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Mid-term results after treatment of intertrochanteric femoral fractures with percutaneous compression plate (PCCP)

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ABSTRACT

Background: With the ageing of the population, intertrochanteric femoral fracture is associated with increased morbidity. There is continuing controversy over the best treatment for the injury, and the choice of internal fixation method has been a focus of dispute. The purpose of this study was to evaluate the results of these fractures being treated with the percutaneous compression plate (PCCP) technique.
Methods: From March 2009 to May 2012, 154 patients with intertrochanteric femoral fractures were treated using the PCCP method. Forty-one patients were excluded from the study. According to the AO classification, the remaining 113 fractures were classified as 35 cases of 31A1 fractures, 59 cases of 31A2 fractures, and 19 cases of 31A3 fractures. The clinical data and imaging results were retrospectively analysed.
Results: The mean operation time was 42.0 (range, 25–82) min, the mean intraoperative blood loss was 40.5 (range, 10–100) ml, and the mean hospital stay was 8.6 (range, 3–18) days. One patient died of renal failure in the perioperative period. Twelve patients died during the 12 months after surgery. The remaining 100 patients were followed-up for 12–36 months and healed their fractures except one, whose neck screw cut out from the femoral neck after 1 postoperative month and resulting in a revision to a hemiarthroplasty. The mean time to bone healing was 12.6 (range, 6–23) weeks. Sixteen patients had pain. There were 13 major device-related complications, including 5 cases of coxa vara, 4 cases of fracture collapse, 2 cases of head penetration, and 2 cases of fracture collapse combined with head penetration. At the time of the last follow-up, 81 patients had regained a pre-injury level of function. The median Harris hip score was 89 points. The median Parker-Palmer score was 7 points. Patients with poor quality of reduction and bad positioning of neck screw were more likely to suffer complications ($p < 0.05$).
Conclusion: The results suggest that the PCCP is an effective and safe method in the treatment of all types of intertrochanteric femoral fractures, but good fracture reduction and ideal positioning of the neck screw are prerequisites for the success of the device.

Introduction

With the rapid increase in the elderly population, the morbidity of intertrochanteric femoral fractures is also displaying a rising trend. The annual worldwide incidence of hip fractures is estimated to be 6.3 million by 2050 [1]. Approximately 50% of hip fractures occur in the intertrochanteric region [2]. To return to pre-injury function and activity levels, operative interventions have gradually become preferred [3]. Currently, there are two main types of implants available for these fractures, namely extramedullary and intramedullary implants. The dynamic hip screw (DHS) has been considered the gold standard in the treatment of intertrochanteric hip fractures for 50 years [4]. However, for unstable intertrochanteric fractures, the failure rate is higher [5,6]. Although intramedullary fixation has an advantage in mechanics, current evidence-based clinical research suggests that intramedullary nailing has no superiority over DHS in complications, fracture healing, functional recovery and reoperation rate [7,8]. Thus, there is a considerable controversy over the choice of treatment for intertrochanteric femoral fractures. Determining a minimally invasive technique to reduce implant failure, decrease

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blood loss, minimise complications, relieve pain, lessen soft damage, and achieve early mobilisation is important for elderly patients.

In the late 1990s, Gotfried developed the percutaneous compression plate (PCCP) technique, which minimises operative trauma by way of two small percutaneous portals, and small-diameter drilling prevents additional bone damage in the remaining lateral trochanteric wall [9–11]. Gotfried first reported the surgical technique and clinical efficacy of treatment of intertrochanteric fracture with PCCP and indicated that the results, particularly with unstable intertrochanteric fractures, were encouraging [9]. With the further clinical application, some studies suggest that PCCP can reduce intraoperative blood loss, shorten operation time, relieve postoperative pain [12–15] reduce the incidence of fracture collapse [14,16], and better improve the functional recovery [17]. On the contrary, other reports suggest that PCCP lengthens operation time [18], increases biomechanical complications [13], and no significant difference in device-related complications, mortality, and functional recovery compared with DHS [12,15,18–20]. There are some disputes of PCCP treatment of intertrochanteric fractures mentioned above and few literature explored the reasons for complications [21]. Therefore, we conducted this retrospective study, which was approved by the Ethics Committee of Southwest Hospital, and present the results concerning the use of the PCCP implant for these fractures. We compare our results with the data published by other authors and evaluate the mid-term results of the newly developed PCCP implants in terms of the stabilisation of fractures through 1–3 years follow-up. We also explore the possible reasons for the observed device-related complications.

