TOTAL KNEE ARTHROPLASTY AFTER PATELLECTOMY

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We compared the outcome of total knee arthroplasty in 19 patients who had had previous patellectomy with the results in a matched series of arthroplasties performed on knees in which the patella was intact. The mean follow-up was 63 months (21 to 114). In the study group, the outcome was poor in five patients. There was instability in the coronal plane in three patients and persistent pain in four. Three supracondylar fractures occurred. The overall complication rate was 36%.

In the control group, pain was relieved in every case and there were no complications. Total knee arthroplasty has a higher complication rate and inferior results if the knee has undergone prior patellectomy.

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There have been conflicting reports of the results of total knee arthroplasty after patellectomy, perhaps because of inconsistencies of diagnosis, clinical grading, indications for arthroplasty and design of implant used (Bayne and Cameron 1984; Lennox, Hungerford and Krackow 1986; Larson et al 1991). We undertook a matched study to compare the outcome of total knee arthroplasty after patellectomy with the outcome in patients who had an intact patella which was resurfaced during the arthroplasty.

PATIENTS AND METHODS

We identified 20 patients who had had prior patellectomy from the 1122 Total Condylar and Kinematic knee arthroplasties (Howmedica Incorporation, Rutherford, New Jersey) performed at the Centre for Hip Surgery, Wrightington Hospital, from 1980 to 1987. One patient was excluded because the follow-up was less than one year. Their mean age was 64 years (36 to 81); 12 were women and 7 men and there were 11 right and 8 left knees. Fourteen had osteoarthritis (OA) and five rheumatoid arthritis (RA).

Four patients who had had bilateral patellectomy had only unilateral knee arthroplasty; four patients who had had bilateral total knee arthroplasty had only unilateral patellectomy. The other 11 patients had unilateral patellectomy and subsequent total knee arthroplasty on the same knee. A Total Condylar prosthesis was implanted in ten patients and a Kinematic prosthesis in nine. The Kinematic prostheses were all of the non-posterior-stabilised (posterior-cruciate-sparing) type.

For comparison, a control group of 19 patients (19 knees), matched for sex, diagnosis, and prosthesis design was selected from our database. None of the knees in the control group had had any previous surgery. Ten patients had had Total Condylar and nine Kinematic prostheses.

The patients were reviewed at three months and six months postoperatively and at yearly intervals thereafter. The mean follow-up was 63 months (21 to 114).

The clinical data were retrieved from the patients' records and standard knee forms which included the results of clinical examination, the degree of pain, stability and total arc of movement (a range of movement from 20° to 100° had an arc of movement of 80°). The preoperative radiographs were graded according to Larsen, Dale and Eek (1977). At review the radiographs were examined for evidence of loosening at the interfaces using the radiographic evaluation system proposed by the Knee Society (Sutton et al 1976).

The final outcome was assessed as excellent if there was a stable knee with no pain on walking or at rest and an arc of movement of 90° or more. A good result was no pain at rest, mild pain on walking, a stable knee and arc of movement between 60° and 90°. A poor result was moderate or severe pain either at rest or on walking, with or without an unstable knee, irrespective of the arc of movement.

RESULTS

Details of the two groups are given in Table I.

Patellectomy had been performed at a mean of 9 years 4 months before total knee arthroplasty (8 months...
Table I. Details of 19 patients (19 knees) who had had patellectomy before total knee arthroplasty compared with a control group of 19 patients (19 knees) without prior patellectomy

