Total knee arthroplasty in neuropathic arthopathy

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We describe the results of total knee arthroplasty (TKA) undertaken for severe, neurosyphilitic Charcot arthropathy in ten patients (19 knees). A cemented condylar, constrained prosthesis was implanted in all but two knees. The mean follow-up was 5.2 years (5 to 6). The mean knee score before operation was 36.5 points (30 to 42) which improved to 76 points (58 to 90) after operation as judged by the Hospital for Special Surgery score. At final follow-up three knees (16%) had aseptic loosening which required salvage by an arthrodesis, six (31%) were functioning poorly and ten (53%) were satisfactory.

We conclude that although Charcot arthropathy is not an absolute contraindication to total knee replacement, there is a high incidence of serious complications.

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The treatment of Charcot arthropathy of the knee remains controversial. Many authors1-4 consider it to be an absolute contraindication to total knee arthroplasty (TKA). In recent years, however, several studies5-10 have shown satisfactory results.

We have therefore evaluated the results after five to six years of TKA undertaken for severe neurosyphilitic Charcot arthropathy.

Patients and Methods

Between January 1992 and November 1994 we treated ten consecutive patients (3 men and 7 women; 19 TKAs) with severe neuropathic knees because of tabes dorsalis. The mean preoperative length of symptoms was 6.7 years (3 to 10). The diagnosis of neurosyphilis had been established clinically and serologically by a neurologist. No patient had ataxia before or after surgery. Nine had bilateral and one a unilateral TKA. At the time of surgery, the mean age of the patients was 52 years (48 to 64). Three patients with severe destruction of both knees had not been able to walk for six months, eight years and ten years, respectively. The remaining seven patients had gross deformity and instability.

All TKAs were carried out by the senior author (Y-HK) using an anterior midline approach and under epidural anaesthesia. Synovectomy, extensive debridement and a lateral release for realignment of the quadriceps mechanism were undertaken in all knees. The mean preoperative valgus deformity was 12° (10 to 14). There was gross destruction of the lateral compartment with lateral subluxation of the patella in all knees, and all required a lateral release.

The prosthesis was cemented in all but one knee. In the early part of the series, one hinged prosthesis (Howmedica modular resection system; Howmedica, Limerick, Ireland) was implanted without cement in a patient with pathological destruction and dislocation of the knee, and one semiconstrained prosthesis (AMK; DePuy, Warsaw, Indiana) in a patient with mild destruction and instability. Thereafter, we used a condylar, constrained prosthesis (Omnifit; Stryker, Allendale, New Jersey) because of early complications in the first two patients. An autogenous bone graft for a defect of the tibial plateau was required in 11 knees as there was a bone defect of more than 10 mm in the lateral tibial plateau after the medial side had been resected. The graft was obtained either from the excised femoral condyles or the tibial plateau. No knee required a custom-made prosthesis.

The mean length of follow-up was for 5.2 years (5 to 6). Patients were assessed preoperatively and at 6 weeks, 3, 6 and 12 months, and yearly thereafter using the Hospital for Special Surgery (HSS) knee rating system.11 The alignment and stability of the knee were assessed clinically with the joint in extension and in 30° of flexion. Anteroposterior (AP) radiographs, with the patients both standing and supine, and lateral and skyline views were obtained for each knee. These were analysed to assess the position of the components and for the presence of any radiolucent lines, which were documented using the criteria suggested
by Kim.\textsuperscript{12} Loosening of the components was defined as the presence of a complete radiolucent line which was more than 2 mm wide, a visible fracture of the cement around the components or a change in their position.

**Results**

**Clinical outcome.** The mean knee score improved from 36.5 points (30 to 42) before surgery to 76 points (58 to 90) at final follow-up.

Before operation, all knees had been moderately painful while walking, although this was less than might have been expected considering the degree of joint destruction and deformity. No patient had pain at rest. At the final follow-up three knees were free from pain, 13 were mildly painful and three were moderately painful. No patient had pain at rest after operation.

Three patients who had been unable to walk were able to do so after operation with two crutches although for only less than one block. Four patients who had been only able to walk less than a block before, were able to manage one to five blocks using a stick, after operation. Two patients, able to walk one to five blocks with support, were able to achieve this distance without support after surgery. The remaining patient who had been able to walk an indefinite distance, continued to do so after operation.

Preoperatively, three patients were unable to negotiate stairs and seven patients used a bannister. At the final follow-up, three were able to negotiate stairs without support, four used a bannister, and three used two crutches.

Before surgery, seven patients were able to sit and rise from a chair, but three were wheelchair-bound and needed help to rise.

The mean range of movement was $117^\circ$ (95 to 120) before operation and $113^\circ$ (105 to 120) after surgery.

