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Expandable proximal femoral nail versus gamma proximal femoral nail for the treatment of AO/OTA 31A1-3 fractures

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ABSTRACT

Introduction: The gamma-proximal femoral nail (GPFN) and the expandable proximal femoral nail (EPFN) are two commonly used intramedullary devices for the treatment of AO 31A1-3 proximal femur fractures. The aim of this study was to compare outcomes and complication rates in patients treated by both devices.

Patients and methods: A total of 299 patients (149 in the GPFN group and 150 in the EPFN group, average age 83.6 years) were treated for AO 31A1-3 proximal femur fractures in our institution between July 2008 and February 2013. Time from presentation to surgery, level of experience of the surgeon, operative time, amount of blood loss and number of blood transfusions were recorded. Postoperative radiological variables, including peg/screw location, tip to apex distance and orthopaedic complications, as, malunion, nonunion, surgical wound infection rates, cutouts, periprosthetic fractures and the incidence of non-orthopaedic complications. Functional results were estimated using the modified Harris Hip Score, and quality of life was queried by the SF-36 questionnaire.

Results: The GPFN and the EPFN fixation methods were similar in terms of functional outcomes, complication rates and quality of life assessments. More patients (107 vs. 73) from the GPFN group were operated within 48 h from presentation (44.8 h vs. 49.9 h for the EPFN group, $p = 0.351$), and their surgery duration and hospitalisation were significantly longer (18.5 days vs. 26 days, respectively, $p < 0.001$). The GPFN patients were frequently operated by junior surgeons: 90% (135) while 50.6% (76) of the EPFN operations were performed by senior doctors. Other intraoperative measures were similar between groups. Cutout was the most common complication affecting 6.7% of the GPFN group and 3.3% of the EPFN group ($p = 0.182$).

Conclusions: Good clinical outcomes and low complication rates in the GPFN and the EPFN groups indicate essentially equivalent safety and reliability on the part of both devices for the treatment of proximal femoral fractures.

Introduction

With the ageing of the population, fractures of the proximal femur have become a major concern for the medical community, with estimated rate of 250,000 hip fractures per year in the USA, and 100,000 in England by 2020 [1–3]. The advanced age of the patients, and the need for early mobilisation in order to prevent the occurrence of untoward sequelae, such as pneumonia, decubitus ulcers and loss of independence, led to the development of minimally invasive fixation techniques, such as intramedullar implants [4].

Several fixation methods have been developed for unstable AO type 31-A2/A3 hip fractures. The proximal femoral nail and the gamma nail are among the most commonly used implants [1,5], while the expandable proximal femoral nail (EPFN) is a rather new device [1,5]. The gamma nail was introduced in the late 1980s. The GPFN nail (GPFN) consists of a sliding lag screw that passes through a short intramedullary nail, with or without excess distal

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locking screws [1,6]. The third-generation gamma nails (GPFN) are shorter and have a lower mediolateral curvature [2,6]. They reportedly had very good surgical outcomes in terms of shorter operation time, reduced blood loss and faster rehabilitation, along with reduced secondary fractures and cutout rates [2,4,6]. The EPFN was introduced by Steinberg et al. [7] in 2005, and the first clinical study was published by Folman et al. in 2006. It consists of an expendable peg that is inserted into the femoral head, making the interlocking screws redundant. The lack of reaming along with the small contact area between the implant's longitudinal bars and the inner surface of the bone guarantees the preservation of the endosteal microcirculation and prevents union problems [5,8]. Indeed, only a few mechanical failure complications were encountered using the EPFN. Gao et al. reported reduced operational time, blood loss and cutouts rates along with no cases of nonunion or secondary femoral shaft fractures during the follow-up period [9]. Newer data also confirm favourable outcomes with the EPFN [10].

Although there is abundant literature on proximal femoral fracture fixation methods, there is no consensus about which of the available devices is superior. They were all reported to provide good functional outcomes with low complication rates. The aim of this retrospective study was to compare the functional and radiographic outcomes and the complication rates of two of these proximal femur fixation appliances.

Patients and methods

Data retrieval and patient selection

After receiving local ethics committee approval, data were retrieved from the medical records of consecutive patients with type 31A1, 31A2 and 31A3 (AO classification) fractures of the proximal femur that were treated with either the GPFN or with the EPFN between July 2008 and February 2013. Exclusion criteria were pathologic or periprosthetic fractures.

A total of 416 consecutive patients were identified as having type 31A1, 31A2 and 31A3 fractures of the proximal femur that were treated with either the GPFN (202) or with the EPFN (214). Thirty patients from GPFN group and 27 patients from EPFN were lost to follow-up, while a further 53 patients from both groups had incomplete records, leaving a total of 149 patients were treated with the GPFN (74% of the original group) and 150 patients (70% of the original group) with the EPFN suitable for inclusion in this study.

