



The Long Gamma Nail for stabilisation of existing and impending pathological fractures of the femur An analysis of 48 cases

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The results in a series of 42 patients with 48 impending or complete pathological femur fractures stabilised with the Long Gamma nail (Howmedica-Osteonics, Rutherford, NJ, USA) are presented. Twenty two impending and 26 completed pathological femoral fractures treated between 1995 and 1999 were retrospectively analysed. The mean age of the patients was 65.7 yrs (range : 40 to 88). All patients were treated with an 11-mm diameter Long Gamma Nail, inserted through a 5-cm incision proximal to the greater trochanter using the antegrade reaming technique. The mean surgical time was 98 minutes (range : 65 to 225).

Reliable stability was achieved in all cases and pain relief was excellent. Complications included 2 superficial and 1 deep wound infections, 4 chest infections, 2 urinary tract infections, and 2 deaths in the recovery. Implant failure occurred in one patient and needed revision to a long stemmed total hip prosthesis.

The Long Gamma nail offers the advantage of a technically less demanding percutaneous insertion through the tip of the greater trochanter, secure proximal femoral fixation and the ability to allow immediate or early weight-bearing ambulation. Because of these advantages, we recommend the use of the Long Gamma nail for stabilisation of pathologic and impending pathologic fractures of the femur.

INTRODUCTION

Cancer is the second leading cause of death in the United Kingdom. In the year 2000, there were

223,000 estimated newly diagnosed cases (National Statistics) in England alone (13). The common bone seeking tumours were ; breast, lung, prostate, kidney and thyroid. The incidence of metastatic disease spreading to bone is 50-84% (16, 17, 19). The femur is the second most common site of bone metastasis, accounting for 60-80% of pathological fractures requiring surgical intervention (7, 9). Approximately one-third of femoral metastases are in the sub-trochanteric region (4, 20).

Aggressive treatment of pathological fractures is often needed in these patients who in many cases may live for months, weeks or years. The goal of treatment of a pathological fracture or impending fracture is to restore the function of the affected limb as quickly as possible, and relieve the pain, thus improving the patient's quality of life (2). With the expected duration of survival for patients with metastatic disease also continuing to improve, there

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Fig. 1. — a. Pathological fracture of the neck of the femur ; b. After fixation with a Long Gamma Nail

is increasing need for stable and durable fixation (3). The lower operative mortality and morbidity and lower complication rates argue in favour of early stabilisation (4, 6, 8, 12, 18).

The advent of intramedullary nails for reconstruction has provided a useful tool in the treatment of pathological fractures of the femur. The Long Gamma nail (Howmedica – Osteonics, Rutherford, USA) is one such device with a proximal diameter of 17 mm and a middle and distal diameter of 11 mm. The distal part of the nail has a cloverleaf shape in cross section and allows two distal locking screws to be inserted to statically lock the nail. A 12-mm diameter lag screw can be inserted into the femoral head at an angle of 125°, 130° or 135°. Its use allows immediate weight bearing as tolerated, which is very much needed in such cases (fig 1 a, b and 2 a, b).

We report our experience with its use in the treatment of 22 impending and 26 completed pathological femoral fractures in 42 patients.

PATIENTS AND METHODS

Data were gathered from the review of case notes, radiographs and records of patients treated with the Long Gamma Nail for impending and pathological fractures of the femur. Between 1995 and 1999, 42 patients (12 males, 30 females) were operated for 26 pathological fractures and 22 impending fractures in the proximal part of the femur. The mean age of the patients was 65.7 yrs (range : 40 to 88). In total, 48 long Gamma nails were used in 42 patients. Six patients had bilateral fractures. Mean time to operation was 3.9 days for impending fractures (range : 1 to 20) and 1.7 days (range : 1 to 6) for fractured femurs.



Fig. 2. — a. Impending pathological lesion of the proximal femur ; b. After fixation with a Long Gamma Nail.

General anaesthesia was used in 39 cases and spinal anaesthesia in 9 cases. Antibiotic prophylaxis was used in 37 patients. Ten fractures needed open reduction of the fracture, while 38 had a closed procedure.

The fracture table was used in all the cases with the patient supine and the injured leg in traction. An incision approximately 5 cm long was made 10 cm proximal to the tip of the trochanter. The medullary canal was entered through the greater trochanter and the femur reamed in the conventional manner. A guide wire was passed and the proximal fragment was reamed to 18 mm to accommodate the expanded proximal portion of the nail. The remainder of the shaft was reamed to two millimetres beyond the selected nail diameter. The nail was inserted by hand without hammering and a 12-mm proximal locking lag screw was placed through a sepa-

rate incision. A set screw was then inserted through the proximal end of the nail to prevent rotation of the lag screw. The distal locking screws were inserted by a free-hand technique.

Long Gamma nails with a diameter of 11 mm were used in all cases. Sixteen fractures were fixed with a 135° angle nail and 32 fractures with a 130° angle nail. The standard 400 mm length was commonly used. All nails were proximally locked whereas one distal locking screw was inserted in 31 nails, 2 distal locking screws in 13 and no distal locking in 4 nails. Tissue diagnosis was taken in 6 cases where the primary tumour was not known.

Postoperatively, patients were encouraged to walk as soon as their general condition permitted. During surgery, no blood transfusion was used in 18 patients

whereas 1-4 units of blood were used in 30 patients. After the second week 23 patients were given radiotherapy, 5 had a combination of chemo and radiotherapy and 1 had chemotherapy alone. All patients were followed up clinically and radiographically.

