J Orthop Sci (2013) 18:977–986
DOI 10.1007/s00776-013-0468-0

ORIGINAL ARTICLE

Percutaneous compression plate versus proximal femoral nail anti-rotation in treating elderly patients with intertrochanteric fractures: a prospective randomized study

Qingshan Guo · Yue Shen · Zhaowen Zong · Yufeng Zhao · Huayu Liu · Xiang Hua · Hui Chen

Received: 14 February 2013 / Accepted: 28 August 2013 / Published online: 2 October 2013

Abstract
Background The treatment and management of hip fracture poses a great challenge for clinicians in osteology and surgery. The aim of this study is to compare the clinical effectiveness of the percutaneous compression plate (PCCP) versus proximal femoral nail anti-rotation (PFNA) in the treatment of intertrochanteric fractures in elderly patients.
Methods A prospective randomized study was carried out from January 2008 to October 2011 involving 90 elderly patients with intertrochanteric fractures (90 hips) who underwent minimally invasive surgery using the PCCP or PFNA. Evaluation variables, including operation time, intra- and perioperative blood loss, duration of hospital stay, incidence of postoperative complications, and final clinical outcomes by the end of follow-up, were used to compare the benefits of these two implants.
Results Among 90 subjects, 45 received PCCPs and 45 received PFNAs. The baseline characteristics of the two groups were comparable. The median follow-up time was 16.9 months (12–24 months). In the PCCP group, the mean operative time was 53 min (40–75 min), and the mean intra- and perioperative blood losses were 100.7 ml (60–150 ml) and 916 ml (433–1339 ml), respectively, which were significantly lower than those in the PFNA group. Nevertheless, there was no statistical difference in the incidence of postoperative complications and final clinical outcomes including pain complaints, range of motion of the hip, postoperative hip function at 12 months, and the recovery of walking ability to pre-injury status between these two implants.
Conclusions Overall, the PCCP and PFNA appear to have similar clinical effects in treating elderly patients with intertrochanteric fractures, although the PCCP provided shorter operation times and less blood loss than PFNA. Both implants discussed were demonstrated to be ideal for the treatment of femoral intertrochanteric fractures in elderly patients.

Q. Guo · Y. Shen (✉) · Z. Zong · Y. Zhao · H. Liu · X. Hua · H. Chen
Trauma Center, Institute of Surgery Research, Daping Hospital, Third Military Medical University, No. 10 Yangtze River Road, Yuzhong District, Chongqing 400042, People's Republic of China
e-mail: sy@upclouds.net

Introduction

Fracture of the proximal femur, generally termed "hip fracture," is one of the most common and severe fractures occurring in the elderly population. It has been reported that 90 % of hip fractures occur in patients over the age of 65 [1]. When compared with other fractures in this population, hip fracture has greater associated rates of death and disability as well as higher medical expenses [1, 2]. During the last 25 years, the incidence of hip fracture has increased rapidly, and it is estimated that 7.3–21.3 million individuals will suffer from this injury globally in 2050 [3, 4]. Therefore, the treatment and management of hip fracture pose great challenges for clinicians in osteology and surgery.

The primary goal for the treatment of intertrochanteric hip fracture is to achieve minimal mortality and morbidity, low re-operation rates, and early successful run-up to sustainable mobility. The basic strategy for achieving this goal greatly depends on the quality of fracture fixation, including biomechanical stability and rigidity [5, 6]. Currently, the sliding hip screw is the most widely used

implant for fixation of intertrochanteric hip fracture and thus serves as a benchmark in this field [7]. In elderly patients, however, this surgical procedure is always associated with substantial intra- and perioperative blood loss and severe soft-tissue damage [8, 9]. Therefore, minimally invasive surgical techniques are being developed in order to overcome these problems implicit in sliding-screw fixations [9]. The percutaneous compression plate (PCCP) and proximal femoral nail anti-rotation (PFNA) are recently developed devices designed for minimally invasive surgery in the treatment of hip fractures, and they have been widely used in elderly patients with demonstrated clinical effectiveness [10–12]. Researchers have also performed numerous clinical studies to compare either the PCCP or PFNA with other orthopedic implants [13–16]. Nevertheless, reports on the clinical effectiveness of the PCCP versus PFNA in elderly patients with intertrochanteric fractures are quite few.

