Total knee arthroplasty in stiff knees after previous infection

Between July 1986 and August 1996, we performed 32 total knee arthroplasties (TKA) on 32 patients with partially or completely ankylosed knees secondary to infection. Their mean age at surgery was 40 years (20 to 63) and the mean follow-up was ten years (5 to 13). The mean post-operative range of movement was 75.3˚ (30 to 115) in those with complete and 98.7˚ (60 to 130) in those with partial ankylosis. The mean Hospital for Special Surgery knee score increased from 57 to 86 points post-operatively. There were complications in four knees (12.5%), which included superficial infection (one), deep infection (one), supracondylar femoral fracture (one) and transient palsy of the common peroneal nerve (one). Although TKA in the ankylosed knee is technically demanding and has a considerable rate of complications, reasonable restoration of function can be obtained by careful selection of patients, meticulous surgical technique, and aggressive rehabilitation.

Functional impairment of the knee because of ankylosis causes discomfort and restricts mobility. The latter impairs acts of daily living and the patient's sense of well-being. Few reports address the technical difficulties of total knee arthroplasty (TKA) in ankylosed, previously infected knees. We have, therefore, assessed the long-term results in patients who had undergone TKA in knees which were either completely or partially ankylosed.

Patients and Methods

Between July 1986 and August 1996, 32 patients with ankylosed knees underwent TKA. There was no evidence of active pyogenic or tuberculous infection at the time of TKA. Patients who were overweight or were heavy manual workers were excluded. There were 25 women and seven men with a mean age of 40 years (20 to 63). The mean follow-up period was ten years (5 to 13). Twenty knees were completely ankylosed and 12 were partially ankylosed with a range of movement (ROM) of less than 80˚. The position of the 20 completely ankylosed knees ranged from 0˚ to 90˚ of flexion. Nine were flexed more than 15˚ and 11 less than 15˚. The mean ROM in the partially ankylosed knees was 49.5˚ (15 to 80). Pre-operatively, all the patients with completely ankylosed knees and seven with partially ankylosed knees were free from pain. All had restricted mobility. Four patients were confined to a wheelchair and the remaining 28 could walk for limited distances. The initial diagnoses were tuberculous arthritis in 18 knees and septic arthritis in 14. There was a scarred sinus track in 15 of the knees with tuberculous and in 12 with septic arthritis. Eleven patients had taken anti-tuberculous medication and 17 had undergone previous surgery to the knee. The age at onset of the infection ranged from seven months to 61 years (Table I) and the mean interval between resolution of infection and surgical intervention was 18 years and 2 months (1 to 51 years). Microbiological cultures of tissue samples obtained intra-operatively were negative in all cases.

Operative technique. Under tourniquet control a midline skin and medial parapatellar capsular incision was used. The ankylosis was taken down at the level of the original joint and the bone stock preserved. Soft-tissue releases were carried out to correct the angular and flexion deformities. Posterior soft-tissue releases were undertaken after resection of bone because the structures were seen better after the femoral
condyles had been removed. In longstanding, stiff knees, posterior capsulotomy or hamstring release was necessary.

In order to improve exposure and ROM, a modified V-Y quadricepsplasty (Fig. 1) was performed in ten knees and a proximal transfer of the tibial tubercle (Fig. 2) in three. The quadriceps tendon was lengthened by approximately 2 to 4 cm with the knee flexed to between 70˚ and 80˚.

A posterior-cruciate preserving prosthesis was used in 25 knees and a posterior-stabilised implant in seven. Prostheses used included the Miller-Galante (Zimmer, Warsaw, Indiana) in 13 knees, the Press Fit Condylar-PS (Johnson & Johnson, Warsaw, Indiana) in seven, the Ortholoc II (Wright, Arlington, Tennessee) in seven, the Total Condylar IV (Kirschner, Fairlawn, New Jersey) in two and others in three. Patellar resurfacing was not performed in four knees because of poor bone stock or extensive damage to the patellar tendon.

