RESULTS OF SURGICAL TREATMENT OF PATELLAR FRACTURES

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Sixty-four patellar fractures treated either by internal fixation or by patellectomy were reviewed retrospectively from 3.5 to 10.1 years (average 6.2 years) after operation. Results were assessed subjectively and objectively. Of the 64 patients, 45% had a good result, 27% fair and 28% poor. On the whole, patellectomy produced better results (60% good, 20% fair, 20% poor), than internal fixation (31% good, 33% fair, 36% poor). Nevertheless, the best results of all were achieved by precise anatomical reduction of the patellar fracture and fixation with K-wires and a tension band. Where this could not be achieved, however, patellectomy gave the best results.

Controversy over the place of patellectomy in the treatment of fractures of the patella has continued since Ralph Brooke presented 30 cases, all apparently with excellent results (Brooke 1937). Hey Groves' initial incredulity was dispelled when he personally examined eight of Brooke's cases and commented that "if the knee were covered with bandage one could not guess which had been the damaged limb" (Hey Groves 1937). Both these authors had previously considered the patella to be a phylogenetic remnant whose removal would impair the efficiency of the knee.

Watson-Jones (1945) was more cautious but remained in favour of patellectomy. Further support came from Duthie and Hutchinson (1958), West (1962), Khong and Pillay (1967) and Mishra (1972). However, Fairbank (1945) disagreed with Brooke, describing the results of patellectomy as ranging from "disastrous to less disastrous". In 1971 Kaufer, repeating Haxton's earlier work (1945), demonstrated that patellectomy reduced the efficiency of the extensor mechanism by as much as 30%, suggesting that the patella be retained. As the popularity of patellectomy declined, internal fixation (osteosynthesis) came into use and became more refined with the introduction of the tension band technique (Müller *et al.* 1979). A recent paper from Scandinavia by Böstman, Kiviluoto and Nirhamo (1981) suggested that patellectomy had little to offer in treating patellar fractures and that even comminuted fractures should be treated by internal fixation. However, it has been our experience that internal fixation for patellar fractures

is a difficult operation, and also that patellectomy did not deserve its bad reputation. Because we were unable to find a prospective review of the surgical treatment of patellar fractures and as they account for 1% of all fractures, we felt that a retrospective review and comparison of the surgical treatment of patellar fractures could be of value.

METHODS AND MATERIALS

One hundred and four patellar fractures had been treated surgically at Black Notley and its associated hospitals between 1972 and 1979. Seventy-five of the patients, with an average follow-up of 6.2 years (range of 3.5 to 10.1) were reviewed initially. There were 42 men and 33 women with an age range of 19 to 99 years (mean age 49 years). However, six had associated intra-articular fractures and five had undergone partial patellectomy. These 11 patients were therefore excluded, leaving 64 patients available for final review.

All the patients were interviewed, examined and asked to give their own subjective assessment of the result, scoring it out of one hundred; radiographs also were taken of all the knees.

Using a spring dynamometer, quadriceps strength was measured in both flexion and extension (Figs 1 and 2). A strap round the patient's ankle led to a spring balance attached to a lever. The patient was asked to resist the pull of the lever and the reading was taken as soon as the patient's foot moved from a pre-arranged mark. Because the foot was clear of the ground in the flexion readings, there was no frictional component. The average of three readings taken in each position was expressed as a percentage of that of the normal leg.

Because it seemed inappropriate to compare elderly women with fit young men on a functional scoring system (Lysholm and Gillquist 1981), an arbitrary method of assessment was used. The four criteria were: pain, limitation of activity, loss of quadriceps power and the

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Fig. 1

Fig. 2

Measuring quadriceps strength. Figure 1—In flexion. Figure 2—Extension.

patient's own previously recorded subjective score. Each patient was scored according to the system shown in Table I. Patients with more than nine points were considered to have a good result, with no pain, no limitation of activity, no quadriceps wasting and no subjective disability in the knee. A patient with a fair result (six to nine points) had a minimum of pain during exertion, limited activities (especially sports) and some wasting of the quadriceps with some subjective symptoms. A patient with a poor result (less than six points) had severe and constant pain with greatly diminished activities and marked weakness of the quadriceps.

