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LATE RESULTS OF PATELLECTOMY IN FRACTURED PATELLA

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The fracture of the patella is one of the first fractures treated by surgery. As early as 1598, Severino (Bick 1948) performed open reduction and internal suture of the fragments with wire. Ever since, open reduction and internal suture have been increasingly popular, and almost every feasible method and material has been used to achieve firm internal fixation. The result of internal suture has not been uniformally encouraging and this has been mainly due to (1) fibrous union or non-union (2) refracture (10 per cent of fractured patellae treated by suture refracture and the majority occur within the first year), and (3) malunion leading to irregularity of the articular surface: predisposing to secondary patello-femoral osteoarthrosis with a painful stiff knee, demanding patellectomy at a later date.

Thompson (1935) introduced partial excision of the patella in selected cases, and Brooke (1937) popularised total patellectomy in the treatment of fractured patella.

In spite of these advancements, the surgical treatment of the fractured patella is still unsettled and controversial. In fact, every case of fractured patella does not need operative interference. Surgery is indicated in (1) comminuted fracture with displaced fragments, and (2) transverse fractures with ruptured extensor mechanism.

The aim of surgery in these cases is to restore the continuity in the extensor apparatus of the knee joint. The controversy lies in the decision: whether or not the patella should be excised. Conflicting views on the effect of excision of the patella with regard to knee function are available. In this paper an attempt has been made to evaluate the functional results of patellectomy in cases of fractured patella.

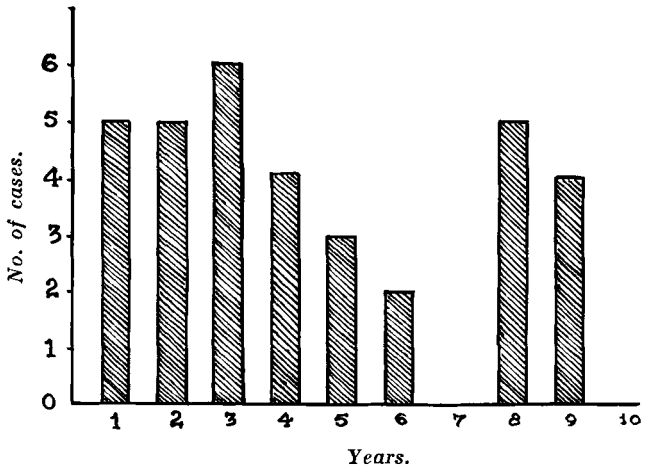

Figure 1. Period of follow-up.

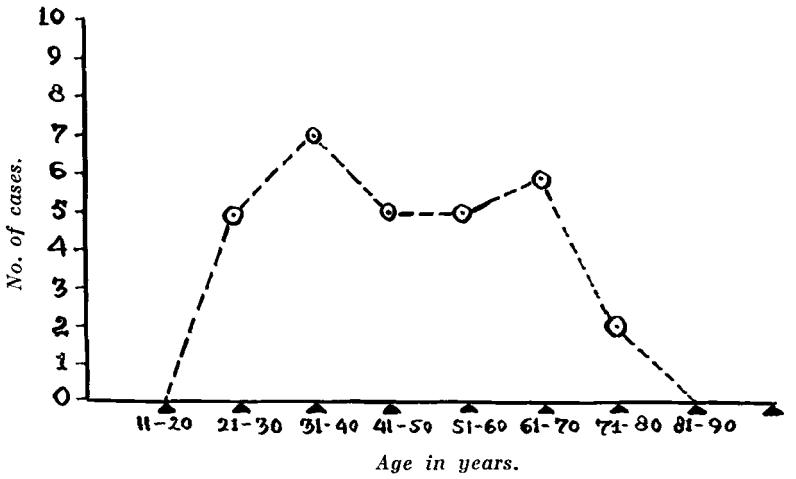

Figure 2. Shows number of cases operated in a particular age group.

METHOD AND MATERIAL

Thirty cases of fractured patella treated by partial or total patellectomy at Walton Hospital, Liverpool, during the period from 1959 to 1967 were studied.

The type of fracture, the type of operation performed, the period of immobilisation, and the length of follow-up were recorded. Each patient was examined, and subjective evaluation depending upon aching at rest, pain, stiffness or weakness in the joint was made. The criteria for objective assessment were crepitus on moving the joint, the range of active flexion, any extension lag, the power in the

quadriceps muscle as compared with the normal side and quadriceps girth at mid thigh level compared with the other thigh to evaluate the degree of muscle wasting.

