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Distal femoral replacement in periprosthetic fracture around total knee arthroplasty

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ABSTRACT

Introduction: Total knee arthroplasty is a common orthopaedic procedure in the UK; consequently, revision surgery and periprosthetic fractures are increasing in incidence. Strategies for management of these cases include non-operative strategies, internal plate fixation and revision of the distal femoral component. One under-reported practice is to perform distal femoral replacement in cases with poor distal femoral bone stock.

Materials and methods: The department's electronic database was searched for all patients undergoing revision of total knee arthroplasty. From these, all patients having distal femoral replacement for periprosthetic fracture around the distal femoral component using the Stryker Global Modular Replacement System (GMRS) implant were filtered. A retrospective analysis of the patient notes was performed to examine the patient demographics, surgical factors and postoperative complications. Postoperative scores were performed for these patients.

Results: From 2005 onwards, 11 patients (mean age 81 years, range 61–90 years) had their implants revised with a distal femoral replacement for periprosthetic fracture with associated poor bone stock. Follow up was for a mean of 33 months (range 4–72 months). One of these patients died of causes unrelated to their operation. Of the rest, all implants survived without the need of re-operation. The mean postoperative Oxford Knee Score for these patients was 22.5 (range 5–34).

Conclusions: Distal femoral replacement for patients with fracture around a total knee arthroplasty has been performed in our department with few complications and acceptable functional outcomes. It is a technically challenging operation and it should be a salvage procedure reserved for patients with poor bone stock and low demands where other methods of fixation are not suitable.

Level of evidence: IV.

Total knee arthroplasty (TKA) is one of the most commonly performed orthopaedic operations in the U.K., with over 60,000 performed in the past year [1]. Consequently, the incidence of periprosthetic fracture is increasing, estimated at 0.3–2.5% [2]. However, with the increasing frequency of joint replacement and an ageing population, the absolute numbers are expected to increase and they pose a great challenge to surgeons to achieve adequate fixation whilst minimizing morbidity and mortality.

There are multiple strategies for addressing distal femoral periprosthetic fractures [3–6], with all aiming to achieve a pain-free knee that is stable, with minimal disruption to length and alignment. Current management strategies include the use of locking plates [3], intramedullary fixation [4], external fixation [5] and revision of the arthroplasty [6]. Each of these strategies has its own merits and limitations with respect to implant stability, the need for bone grafting, the presence of an ipsilateral total hip replacement and complications.

In the case of distal femur periprosthetic fractures with limited bone stock, certain surgical options are technically impossible (Fig. 1). One strategy for managing patients presenting with periprosthetic fractures not amenable to fixation is to use a distal femoral replacement prosthesis. These prostheses have been used successfully in oncological surgery [7]; however, relatively few series of patients with different prostheses used for this indication have been reported in the literature [8–10]. Traditionally, TKA revision operations have used constrained implants to provide immediate and long-term stability [11]. In cases with poor bone stock or gross ligamentous instability, a distal femoral replacement has been shown to be a viable strategy in the provision of a stable implant in low-demand patients [12,13].

The Global Modular Rotating System (GMRS) implant (Stryker, Newbury, UK) has been designed for reconstruction

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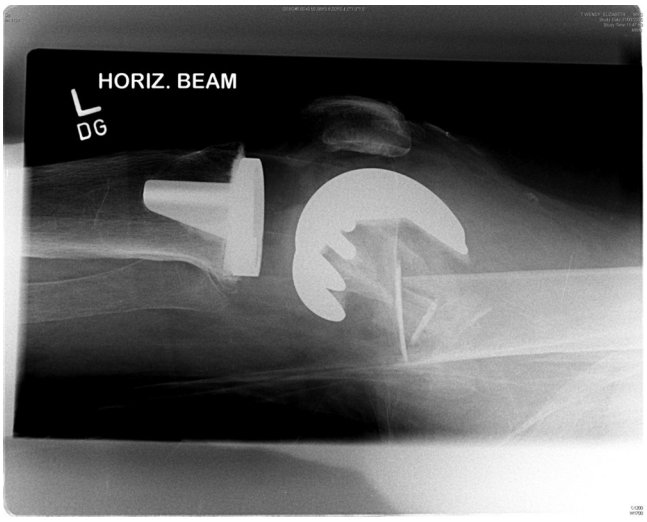

Fig. 1. Radiograph with example of periprosthetic fracture around femoral component suitable for distal femoral replacement. Fracture line extends distal to proximal femoral border with loosening of component.

of large segmental femoral defects in tumours, failed previous arthroplasty or trauma. This article reports the clinical and radiological results of the GMRS implant for revision total knee replacement (TKR) in patients with periprosthetic fracture around a distal femoral component.

