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Stabilisation of acute femoral fractures in Paget's disease

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Abstract Eleven cases of acute femoral fractures in patients with Paget's disease are presented following stabilisation with the solid AO femoral nail. In three cases with severe deformity of the femur, reaming was required to enable implant insertion. No corticotomies were required. The median operation time was 55 (35–65) min. There was no operative mortality and no patient developed signs of acute respiratory distress syndrome/fat embolism. Skeletal stability was achieved in all cases. The reconstruction proximal locking option (spiral blade) was utilised in ten of the eleven cases. In all cases a 9 mm nail was inserted. One patient (pagetic sarcoma) died 23 months after surgery. Ten of the eleven fractures healed uneventfully. The mean time to union was 32 (26–42) weeks.

Résumé Nous présentons onze cas de fracture du fémur associée à la maladie de Paget que nous avons traité avec un enclouage solide verrouillé (SFN) de AO (Synthes). Dans trois cas la déformation du fémur était si sévère qu'il fallu faire un alésage du canal médullaire pour permettre l'introduction du clou. En aucun cas il a été nécessaire de faire une ostéotomie. Le temps médian opératoire était 55 minutes (35–65). La mortalité opératoire était nulle avec pas un seul cas de syndrome d'insuffisance respiratoire ou d'embolie graisseuse pendant ou après l'opération. La stabilité de l'ostéosynthèse a été obtenue dans tous les cas. Dans 10 cas sur 11, l'option de verrouillage avec la lame spirale a été utilisée. Dans chaque cas un clou de 9 mm de diamètre a été utilisé. Un malade (avec sarcome associé à la maladie de Paget) est mort 23 mois après la chirurgie. La consolidation de la

fracture a été établie dans 10 cas sur 11 sans aucun problème. Le temps moyen d'union était 32 (26–42) semaines.

Introduction

Intramedullary nailing is widely accepted as the treatment of choice for subtrochanteric and diaphyseal fractures of the femur [18]. Advantages of this method include small surgical incisions distant to the zone of injury, the ability to stabilise the skeleton without directly accessing the fracture, and physiological load transmission down the mechanical axis of the bone. Hollow nails designed for insertion after reaming of the medullary canal have more recently been complemented by the availability of thinner solid nails, which may be inserted without reaming. From March 1994 this unit was one of the United Kingdom trial centres for the AO solid femoral nail (SFN, Synthes, Switzerland). We have previously reported our initial experience with this implant [16], together with comparative analyses of union time [7] and heterotopic ossification rates [6] between the AO-SFN and reamed nails.

Fractures in femora affected by Paget's disease pose problems for the surgeon, specifically pre-fracture deformity together with poor bone quality due to the disease process [11]. We reviewed our cohort of femoral shaft fractures treated in a standardised fashion with the solid femoral nail to investigate whether patients with Paget's disease were associated with a poor outcome.

Patients and methods

The medical and radiographic records of all patients treated with the AO solid femoral nail were retrospectively reviewed. Between March 1994 and December 1997 eleven fractures in Pagetic femora were identified in eleven patients, of mean age 85 years (range 67 to 96 years). Paget's disease was diagnosed according to the radiological criteria defined by Murray and Jacobson [12]. All but one had sustained an acute complete fracture following a fall or

Statement

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.

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Fig. 1 **a** Pagetic diaphyseal fracture stabilised with an unreamed femoral nail, proximally locked with spiral blade. **b** Union of fracture 7 months later

motor vehicle accident; one procedure was performed for a stress fracture. There were six subtrochanteric fractures and five diaphyseal fractures (AO 31,32). All fractures were closed. One case was associated with a pagetic sarcoma and received radiotherapy following stabilisation of the fracture.

All fractures were stabilised with the AO solid femoral nail within 24 h of injury. The patients were placed supine on a traction table or free on a radiolucent table according to surgeon preference. A stab incision about 3 cm long was made approximately 10 cm above the tip of the trochanter, and a proximal guide wire was passed. The canal was opened with a 13 cm cannulated drill bit prior to nail insertion. Procedures were performed by a consultant or by a senior registrar under direct consultant supervision. Three cases required reaming of the deformed femoral medullary canal to allow passage of the solid femoral nail, eight nails were inserted without reaming. No corticotomies were required. The reconstruction proximal locking option (spiral blade) was utilised in ten of the eleven cases (Fig. 1), the eleventh used the "Grosse-Kempfe" style antigrade proximal locking screw. In all cases a 9 mm nail was inserted. All nails were distally locked with two screws. Prophylactic antibiotics were given to all patients.