Each knee was examined radiographically to detect any degenerative changes in the femoral condyles following partial or total patellectomy and any ossification in the quadriceps tendon.

The results were classified into four groups:

1. *Excellent:* When the operated knee was functionally indistinguishable from the normal knee, i.e. no symptoms, loss of flexion not more than 10°, no extension lag, power normal and no quadriceps wasting, no degenerative changes in the X-ray.

2. *Good:* When the patient was satisfied with the results, but further questioning or examination revealed a knee less efficient than normal, i.e. minimal subjective symptoms, e.g. occasional aching or stiffness, limitation of flexion not more than 30°, no extension lag, quadriceps wasting not more than half an inch, power normal.

3. *Fair:* When the knee functioned well but some definite subjective or objective disabilites were present, i.e. aching, occasional stiffness, weakness on going upstairs, flexion at least 90°, extension lag not more than 10°, quadriceps atrophy up to 1 inch and power slightly less than normal.

4. *Poor:* When the knee failed to attain the above standards, i.e. the patient complained of constant pain and stiffness in the knee, flexion less than 90°, extension lag more than 10°, marked quadriceps and power very weak.

The follow-up of these thirty cases was from one year to nine years after operation, the average time being four years (Figure 1).

Sex, Age and Side

The youngest patient in the series was 25, and the oldest was 77 years. The fractured patellae severe enough to demand surgery were commonest in the age group of 31 to 40 years (Figure 2). There were 21 males and 9 females, giving a sex ratio of 2:3 males to 1 female. Both sides were involved with equal frequency. One case had a re-fracture, the first fracture having been treated non-operatively 20 years ago.

Type of Fracture and Operation

Nine cases presented with transverse fractures and 21 with comminuted fractures. The type of operation performed in these cases is shown in Table 1.

The majority of these cases were operated upon within five days of injury; 9 cases were operated on the day of admission. Only 2 cases had delayed operation, one on the tenth day and the other on the seventeenth day. Both were involved in road traffic accidents, had multiple fractures, and were unfit for early surgery. Three cases were open fractures and all had their operation on the day of injury.

All these knees after operation were immobilised in a plater cylinder for 3 to 4 weeks, followed by supervised knee mobilisation. Static quadriceps exercises were encourged as soon as possible after the operation. The average period from operation until discharge from the clinic was 4.5 months.

Table 1. Type of fractured patella and different operations performed.

Type of fracture	No. of cases	Total patellectomy	Partial patellectomy
Transverse fracture	9	6	3
Comminuted fracture	21	20	1
Total	30	26	4

RESULTS

Subjective assessments: Sixteen patients (53.3 per cent) were asymptomatic and the rest presented with varying degrees of aching, stiffness or weakness, as shown in Table 2.

Objective assessments: The clinical findings at review are shown in Table 3. The overall functional results of patellectomy are shown in Table 4.

DISCUSSION

The majority of patients after patellectomy recovered good knee function. In this statistically small series of 30 cases of fractured patella treated by patellectomy, 21 cases (70 per cent) recovered excellent to good knee function, 6 were fair and only 3 had poor results. In 2 of these 3 cases the poor results were due to associated injuries and postoperative complications and not wholly attributable to the patellectomy. This is very much in agreement with the results published by Blodgett & Fairchild (1936), Brooks (1937), Dobbe & Ryerson (1942), Herwitz & Lambert (1946) and many others.

Scott (1949), analysing the long-term results of 101 cases of fractured patella treated by total patellectomy, reported that only 5 per cent of patients considered they had a normally functioning joint, 90 per cent had aching in the joint, and 60 per cent complained of weak-

Table 2. Subjective assessment.

Symptoms	Total patellectomy	Partial patellectomy	Per cent
Aching	10	–	33.3
Pain	–	–	–
Stiffness	7	–	23.3
Weakness	4	–	13.3
Asymptomatic	12	4	53.3

Table 3. Objective assessment.

No.	Objective assessment	Total patellectomy	Partial patellectomy
1	Crepitus	7	1
2	Loss of flexion		
	0 to 10°	12	3
	10 to 30°	8	–
	over 30°	5	1
3	Extension lag		
	No lag	24	4
	Less than 10°	1	–
	More than 10°	1	–
4	Quadriceps wasting		
	No wasting	8	3
	Less than ½″	12	1
	½ to 1″	6	–
	More than 1″	–	–
5	Quadriceps power		
	Normal	15	4
	Slight weakness	8	–
	Marked weakness	3	–
6	X-ray findings		
	Degenerative changes	4	1
	Ossification in tendons	16	–

Table 4. Overall results.