In order to compare the clinical effects of the PCCP versus PFNA in the treatment of hip fractures in elderly patients, we conducted a prospective randomized study from January 2008 to October 2011 involving 90 elderly patients with intertrochanteric fractures who underwent minimally invasive surgery using the PCCP or PFNA. Evaluation variables, including operation time and intra- and perioperative blood loss, incidence of postoperative complications, and final clinical outcomes at the end of follow-up, were used to compare the benefits of these two implants.

Materials and methods

Patients

This study was approved by the Ethics Committee of the authors' institution. The inclusion criteria were: (1) being older than 60 years (≥60 years); (2) having intertrochanteric fractures of type 31A1 and 31A2 based on the Orthopedic Trauma Association (OTA) classification; (3) an American Society of Anesthesiologists (ASA) Score of I-IV. The exclusion criteria were: (1) younger than 60 years (<60 years); (2) subtrochanteric fractures (type 31A3 in the OTA classification); (3) an ASA score of V; (4) existing or previous fractures in the same or contralateral hip; (5) injuries that could affect the outcome measures; (6) abnormalities that could affect the outcome measures. A total of 136 patients were assessed for eligibility between January 2008 and October 2009. Among them, 33 patients were excluded on the basis of inclusion and exclusion criteria, and 13 refused to participate. Finally, 90 patients (90 hips) were enrolled in this study (Fig. 1). Written informed consent was obtained from each patient or the family members if the patients were incapable of consent.

The patients were randomized into two groups,the PCCP ($n = 45$) or PFNA ($n = 45$), using a sealed-envelope system. The baseline characteristics, including age, gender, cause of fracture, ASA risk score, OTA classification, fracture type based on the Evans-Jensen classification (types I and II as stable and types III–V as unstable), comorbidities, and pre-injury walking ability score (0–9 points according to Parker and Palmer's method [17]), are described in Table 1.

Methods

For all patients in both treatment groups, PCCP or PFNA operations were generally performed according to the standard protocols provided by the manufacturer and the procedures described in the previous literature [10, 12, 18, 19]. The PCCP implant (Orthofix Orthopedics International, Bussolengo, Italy) used in this study is composed of a 125-mm plate, two neck screws with lengths from 90 to 140 mm in 10-mm increments, and three shaft screws with lengths from 31 to 43 mm in 3-mm increments (Fig. 2a). The PFNA implant (Synthes Inc., West Chester, PA, USA) was a solid titanium nail with a length of 170 or 240 mm (Fig. 2b). Both the PCCP and PFNA were inserted using a percutaneous technique.

In order to make the operating procedures comparable between the two groups, all operations were performed by expert surgeons who had equal levels of experience with both the PCCP and PFNA. Regional anesthesia was used for both groups. Preoperative antibiotics were administered intravenously to the patients in order to reduce the risk of postoperative infections. All patients underwent implantation on a traction table in a supine position. Blood pressure, pulse, respiration, body temperature, and blood oxygen saturation were monitored during the operation. The operative time was recorded from the start of the skin incision to the time that skin closure was performed by a nurse. Intraoperative blood loss was measured by collection of the suction volume and change in the weight (wet vs. dry) of the sponges. No drains were used. Perioperative blood loss was calculated based on the hemoglobin level and the estimated blood volume of the patient, using the method described by Foss and Kehlet [20]. Estimated blood volume was determined according to gender, body weight, and height [21].

On the first day after surgery, plain anteroposterior (AP) and lateral radiographs were taken to evaluate the reduction of fracture and the position of the PCCP or PFNA implants. All patients were administered prophylactic antibiotics for 3 days. Under the guidance of surgeons, all patients were encouraged to exercise their hip, knee, and ankle joints from the first day post-surgery. They also started to walk with full weight-bearing with a walking aid as soon as