Weight bearing was allowed according to stability of the fracture-nail construct and patient tolerance. Fracture classification (AO), injury severity score (ISS), operative time, time to full weight bearing, time to union and complications were prospectively recorded.

Clinical and radiographic follow up after discharge took place in the dedicated fracture clinics. Union was defined as the presence of circumferential callus on biplanar radiographs together with painless full weight bearing. No patients were lost to follow-up; minimum follow-up time was thirty-six weeks.

Results

The median operation time was 55 (35–65) min. The median ISS was 9 (9–13). There was no operative mortality and the median time in hospital was 7 (5–12) days.

There was no incidence of infection in these series and none of the patients developed signs of acute respiratory distress syndrome/fat embolism intra- or post-operatively. One patient (Pagetic sarcoma) died 23 months after surgery.

Skeletal stability was achieved in all the cases. The reduction of the fractures was satisfactory. There was no deformity exceeding 5° and no leg length inequality greater than 1 cm. All the patients were mobilising post-operative with crutches or a frame. All the patients were encouraged to fully weight-bear and regain their previous walking capacity within 2 weeks of the operation.

Ten of the eleven fractures healed uneventfully. One failed to unite and was associated with breakage of the only antigrade screw, the only implant failure observed. The mean time to union was 32 (26–42) weeks.

Discussion

It is widely accepted today that Pagetic femoral fractures should be treated operatively because conservative management is associated with difficulties in controlling the position of the fracture; This is particularly important for subtrochanteric fractures, where a high incidence of varus deformity, carrying an increased risk of refracture has been reported [2, 4].

From all the available treatment modalities to the surgeon, intramedullary nailing appears to be a favourable option providing skeletal stability and allowing early mobilisation. Most of intramedullary implants today require reaming prior to nail insertion. This is associated with prolonged operation time, a risk of fat embolus and troublesome bleeding during the operation, which may occur due to abnormal biology of the Pagetic bone.

Dove reported that excessive intra-operatively bleeding occurred in 11% of the cases and in one case, the patient exsanguinated as a result of pulsatile bleeding from bone [4]. In this series we did not encounter this problem and the unreamed technique may be important in this regard. Reamed intramedullary nailing is associated with marrow embolization in human and animal experiments and this may cause pulmonary damage [13, 14].

There were no systemic intra-operative or post-operative complications, contrary to Heinz et al. [10], who reported 20% systemic complications. We have not identified systemic problems in this small study.

Pagetic fractures are often subtrochanteric and fractures in this area have presented several problems in the past, particularly when plates or nail plates were used (implant failure and non-unions) [9, 19]. Varus neck angulation has also been a problem with the use of conventional nails [17]. In our cases the use of the proximal locking option with the spiral blade provided good alignment and skeletal stability and it was found easy to use, in contrast with other reports of reconstruction nailing where problems with locking into the femoral neck have been encountered [3].

Some authors have advocated that normalization of bone turnover, with either diphosphonates or calcitonin, should improve fracture healing and reduce the increased vascularity of Pagetic bone and risk of bleeding during the operative procedure [11]. In all our cases the fractures were stabilised acutely and despite no diphosphonate or calcitonin administration. We did not encounter problems with healing. Our crude union rate was 91% and the mean time to union was 32 (26–42) weeks. The time to union is slightly longer compared with a mean of 27 weeks in our series of non-pathological fractures [7]. Our non-union rate of 9% is one-third of the non union rate reported by Grundy [8] and one-quarter the non-union rate reported by Dove [4].

The peculiar mechanics of the Pagetic bone, and the usually abnormal mechanical diaphyseal axis, may cause difficulties in inserting the nail. Moreover, fractures treated without mechanical realignment by means of an osteotomy may fail to unite and give rise to implant failure [4]. In this series the relatively narrow SFN may allow some additional leeway when negotiating deformed femoral canals; no patient required osteotomy although three of eleven canals were reamed to ease passage of the implant but there was no nail failure or loss of skeletal stability. Barlow and Thomas [1] reported a series of three Pagetic subtrochanteric fractures treated successfully with the Russell-Taylor reconstruction nail. One of their patients required a diaphyseal osteotomy to allow nail passage; all nails were inserted after reaming. Average time to union was 10 weeks.

Sinha and Mani [15] reported a single case of a “distal” femoral fracture (in fact a fracture at the junction of the middle and distal thirds of the shaft) treated with the Russell-Taylor supracondylar nail. The patient died four weeks after surgery, before union could be expected to occur.

We believe that this is the largest reported series of such fractures treated by a single modern technique. It appears that unreamed nailing with the AO solid nail is a good option for the stabilisation of acute subtrochanteric and diaphyseal fractures in Pagetic femora providing reliable skeletal stability and good healing results.

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