Intravenous cephalosporins were given immediately after the deflation of the tourniquet and bone cement was mixed with 1 g of cephalosporin in all cases. Prophylactic cephalosporin was given for two weeks. Prophylactic anti-tuberculous medication was given for about six months. Isometric exercises of the extensor and flexor muscles were begun shortly after surgery to prevent extensor lag in patients with a V-Y quadricepsplasty or proximal advancement of the tibial tuberosity. Suction drains were removed three days after operation. From the third post-operative day active, assisted and gentle passive ROM exercises were started. The ROM was increased by using steps or a high-chair in patients with more than 90˚ of flexion. Continuous passive motion was used in patients with good skin and soft tissues. After eight to ten days, patients were mobilised and continued to use crutches for two months. They were discharged at two to four weeks after operation. No patient

Radiographs of the left completely ankylosed knee of a 63-year-old woman who had V-Y quadricepsplasty showing a) the pre-operative anteroposterior (AP) and lateral views with severe flexion deformity and b) post-operative AP and lateral views at two years with no radiolucent lines.

Radiographs of the completely ankylosed left knee of a 50-year-old woman showing a) pre-operative AP and lateral views with bony ankylosis in 5˚ of flexion and b) post-operative AP and lateral views at 11 years 10 months with no loosening or osteolysis and complete healing of the site of the osteotomy of the tibial tubercle.
required manipulation under anaesthesia for stiffness of the knee.

The Hospital for Special Surgery (HSS) knee score was used to assess clinical outcome and anteroposterior and lateral radiographs were taken at regular intervals. These were reviewed blind by the senior author (DKB).

Results

The mean post-operative ROM was 75.3˚ (30 to 115) in the completely ankylosed and 98.7˚ (60 to 130) in the partially ankylosed knees. Overall, the mean post-operative improvement in ROM was 65.6˚ (Table II).

The mean pre-operative HSS score was 59.7 points (26 to 87) in the completely ankylosed and 52.1 points (29 to 66) in the partially ankylosed knees. The mean post-operative HSS score increased to 84.9 (64 to 94) and 86.7 points (69 to 97), respectively, in the two groups.

The mean HSS score improved from 61 (40 to 71) to 81 points (73 to 94) post-operatively in patients in whom a modified V-Y quadricepsplasty had been performed, and from 65 (56 to 74) to 87 points (83 to 94) in those with a proximal transfer of the tibial tubercle.

Seven knees had a post-operative flexion contracture, including five in the modified V-Y quadricepsplasty group and two in the group with proximal transfer of the tibial tubercle. This contracture decreased to a mean of 9˚ within the first year and disappeared by the second.

Two (6.3%) of the knees showed radiolucent lines around the tibial component. These were incomplete, non-progressive, asymptomatic and less than 2 mm wide over the period studied.

Post-operative complications occurred in four knees (12.5%). There was one superficial infection, one supracondylar fracture of the femur, one transient palsy of the common peroneal nerve and one deep infection. The superficial infection was in a patient who had partial ankylosis and it resolved with conservative treatment. The other three complications were in patients with complete ankylosis. The supracondylar fracture occurred six years and seven months after surgery and was successfully stabilised using Ender’s nails. The deep infection developed one year and ten months after surgery and was treated successfully by arthrodesis.

Discussion

The indications for conversion of an ankylosed knee to TKA include good patient motivation, well-preserved neurovascular tissue and extensive experience in TKA on the part of the surgeon. Although a solid fusion successfully relieves pain, mobility and psychological function may be severely restricted. For mobility, 65˚ to 70˚ of flexion are needed in the swing phase of normal gait, at least 90˚ to descend stairs and 105˚ to rise independently from a low chair. The ability to walk and sit normally is important to the patient’s overall sense of well-being.

Knees with partial ankylosis after infection are extensively scarred. Since the mean age in our series was 40 years, patients were advised that the outcome could not be guaranteed and that they would need one or more revisions in their lifetime. Nonetheless, they chose reconstructive joint surgery for social reasons and the needs of their careers.

The arthritic knee with a limited arc of flexion may develop a quadriceps contracture. Operative exposure can be difficult and jeopardise the insertion of the patellar tendon as the quadriceps mechanism is everted. After implantation of the prosthesis and relocation of the patella, the pre-existing quadriceps contracture can restrict post-operative flexion. Aggressive post-operative physiotherapy can stretch the extensors effectively and gradually rehabilitate the muscles. Adequate correction of any pre-operative flexion deformity can be accomplished intra-operatively by a combination of capsular release and bone resection and occasionally resection of the posterior cruciate ligament. Post-operative physiotherapy is less effective for treating a flexion contracture than for regaining flexion.