<table>
<thead>
<tr>
<th></th>
<th>Previous patellectomy</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (knees)</td>
<td>19 (19)</td>
<td>19 (19)</td>
</tr>
<tr>
<td>Male: female</td>
<td>7: 12</td>
<td>7: 12</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Age at surgery (yr; range)</td>
<td>64 (36 to 81)</td>
<td>64 (35 to 80)</td>
</tr>
<tr>
<td>Follow-up (mth; range)</td>
<td>63 (21 to 114)</td>
<td>63 (21 to 111)</td>
</tr>
<tr>
<td>Total Condylar prosthesis</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Kinematic prosthesis</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Other previous operations (n)</td>
<td>6 (1 to 4)</td>
<td>None</td>
</tr>
<tr>
<td>Range of flexion in degrees (range)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>78 (18 to 130)</td>
<td>82 (40 to 120)</td>
</tr>
<tr>
<td>Postoperative</td>
<td>90 (35 to 120)</td>
<td>83 (40 to 110)</td>
</tr>
<tr>
<td>Complications</td>
<td>7 (36.8%)</td>
<td>None</td>
</tr>
<tr>
<td>Revisions</td>
<td>2 (10.5%)</td>
<td>None</td>
</tr>
</tbody>
</table>

to 26 years). One patient had had knee replacement only eight months after patellectomy because of persistent pain. Six patients had had other previous operations such as arthroscopy or meniscectomy; one had had three other operations and another had had four; these two patients both had internal fixation for fractured patella and later removal of metal.

The indications for knee arthroplasty were pain and deformity in all patients except for one in the study group who had had a fusion converted to a total knee arthroplasty to relieve increasing back pain and functional disability.

Preoperative radiography. Eight out of the 19 pairs of patients had the same radiographic grade in at least one compartment: the other 11 pairs had a difference of 1 to 2 grades between them in one or other compartment.

Pain relief. Pain was completely relieved in 15 patients in the study group but persisted in four. In the control group pain was relieved in all 19 patients.

Arc of movement. The mean preoperative arc of movement in the study group was 78° (18° to 130°); postoperatively, it was 90° (35° to 120°). Fixed-flexion deformity was present in eight patients preoperatively (5° to 50°) and in two patients postoperatively (5° to 10°). The range of movement was increased by the operation in ten patients, decreased in six and unchanged in three.

In the four patients who had bilateral knee arthroplasty after unilateral patellectomy, the mean arc of movement was 13° greater in the knee that had undergone patellectomy than in the other. In three of the four patients who had unilateral arthroplasty after bilateral patellectomy, arthroplasty reduced the arc of movement by a mean of 47°.

The mean preoperative arc of movement in the control group was 82° (40° to 120°); postoperatively, it was 83° (40° to 110°).

Stability. At review three knees in the study group were unstable in the coronal plane; there was no instability in the control group.

Complications. Seven patients in the study group had complications. The patient in whom a knee fusion was converted to an arthroplasty suffered a rupture of the extensor mechanism. After two further operations his knee was finally rerearthrodesed. Subluxation of the extensor mechanism occurred in another patient, and was successfully treated by lateral release and medial plication.

Two patients have required revision, one for aseptic tibial loosening and the other for infection. There were three supracondylar fractures, two in patients with RA and one in a patient with OA. The fractures occurred two months (RA), four months (RA) and eight months (OA) after surgery. None had anterior femoral notching. One patient was treated by external fixation, with a good result, one was treated by internal fixation and has residual pain and requires a walking aid, and one who required revision of the femoral prosthesis to a long-stemmed component also had a poor result.

In the control group there were no complications.

Prosthesis design. Among the nine patients in the study group treated with Kinematic prostheses, four had a disrupted posterior cruciate ligament or had this ligament excised at surgery; in five the posterior cruciate ligament was intact and was retained. There was one poor result in the first group and two in the second. Two of the ten patients treated with the Total Condylar prosthesis had a poor outcome.

Outcome. In the study group the overall outcome was excellent in nine patients, good in five and poor in five. In the control group the outcome was excellent in 15 patients, good in three and poor in one.

The diagnosis and sex of the patients were found not to affect the outcome.

