of fractures sustained in relation to the final assessment. There was no relationship between the type of fracture sustained and the final group assessment of the patient.

Compound fractures—There were three compound fractures in the survey. The numbers are too small to allow any definite conclusions. However, it is worth noting that none of these patients gained an excellent result: the result was good in one case and poor in two cases.

Range of movement and stability—Only three patients had less than a full range of knee flexion. They had flexion of 40 degrees, 75 degrees and 90 degrees from the neutral position. One of these patients had been in plaster for eleven weeks. The other two patients showed no obvious reason for the limitation of movement.

No patient had any clinical evidence of instability in the injured knee. Only one patient had a lag in extension. This was of 5 degrees, and was associated with impaired muscle bulk and quadriceps power.

Splintage after operation—All patients except one mentioned above were treated in a plaster-of-Paris cylinder for periods of one to eight weeks. Within these limits there was no relationship between the length of time in plaster and the final result.

Many patients in this survey remarked spontaneously that it had been two to three years before the knee had made its fullest recovery.

DISCUSSION

From this series it seems clear that although patellectomy in rabbits invariably gives rise to osteoarthritis there is no evidence to suggest that this is the inevitable sequel in man. This supports the observation of Brooke (1946), who found no evidence of osteoarthritis in a five to fifteen years' follow-up of thirty-five patients following patellectomy.

TABLE I
RESULTS RELATED TO AGE AND FOLLOW-UP

Grading	Average age (years)	Average follow-up (years)
Excellent	43	7
Good	47	8
Poor	42	8

TABLE II
RESULTS RELATED TO CALCIFIED DEPOSITS OR ECTOPIC BONE

Grading	Considerable	Moderate	Slight or none
Excellent	1	2	4
Good	2	4	6
Poor	0	3	9

TABLE III
RESULTS RELATED TO TYPE OF FRACTURE

Type of fracture	Excellent	Good	Poor
Displaced—comminuted	5	9	6
Undisplaced—comminuted	1	1	3
Displaced—transverse	0	1	2

Wass and Davies (1942) reported that more than a trifling amount of calcification or ossification at the site of patellectomy was a distinct disadvantage and interfered with recovery of knee function. However, Dobbie and Ryerson (1942) reported that the effect of nodule formation and calcification in the patellar tendon was beneficial in producing a substitute patella. Duthie and Hutchinson (1958) found that the degree of discomfort in the knee probably had a direct relationship to the amount of ossification in the tendon. I have been unable to substantiate any of these findings. There was no correlation between the amount of these deposits and the degree of function or discomfort in the joint.

It has been shown that total patellectomy for comminuted or displaced transverse fractures of the patella does not give the uniformly excellent results previously reported by some authors. We have been unable to find any specific factors related to the type of fracture sustained, the surgical technique adopted or the initial post-operative management which can be shown to influence the final symptomatic and functional results. However, in this retrospective survey one important piece of information was not available. This was the nature and degree of damage done to the femoral and tibial articular surfaces at the time of injury. It is suggested that the long-term results of patellectomy following trauma may be directly related to this initial damage, and it is proposed to investigate this possibility further in a prospective study.

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