A weighted scoring system has been proposed to quantify the risk of sustaining a pathologic fracture through a metastatic lesion in a long bone (12). A numerical score is assigned to four variables viz. the location of the lesion, the degree of pain, the radiographic appearance and the size of the lesion. Mirels recommended irradiation and observation of lesions with a score of 7 points or less and operative treatment of those with a score of 8 points or more (12). Operative treatment was recommended to those patients with a score of 8 points or more in our series.

RESULTS

The mean operating time was 98 minutes (range : 65 to 225) and the blood replacement averaged 1.5 units. Of the 42 patients, 29 sat out in a chair within the first postoperative week and 69% were ambulatory by one week. Skeletal stability was achieved in all the patients. Mean hospital stay was 9.2 days (range : 4 to 45). Of the 42 patients, 18 were alive at the time of final follow-up, with a mean survival of 13.7 months (range : 0 to 220) after the operation. The primary tumour pathology is displayed in table I.

We had 2 cases of superficial wound infection that responded to antibiotics and one patient had deep wound infection that needed debridement in the theatre, and the wound eventually healed. Six patients developed chest infection and two patients had urinary tract infection. One patient went into renal failure and two patients died in the recovery (table II). In our series of 48 nails only one nail failed mechanically. This happened in a patient with metastatic renal cell carcinoma at 4 years after the procedure and had to be revised to a long stemmed total hip replacement.

DISCUSSION

The peritrochanteric and subtrochanteric region of the femur is an area of high stress and is frequently involved by metastatic disease, resulting in

Table I. — Primary tumour pathology

Histology of the lesions	Numbers
Breast	24
Bronchus	7
Oesophagus	2
Colon	1
Prostate	5
Kidney	2
Lymphoma	1
Multiple Myeloma	5
Solitary Plasmacytoma	1

Table II. — Complications

Chest Infection	4
Urinary tract infection	2
Superficial wound infection	2
Deep wound infection	1
Renal failure	1
Deaths	2

pathological or impending pathological fractures (4, 20). These should be stabilised prophylactically, before a real fracture occurs. The biomechanics of the subtrochanteric region of the femur necessitates the use of an implant which is able to withstand long-term cyclic loading. This is especially true in patients with metastatic deposits where healing of the fractures is not expected (20). Even if the operative treatment of metastatic fractures does not prolong the patient's life, it certainly improves its quality (2).

The advent of reconstructive intramedullary nails has provided a useful tool in the treatment of pathological fractures of the femur. The commonly used nails are the Long Gamma Nail (Howmedica – Osteonics, Rutherford, NJ, USA), the Russell Taylor Reconstruction and Delta nail (Smith & Nephew Richards, Memphis, TN, U.S.A.), Long Intramedullary Hip Screw (Smith & Nephew Richards, Memphis, TN, U.S.A.) and the Proximal Femoral Nail (Stratech-SYNTHES, Hertfordshire, UK). Biomechanical studies have compared fracture site motion between different second-generation intramedullary nails used to fix subtrochanteric fractures of the proximal femur. Four types of reconstruction nails were studied (the

Russell-Taylor Delta [Smith & Nephew, Memphis, TN, USA], the Uniflex [Biomet, Warsaw, IN, USA], Alta CFX, [Howmedica-Osteonics, Rutherford, NJ, USA] and the long Gamma nail [Howmedica-Osteonics, Rutherford, NJ, USA]). As fracture severity increased (comminution, gap, and combined neck fracture), the choice of implant, particularly with reference to proximal nail dimensions and implant materials, was a significant factor in reducing fracture site motion. Roberts *et al*'s data (15) suggested that when subtrochanteric fractures are unstable (e.g., comminution, segmental bone loss) and early weight bearing is desirable, the choice of implant is critical and should be restricted to implants that allow minimal fracture site motion

The Zickel nail (Zimmer, Warsaw, IN, USA) was an early intramedullary implant for the subtrochanteric region of the femur, but was associated with difficulties relating to insertion and removal, leg length discrepancy and failure of fixation (10, 20). The use of the Russell-Taylor reconstruction nail to treat pathological fractures of the femur has been marred by a difficult surgical technique and postoperative femoral shortening, varus angulation and rotational instability (20).

The Long Gamma nail insertion technique is less demanding and because of its load sharing properties offers an attractive option, for treatment of existing and impending pathological fractures of the femur. It allows a percutaneous insertion technique through the tip of the greater trochanter, thus reducing the bleeding by minimal disruption of the abductors. The secure proximal fixation of the hip screw allows immediate weight bearing. Almodovar *et al* achieved 90% good results using the long Gamma nails in their analysis of 30 patients (1). In our series 30 patients were transfused between 1 and 4 units of blood whereas no blood transfusion was used in 18 patients. These findings were comparable to the other series published (5).

Femoral intramedullary reaming carries a risk of fat embolism. A distal venting hole was not used routinely in our series. Data from cadaveric work is available which states that proximal and distal venting holes reduced the intramedullary pressures

significantly in the intact femur and this practice is useful in patients with pulmonary disease (11) and helps to reduce the risk of hypotension during reaming of the medullary canal in femoral metastases (14). Though Gamma nails insertion needs reaming of the femurs as compared to the other third generation unreamed nails, the ability to allow weight bearing and the relative ease of insertion of the Gamma nail is an advantage in such patients, particularly those who have a shortened life span (6).

Our results have shown that the use of the Long Gamma nail alleviated the pain and improved the patient ambulation which compared with the results of Dameron *et al* (3). Adequate stability was achieved in all cases and there was a very low implant related and local complication rate. The incidence of mechanical complications was 1 in 48 that needed revision to a long stemmed prosthesis. In retrospect this patient may have been better served with a resection stem as a primary procedure.

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