RESULTS

Of the 64 patients we are reporting 29 (45%) achieved a good result, 17 (27%) were considered fair and 18 (28%) poor (Table II). Thirty-four patients (53%) had patellectomies and the remaining 30 (47%) had osteosynthesis. In the patellectomy group, 60% (20 patients) had a good result, 20% (7 patients) a fair result and 20% (7 patients) a poor result. In the osteosynthesis group, 31% (9 patients) achieved a good result, 33% (10 patients) a fair result and 36% (11 patients) a poor result. It would seem, therefore, that patellectomy produced the overall better result. Moreover, patellectomy had been carried out on the more comminuted fractures, in which the bone had been subjected to a higher energy injury.

In the internal fixation group, two different techniques had been used to reconstitute the patella. One was circumferential wiring, a procedure carried out on 16 patients of whom two had a good result, five a fair result and nine a poor result. In the other 14, in whom K-wires and anterior tension band wiring had been performed, seven had a good result, five a fair result and two a poor result.

Table I. Scoring system

Symptoms, signs and subjective assessment	Score
<i>Pain</i>	
No pain	3
Minimal pain during activity	2
Constant severe pain even at rest	1
<i>Limitation of activity</i>	
Unlimited activity	3
Limitation of activities, especially sports	2
Greatly diminished activities	1
<i>Loss of quadriceps power</i>	
No loss of quadriceps strength	3
30–45% decrease in strength	2
Greater than 45% decrease in strength	1
<i>Subjective functional assessment</i>	
75–100	3
50–74	2
0–49	1

Table II. Comparison of results

Group (no., %)	Good		Fair		Poor	
	No.	%	No.	%	No.	%
Overall results (64)	29	45	17	27	18	28
Total patellectomy (34, 53)	20	60	7	20	7	20
Osteosynthesis (30, 47)	9 (2C) (7K)	31	10 (5C) (5K)	33	11 (9C) (2K)	36

C, circumferential wiring

K, anterior tension band and K-wires

In an attempt to assess how long the patients took to recover and how completely they recovered, those 29 with good results were asked how long it took them to reach their present satisfactory state, while those 18 with poor results were asked when their symptoms developed.

Fig. 3

Fig. 4

Figure 3—Poor results: onset of symptoms. Figure 4—Good results.

Seven patellectomy and six osteosynthesis patients with poor results complained of symptoms within the first four months, while the remaining five osteosynthesis patients with poor results did not complain of symptoms until after this time. One osteosynthesis patient did not complain of symptoms for three years (Fig. 3).

The findings for the 29 patients with good results show a similar consistency. Seven of the nine osteosynthesis patients achieved good results within the first six months in contradistinction to the patellectomy patients, three of whom achieved a good result within the first six months while the remaining 17 continued to develop good results over the next two years. Postoperative relief of symptoms (or lack of relief) was most apparent between 6 and 12 months (Fig. 4).

Quadriceps strength was measured as previously described and the results are shown in Table III. Wilkinson (1977) has shown that in normal individuals

the quadriceps muscle of one leg may be as much as 20% stronger than that in the other leg, and that strength does not necessarily correspond with dominance. Accordingly, up to 30% difference was not considered to be significant, 30–45% was considered to be moderate loss and over 45% was considered to be marked loss of quadriceps strength. No patient who had undergone osteosynthesis and retained his patella had lost more than 45% of quadriceps strength, whereas nine of the 34 patellectomies had done so and nine had fair or poor results; however, of the 16 who had undergone patellectomy and regained full quadriceps strength, all had good results.

DISCUSSION

Our results show that less than half of all the patients reviewed (45%) had good results, confirming that a fractured patella is a serious injury with a poor functional result.