Materials and methods

From March 2009 to May 2012, 154 consecutive patients with intertrochanteric femoral fractures were treated with a PCCP (Orthofix Italy) in our institute. Because the main analysis group is isolated geriatric low energy intertrochanteric femoral fractures, 41 patients were excluded from the study, including pathological fractures in 2 cases (pathological fractures may affect the fracture healing time), old fractures in 2 cases (old fractures may have more intraoperative blood loss and longer fracture healing time), multiple fractures in 3 cases (multiple fractures may affect operation time, intraoperative blood loss, postoperative haemoglobin fall value and hospital stay), younger than 60 years old in 15 cases (younger patients are less likely to have medical comorbidities/complications and a shorter length of stay), and with non-fall/low energy mechanisms in 19 cases (higher energy injuries may further alter the types of hip fracture patterns). The remaining 113 patients were included in this study. There were 43 men and 70 women. Fifty-four injuries involved the left side, and 59 involved the right side. The median age of the patients was 81 years. All injuries were closed. According to the AO/OTA classification system [22], the fractures were classified as 35 cases of 31A1 fracture, 59 cases of 31A2 fracture, and 19 cases of 31A3 fracture. With regard to comorbidities, according to the American Society of Anesthesiologists (ASA) scale [23], 8 patients were classified as ASA 1, 60 patients were classified as ASA 2, 43 patients were classified as ASA 3, and 2 patients were classified as ASA 4 (Table 1).

Table 1
Demographic analysis.

Variables	Value	Percentage (%)
Number of patients	113	
Age	81 (75.5, 85)[a]	
60–79	42	37
80–99	69	61
≥100	2	2
Gender		
Male	43	38
Female	70	62
AO fracture types		
A1	35	31
A2	59	52
A3	19	17
Laterality		
Left	54	48
Right	59	52
ASA scale		
I	8	7
II	60	53
III	43	38
IV	2	2
V	0	0
Pre-fracture mobility		
Independent	94	83
Assisted (one aid)	17	15
Assisted (frame)	0	0
Wheelchair	2	2

[a] Median (the 25th and 75th centiles was included in brackets).

Preoperative protocol

After admission, the overall pre-injury conditions of the patient, such as life self-care ability, level of function, mental status, history of chronic diseases, were obtained. We appropriately optimised medically and attempted to gradually stabilise the condition of the injured patients within 1–2 days, in conjunction with our medical colleagues. Routine preoperative preparation of blood and routine review of blood were conducted. Epidural anaesthesia or nerve block anaesthesia was employed.

Surgical technique

The surgical technique is the same as Gotfried's description [10] (Fig. 1). But for A3 type fractures, the first neck screw was inserted into the appropriate position in the femoral neck, with the entrance point avoiding the fracture line (to avoid splitting and re-displacement in the proximal fracture when drilling). Other steps were performed in the same manner as Gotfried's description [10].

Postoperative treatment and evaluation

Antibiotics were applied for 3–5 days postoperatively, and anticoagulant therapy was not given before or after surgery. Routine blood review was performed on the second postoperative day. The imaging examinations included anteroposterior and lateral radiographs for the affected hip. After an X-ray examination was performed on the second postoperative day, patients were encouraged to perform functional exercises with the affected limb. Patients with type A1 and type A2 fractures who had good/acceptable fracture reduction and ideal positioning of the neck screw were allowed full weight bearing. Patients with type A3 and type A2 fractures who had bad fracture reduction or bad positioning of neck screw were subjected to a more conservative strategy. Touchdown weight bearing with the help of crutches or a frame began two weeks after surgery. One month after surgery, the patients were allowed partial weight bearing. Progressive weight bearing was encouraged as tolerated. Full weight bearing was encouraged after 2 months of partial and increasing weight bearing, based on the evidence of callus formation on radiographs. Patients were examined clinically and radiographically with a minimum follow-up period of 12 months.

The operation time, intraoperative blood loss, postoperative blood transfusion volume, postoperative haemoglobin fall values,