DISCUSSION

The negative effects of patellectomy on the statics and kinematics of the knee are now well recognised (Denham and Bishop 1978; Kaufer 1979; Sledge and Ewald 1979) but there have been conflicting reports on the effect of prior patellectomy on the outcome of total knee arthroplasty (Bayne and Cameron 1984; Marmor 1987). A technique for restoring the moment arm and improving the quadriceps leverage by a patellar tendon bone graft has been reported by Buechel (1991). Although these studies were from several centres and a variety of prostheses was used, some qualified comparisons can be made.

Marmor (1987) reported good or excellent results in all the knees which he treated by unicompartmental arthroplasty and Larson et al (1991) had seven good or excellent results in 12 total knee arthroplasties of several
different types. Bayne and Cameron (1984), however, reported failure in all 14 knees treated after patellectomy and Lennox et al (1986) achieved good or excellent results in only 5 of 11 knees using the PCA prosthesis. In our series 14 of 19 patients had good or excellent results, a success rate of 74%.

The main indication for knee arthroplasty is pain. In our study group four patients (21%) had incomplete pain relief after arthroplasty. The results from other series differ widely, persistent pain having been reported in 33% to 93% of patients.

One of the consequences of patellectomy may be a reduced arc of movement of the knee due to the effects of postoperative immobilisation and adhesion of the extensor mechanism (Kaufer 1971; Steurer et al 1979). It is therefore of interest that in our patients who had bilateral knee arthroplasty the knees which had undergone prior patellectomy had a greater arc of movement than did those with an intact patella. The mean postoperative arc of movement in the study group was also higher than in the control group.

In an intact knee at 90° flexion, the patellar ligament is approximately parallel to the posterior cruciate ligament and the quadriceps tendon is parallel to the anterior cruciate ligaments (Fig. 1a). Anteroposterior stability may therefore be maintained in this position of flexion by preserving the patella. Patellectomy results in a change in the alignment of the quadriceps and patellar tendons and may aggravate anteroposterior instability if the cruciate mechanism is damaged or absent (Fig. 1b). Bayne and Cameron (1984) recommended the use of a hinged prosthesis if the cruciate ligaments were destroyed and the patella was absent. In our series, however, there were no cases of anteroposterior laxity although three knees were unstable in the coronal plane.

We had a supracondylar fracture rate of 16% in our study group. We have not found previous reports of this complication of arthroplasty after patellectomy (Bayne and Cameron 1984; Lennox et al 1987; Marmor 1987; Larson et al 1991). The incidence of supracondylar fractures after total knee replacement has been reported to be 0% to 0.54% (Merkel and Johnson 1986) and 0.29% (Ritter, Faris and Keating 1988) with predisposing factors such as osteoporosis, rheumatoid arthritis and notching of the supracondylar region of the femur (DiGioia and Rubash 1990). No previous series has related fractures to previous patellectomy (Merkel and Johnson 1986; Culp et al 1987; Figgie et al 1990).

Denham and Bishop (1978) in their calculations of forces at the knee showed that patellectomy causes an increase in the tension in the patellar ligament of 30%, an increase in the tibiofemoral reaction force of 14% and an increase in the tangential force at the tibiofemoral joint of 250%. Patellectomy therefore causes an increase in the forces acting on the femoral condyles and this may explain the fractures which occurred just proximal to the femoral component. Notching of the anterior femur was not a factor in the three fractures which occurred in our series.

The Kinematic prosthesis used in some of our patellectomised patients was of a relatively unconforming design without posterior stabilisation, yet the outcome in the patients treated with this prosthesis who were without a functioning posterior cruciate ligament was no worse than in those with an intact ligament. Comparing the two designs of prosthesis used, it is of interest that the Total Condylar implant seemed to give better results, perhaps because its relatively more conforming design was advantageous in the absence of the patella.

Although the patients who had knee arthroplasty after prior patellectomy had more complications and a generally less successful outcome than did those with an intact patella, the results were, nevertheless, good enough for us to continue to recommend the operation in this special group of patients.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


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