Results	Total patellectomy	Partial patellectomy
Excellent	3	2
Good	15	1
Fair	5	1
Poor	3	–

ness. In the present series, 16 patients (12 total patellectomies—47 per cent and 4 partial patellectomies) felt that the injured knee was as good as the normal side. As shown in Table 3, only 10 patients (13.3 per cent) felt any weakness. Two patients felt aching in the joint more or less all the time, but the remaining 8 had only occasional aching with bad weather. The degree of stiffness and weakness in the joint was not observed to cause any significant disability to the patients.

The quadriceps wasting is a marked feature in cases of fractured

patella and the muscle does not seem to regain its normal girth after patellectomy. Eleven cases regained normal quadriceps girth, but 19 had quadriceps wasting varying from ½ inch to 1 inch (13 cases less than ½ inch). Only 4 patients complained of slight subjective weakness, whereas the majority of the patients were quite unaware of the quadriceps wasting. This could be explained by the immense reserve power of the quadriceps muscle. The clinical assessment of quadriceps power revealed normal power in 19 cases, slight weakness in 8 and marked weakness in 3 cases.

Smillie (1951) suggested that excision of the patella frequently led to an extension lag of 5° to 15°. In the series reported here only 2 cases showed an extension lag of 5° to 15°, the rest recovered full extension. The extension lag after excision of the patella could be prevented by care during the post-operative period, the flexion movement not being started until the power of active straight leg raising had been regained (Wardle 1950).

Blodgett & Fairchild (1936) believed that the patella did not regenerate after excision. On the contrary, Friberg (1942) demonstrated regeneration of bone in the patellar bed and observed that marked regeneration was associated with poor end results. Regeneration of the excised patella was also observed in young puppies by Carey et al. (1927). In the present series a complete regeneration of the patella has not been demonstrated, but 16 cases did show varying degrees of ossification in the quadriceps tendon. This could be regarded as an attempt at regeneration.

The analysis of the results of patellectomy in cases showing some ossification in the quadriceps tendon shows 2 excellent, 8 good, 5 fair and 1 poor result. This is in marked contrast to Duthie & Hutchinson (1958), who believed that the ossification in the quadriceps tendon was commonly associated with a poor end result. Jensenius (1951) believed that the phenomenon of regeneration of the patella was undesirable and led to arthritic changes in the same way as a badly sutured patella. Out of 16 cases with ossification in the quadriceps tendon, only 3 showed degenerative changes in the femoral condyles, whereas the remaining 13 were normal. It is reasonable to conclude that the ossification in the quadriceps tendon is neither responsible for degenerative changes in the femoral condyles nor is associated with poor end results. It is probably an incidental finding and is the result of osteoblast remaining in the tendon after the excision of the patella.

The patella is believed to glide on the articular surface of the femoral condyles with less friction than the quadriceps tendon. Thus, the patella is said to protect the femoral condyles from the traumatising influence of the tendon. A high incidence of degenerative changes of the femoral condyles following patellectomy has been reported by various workers (Bruce & Walmsley 1942). In the series no evidence could be found to suggest that the patellectomy itself produced osteoarthrosis during the period of follow-up. Only 5 cases showed some evidence of mild degenerative changes and the average age of these patients was 66 years; therefore, one cannot exclude the possibility of the arthritic changes being a part of normal wear and tear. Moreover, the initial injury to the articular surface may well have laid the foundation for degenerative changes in the femoral condules. Patellofemoral arthritis is reported to occur in cases of partial excision of the patella if precautions are not taken to avoid tilting of the patellar fragment (Thompson 1935). The articular surfaces of femoral condyles may be damaged by the retained patellar fragments rather than by removing it.

SUMMARY

1. Thirty cases of fractured patella treated by partial or total patellectomy have been analysed to assess the late results of patellectomy.

2. The functional results of patellectomy in fractured patella are good. The patellectomy does not adversely affect the motion, strength or stability of the knee joint.

3. Complete excision of the patella is not always followed by arthritic changes in the femoral condyles.

4. The ossification in the quadriceps tendon is probably not of much clinical significance.

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