The quadricepsplasty described by Thompson involves detaching most of the quadriceps mechanism from the patella while the method described by Judet, Judet and Lord involves detaching vastus lateralis and medialis from the entire length of the femur. Neither of these techniques is particularly helpful in TKA because the contracture is at the knee and an intact extensor mechanism with a sealed joint is desirable. Scott and Siliski and Trousdale et al reported that V-Y quadricepsplasty leaves a devascularised tongue of quadriceps and patella resulting in wound dehiscence and patellar fracture. They recommend preservation of the lateral superior geniculate artery. Wolff et al increased flexion by proximal transfer of the tibial tubercle, but had some difficulty with internal fixation, wound closure and post-operative rehabilitation.

Severe soft-tissue contracture was present in most of our patients and we had to lengthen the quadriceps tendon with a modified V-Y plasty in ten and transfer the tibial tuberosity proximally in three. We performed a V-Y quadricepsplasty to avoid avulsion of the patellar tendon, to facilitate exposure and to improve the range of flexion. Although post-operative immobilisation was limited in our series, rehabilitation over several months was necessary to overcome the weakness of the lengthened quadriceps muscle. In two patients there was an extensor lag.

Pre-operatively, we tested the strength of the quadriceps by palpating the isometrically contracted muscles. Post-operatively, the strength of the quadriceps recovered slowly over several years.

Table II. The mean ROM (˚, range) for the 32 knees

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-operative</th>
<th>Last follow-up</th>
</tr>
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<tbody>
<tr>
<td>Complete ankylosis</td>
<td>0.0</td>
<td>75.3 (30 to 115)</td>
</tr>
<tr>
<td>Partial ankylosis</td>
<td>49.5 (15 to 80)</td>
<td>98.7 (60 to 130)</td>
</tr>
<tr>
<td>Mean</td>
<td>18.5</td>
<td>84.1</td>
</tr>
</tbody>
</table>

Pre-operatively, we tested the strength of the quadriceps by palpating the isometrically contracted muscles. Post-operatively, the strength of the quadriceps recovered slowly over several years.
In general, TKA in ankylosed knees has a poor prognosis. In 1983, Mullen\textsuperscript{10} reviewed 13 knees with ankylosis which had been treated by TKA. The mean pre-operative ROM was 16° to 48° and it improved post-operatively to 0° to 103°. Only two had no pre-operative ROM. The post-operative ROM was 0° to 95° and 0° to 60°, respectively. In 1989, Aglietti et al\textsuperscript{11} reported the results of TKA in six stiff knees with fixed flexion deformities. The results were less satisfactory than after routine primary arthroplasty and the mean post-operative ROM was 68°. In 1996, Naranja et al\textsuperscript{12} assessed 37 knees with no movement pre-operatively in a multicentre study of TKA. The mean lack of extension was 7° and the mean flexion 62°. There were complications in 57% of the knees including stiffness requiring manipulation, delayed wound healing, recurrent haemarthrosis, avulsion of the patellar tendon or tibial tubercle, persistent pain requiring arthrodesis, aseptic loosening, and deep infection. Only ten knees (29%) had a satisfactory outcome. In 1996, Cameron and Hu\textsuperscript{2} analysed the results of TKA after arthrodesis in 17 patients. Using the HSS rating, 29.4% were excellent, 29.4% good, 17.6% fair, and 17.6% poor. Complications occurred in nine patients (53%), including myositis ossificans, early loosening of the tibial component, ligamentous laxity, and rupture of the quadriceps tendon.

By comparison, the results in our study are good. The mean ROM increased from 18.5° to 84.1° and the mean HSS knee score improved from 57 to 86 points. Complications occurred in four knees (12.5%). We obtained satisfactory results and reduced complications by a combination of adequate soft-tissue releases, lengthening, meticulous surgical technique and an extensive rehabilitation programme.

We suggest that although TKA in ankylosed knees is technically demanding and has a high rate of complications, reasonable restoration of function can be obtained by careful selection of patients, meticulous surgical technique and aggressive rehabilitation.

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