**Radiological outcome.** The mean postoperative femoral angle was $96^\circ$ (84 to 105, $sd$ 4.2), and the mean tibial angle $90^\circ$ (88 to 94, $sd$ 3.8) in both planes. The position of the components remained unchanged in all but two of the knees during the period of follow-up. In these two, the femoral component had been dislodged by a supracondylar fracture. The one knee with a cementless hinge arthroplasty did not show any change in position of the prosthesis, but it was loose. The mean, postoperative alignment was $7.4^\circ$ of valgus angulation (3 varus to 10 valgus, $sd$ 1.8). Most patellae (17) were centred, but one was subluxed laterally, and one was dislocated laterally. No symptoms were attributable to the subluxation.

In 11 knees the tibial autogenous bone graft appeared to be well incorporated. Examination of the radiographs indicated that seven knees had no radiolucent line and 12 had an incomplete radiolucency, less than 1 mm wide, beneath the medial and/or lateral side of the tibial component on the AP view (Fig. 1).

**Complications.** The incidence of complications was high (9 of 19 knees, 47%). One knee had a recurrent lateral dislocation of the patella which was corrected by a lateral release. Three knees with complete destruction and dislocation of the tibiofemoral joint before surgery had a recurrent, posterolateral dislocation after operation. These knees were...
immobilised in a cylinder brace for six months. Thereafter, there was no further dislocation. Two patients suffered a supracondylar fracture of the femur with displacement of the femoral component (Fig. 2) and are awaiting arthrodesis. The patient with a cementless hinge sustained a fracture at the level of the tip of the femoral component. The fracture was fixed with a plate, screws and cables. Ultimately, there was aseptic loosening. One patient suffered a late rupture of the quadriceps tendon at its insertion into the superior pole of the patella.

Thromboembolic prophylaxis was not used because of the low incidence of deep-vein thrombosis in this Korean ethnic group. No patient developed a thromboembolic complication.

Discussion
There have been few reports of TKA in knees with Charcot arthropathy. The good or excellent results reported by Soudry et al and Yoshino et al are probably attributable to the mild preoperative deformity of the knee in their cases.

Our incidence of complications was high (9 of 19 knees, 47%). We believe that the main reason for this relates to the selection of patients. Our criteria for inclusion in this series were strict as all patients had severe Charcot arthropathy. In other reports, there may have been less destruction of the knee. We believe that the degree of bony destruction and instability of the knee are critical to the success of TKA in patients with Charcot arthropathy. Contrary to other reports, however, neither Eichenholtz’s stage of coalescence nor the presence of ataxia was related to our high rate of complications.

It has been suggested that rotating hinged or revision prostheses should be used for patients with grossly unstable knees, whether or not they are neuropathic. Constrained prostheses are designed to provide intrinsic stability, but such constraint transmits increased stress to the cementbone and cement-implant interfaces. This leads to higher rates of aseptic loosening than have been found with less-constrained designs. The use of a constrained prosthesis requires the removal of a considerable amount of bone from the intercondylar region of the femur. Constrained implants are also designed for use with a stem. Both these design features decrease the available bone stock for subsequent revision, should this be required.

The rationale for the use of a hinged prosthesis in one knee was to provide intrinsic stability since the knee was dislocated pathologically before surgery. A supracondylar fracture occurred thereafter and aseptic loosening of the femoral component was apparent one year later. We therefore conclude that a hinged prosthesis should be avoided if possible. A condylar, constrained prosthesis is more appropriate.

The cause of late rupture of the quadriceps tendon in one patient is not known. It may have been related to reduced local vascularity or to anteromedial subluxation of the TKA.

Radiographs of the right knee of a 58-year-old man. Figure 2a – Before operation there was destruction of the lateral compartment with lateral subluxation of the tibiofemoral joint and of the patella. There was bony detritus in the suprapatellar pouch. TKA with an AMK semiconstrained prosthesis failed because of subluxation of the components and rupture of the quadriceps tendon 1.5 years after operation. The prosthesis was revised to an Omnifit condylar constrained prosthesis and the quadriceps tendon was repaired. Figure 2b – Four years later the patient sustained a supracondylar fracture of the right femur with displacement of the femoral component and is awaiting arthrodesis.
Three knees with complete destruction and dislocation of the joint preoperatively, also showed recurrent dislocation postoperatively. This may have been due to problems in balancing the flexion gap, with so much distal and posterior destruction of the femoral condyles. We thus recommend that a knee with preoperative subluxation or dislocation should be immobilised in a long-leg brace for at least six months after surgery.

Only 53% of our TKAs in patients with severe Charcot arthropathy were satisfactory at a mean follow-up of five years. We conclude that although TKA is not absolutely contraindicated in this condition, there is a high incidence of serious complications.

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References