In the osteosynthesis group, the majority of cases (16 out of 30) were treated by circumferential wiring; 9 of these 16 had poor results and these accounted for the majority of the poor results of osteosynthesis. Our results are in accord with those of Weber *et al.* (1980); they studied different methods of fixation for patellar fractures and concluded that circumferential wiring was the least effective, as it gave poor fixation, limited patellar retinacular function and might interfere with the blood supply of the patella.

Table III. Loss of quadriceps power

Group	Loss of quadriceps power		
	0–30%	30–45%	45% +
Total patellectomy (34)			
Good	16	4	
Fair		5	2
Poor			7
Osteosynthesis (30)			
Good	7	2	
Fair	8	2	
Poor	4	7	

Of the 14 patients treated by tension band wiring, 7 had good results, 5 were fair and 2 poor. These results correlated closely with the quality of reduction and fixation; the more comminuted fractures which were technically difficult to reduce and hold had the worst results. However, those transverse fractures with no comminution at the fracture line, and which were easily reduced and held, progressed to a satisfactory clinical result and did not deteriorate with time.

A feature in our survey was that patients with poor results had symptoms which varied with the different procedures. After patellectomy, patients with poor results typically complained of weakness and instability; those treated by osteosynthesis complained of pain, both on activity and at rest. The most likely cause of this pain is degenerative change in the patellofemoral joint, which was confirmed radiologically in all the eleven poor results after osteosynthesis. The subjective complaint of weakness was investigated by measuring quadriceps strength (Table III). Significantly, no patient lost more than 45% quadriceps strength after osteosynthesis. In the patellectomy group, 16 of the 34 regained full power and achieved a good result, suggesting that even in the absence of the patella full quadriceps strength may be regained.

With regard to timing, patients who underwent patellectomy seemed to improve as time passed, taking up to two years to reach their optimum state. Thus, 20 of the patellectomy patients were still achieving good results up to two years after the injury, whereas the 9 patients with good results after osteosynthesis achieved their optimum state in 8 months. In the group of patients with poor results, seven patellectomy patients developed their symptoms either immediately or within three months of their injury, whereas in the osteosynthesis group, five of 11 patients did not develop their symptoms until many months after the original injury. In brief, patients who had undergone patellectomy improved with time, whereas those who had undergone osteosynthesis became worse with time.

Direct comparison of patellectomy and fixation

proved unsatisfactory, first because the operations tend to be used for different injuries, osteosynthesis being preferred for the simple transverse avulsion type of fracture; secondly, because osteosynthesis is not a consistently reproducible operation, it can be technically difficult to achieve an anatomical reduction and stable fixation, and less than satisfactory reduction was sometimes accepted.

Comparison of the two methods for all fractures showed that twice as many patients achieved a good result after patellectomy as after osteosynthesis. The unsatisfactory results following osteosynthesis may be partly attributed to the large number of patients (16 out of 30) treated by circumferential wiring, with 57% of this group (9 out of 16) having poor results.

Measurement of quadriceps power following osteosynthesis showed little functional loss, whereas all nine patients who had lost more than 45% of quadriceps power had undergone patellectomy. However, nearly 50% of the patellectomy patients were able to regain full quadriceps power and all those who regained full power were satisfied with the knee. We were unable to relate the results after patellectomy to the technique used for repairing the quadriceps expansion. Kaufer (1971) has shown that a 30% increase in quadriceps power is required to overcome the mechanical disadvantage of patellectomy; such an increase demands a considerable amount of rehabilitation and complete recovery may take several years to achieve.

Conclusion. After a fracture of the patella, the best results are obtained by accurate reduction and stable fixation, probably by tension band wiring. If accurate reduction and stable fixation cannot be achieved, then patellectomy seems preferable, especially with comminuted fractures. However, after patellectomy patients must accept an intensive and prolonged rehabilitation programme and understand that the knee will not reach its maximum function in under two years.

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