Surgery

All operations were performed on a fracture table with the patient in a supine position and with the use of an image intensifier. The procedure for the EPFN is described in depth elsewhere [8]. Briefly, the nail is inserted using a minimally invasive technique through the medial border of the greater trochanter after obtaining good closed reduction using image intensifier C-arm. An expendable peg (8 mm that expands to 12 mm) is placed into the femoral neck and head and both components are expanded using a manual hydraulic pump under image intensifier control until good abutment to the inner cortexes is achieved. Care is taken to expand the nail to the maximal inner diameter and not to exceed 70 mm Hg, This causes expansion of the nail from its initial diameter of 10–12 mm to 16–19 mm, resulting in abutment of the longitudinal bars to the inner surface of the medullary canal and, therefore, enhanced implant–bone grip [5]. At the end, the peg and nail are locked (Fig. 1A and B). The GPFN procedure was performed according to the standard protocol using the manufacturer's instructions (GPFN, Stryker, Mahwah, NJ, USA),

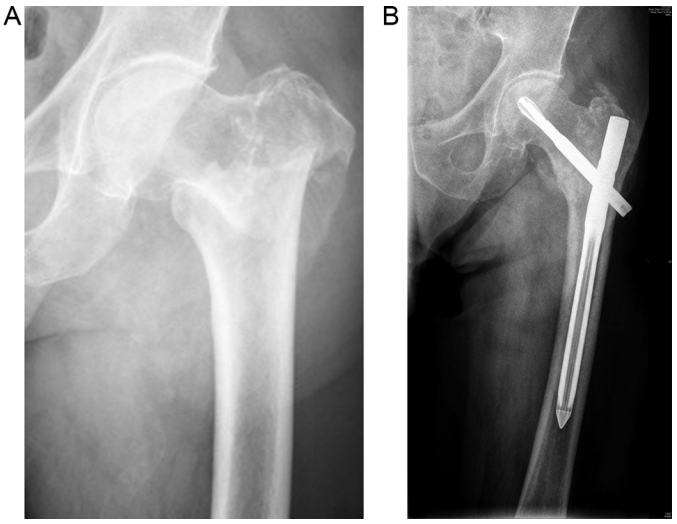

Fig. 1. A 93-year-old male with a left 31A3 fracture (A) was treated with an Expandable Proximal Femoral Nail (B).

first closed reduction performed under image intensifier control and second nail insertion (Fig. 2A and B).

Postoperative protocol

Postoperative management included, early mobilisation and weight bearing as tolerated and prophylactic treatment to prevent vein thrombosis. Clinical and radiographic follow up was performed at 6 weeks, 3, 6, 12 and 24 months post-surgery and then every 2 years. Clinical evaluation was carried out with the use of Harris Hip Score (HHS) [11] at each visit—the scores from the most recent follow-up appointment were used. Quality of life was measured with the short form-12 (SF-12) [12].

Demographic information, such as age, gender and comorbidities, along with operational data, the surgeons' level of experience, duration of surgery, blood loss, decreased haemoglobin levels and the need for blood transfusions, together with data on other hospitalisation characteristics and any intraoperative and postoperative complications were retrieved from the medical files. Malunion was defined by more than 10^0 of varus or valgus

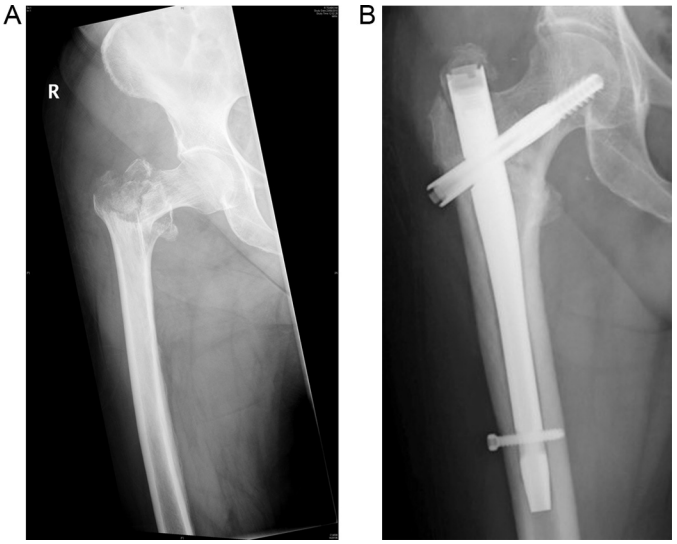

Fig. 2. A 84-year-old female with a right 31A2 fracture (A) was treated with a Gamma Proximal Femoral Nail (B).