Materials and methods

The modular-rotation-hinge distal-femoral replacement has been used by our department since 2005 for the management of distal femoral periprosthetic fractures with loosening of the prosthesis and revision of TKRs with inadequate bone stock.

Patients who had undergone the implantation of the GMRS between January 2005 and June 2011were identified using the department's electronic patient database (BlueSpier, Bluespier International, Droitwich, UK). A total of 16 patients were identified; 11 of them were cases of periprosthetic fracture involving the distal femoral component with a poor bone stock and that had been deemed, at the time of presentation, unsuitable for conservative management, internal fixation or simple component revision. The remaining five of these were cases of revision of a TKA.

Using the patients' electronic and paper notes and the hospital's theatre database system, the patients' demographic details, surgical factors and postoperative function and complications were obtained and noted.

Surgical technique

In all cases, cefuroxime was given at the induction of anaesthesia and a tourniquet was inflated for the duration of the procedure. All knees were approached via the previous midline incision. The knee was opened through a standard medial parapatella arthrotomy with eversion of the patella. Some of the femoral components were found to be completely loose on opening the knee and they were simply removed. In the majority of cases, some of the implant was still bonded to the femur. In the cases of periprosthetic fracture, the distal femur was approached through the fracture site. The distal femur was flexed, exposing the posterior surface. The capsule was then dissected off the bone. Finally, the collateral ligaments were divided at their femoral origin. Once the distal femur had been removed, a cut was made perpendicular to the anatomical axis of the distal femur. The tibial component was then removed in a standard fashion, preserving as much tibial bone as possible. Once all the components had been removed, the size of the deficit was measured, to estimate the size of the femoral component required. The tibia was then cut flush and the tibia deficit built up in the standard fashion. The trial femoral component was then inserted. Rotation of the femoral component was assessed by flexing and extending the knee and observing the patella tracking. Any patella which had previously been replaced was retained. Care was taken to ensure that the leg was not lengthened. Both components were then cemented with Palacos R and G cement (Heraeus, Hanau, Germany) using a standard technique. Closure was in layers with no drains.

Postoperative regime

All patients were managed in a postoperative cricket-pad splint until the wound had healed. Cefuroxime was given for a further 48 h after surgery. Once the wound was dry, flexion exercises were commenced. Tinzaparin was given for thromboprophylaxis once the wound had dried and it was continued for the duration of the inpatient stay. All patients were mobilized fully weight bearing from the first postoperative day with physiotherapy assistance.

Follow-up

A plain antero-posterior (AP) radiograph and a lateral knee plain radiograph were performed prior to discharge. Patients were then reviewed at 6 weeks, 6 months and then annually thereafter. Radiographs were performed at each clinic appointment to assess for loosening or radiolucency. Patients were then interviewed at follow-up to assess postoperative functional scores using the Oxford Knee Scores and Short Form-36 (SF-36).

Injury classification was assessed independently by two authors (SJ and PH) using the Su classification [14] and the Rorabeck and Taylor classification [15].

The Su classification of fractures involving the distal femoral component of a TKA comprises:

- Type 1 – the fracture is proximal to the femoral component,
- Type 2 – The fracture originates at the proximal end of the component and extends proximally and
- Type 3 – The fracture extends distal to the proximal border of the femoral component.

The Rorabeck and Taylor classification of fractures involving the distal femoral component of a TKA includes:

- Type 1 – the fracture is non-displaced with a well-fixed intact knee implant,
- Type 2 – the fracture is displaced with an intact implant and
- Type 3 – the fracture is either displaced or non-displaced but with a loose or failing implant.

Results

Eleven patients received the GMRS implant. All were female with a mean age of 81 years (range 61–90) at the time of surgery. The demographic details are presented in Table 1.

No patient has required re-operation of either the femoral or tibial components. None of the postoperative radiographs had features of loosening or radiolucent lines. The operative details are presented in Table 2.

The operations for revision of periprosthetic fracture around the distal femoral component had a mean follow-up of 33 months (range 4–72 months). All of these injuries were classified as Su Grade 3 and all but one were classified as Rorabeck Grade 3, with one being Grade 2. All patients were able to achieve full extension