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Treatment of pertrochanteric fractures with a proximal femur locking compression plate☆

Guo-Chun Zha [a,b], Ze-Lin Chen [b], Xiao-Bo Qi [b], Jun-Ying Sun [a,*]

[a] Orthopaedic Department, The First Affiliated Hospital of Soochow University, 188 Shizi Street, Suzhou, Jiangsu 215006, PR China
[b] Orthopaedic Department, The People's Hospital of Zongyang, Zongyang, Anhui 246702, PR China

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ABSTRACT

Background: Pertrochanteric femoral fractures are one of the most common fractures in old patients. However, fixing pertrochanteric fractures properly is clinically challenging. There are also no routine treatments for this facture. Here, we report the clinical trial of pertrochanteric fracture treatment with a proximal femur locking compression plate (PFLCP). By recording and analysing the radiographic and clinical results from patients treated with PFLCP, we found that PFLCP could provide three-dimensional fixation mechanical advantages compared with conventional treatments, even in the case of unstable fractures in the osteoporotic bone.

Methods: The report included a total of 110 patients (72 females and 38 males) with pertrochanteric femoral fractures who were subjected to PFLCP treatment. The mean age of the patients was 75 (48–93) years. Pertrochanteric fracture includes both intertrochanteric and subtrochanteric femoral fractures: intertrochanteric fractures were classified according to Jensen (1980), whereas subtrochanteric fractures were classified according to Zickel (1980). Detailed clinical conditions of all patients, including blood loss, drainage and length of incision, were recorded individually. The duration of image intensification was also monitored. Patients were revisited at 6 weeks, 3 months, 6 months and 1 year after the operation. The progress of healing, as well as the occurrence of complications, was recorded.

Results: Amongst the 110 patients, 108 (98%) were available for follow-up check-up at 6 weeks, 104 (95%) at 3 months, 100 (91%) at 6 months and 94 (85%) at 1 year. The other patients were lost to follow-up because of death. The union rate was 95% (99/104), 98% (98/100) and 100% (94/94) at the 3-month, 6-month and 1-year period during the follow-up check-up, respectively. The patients healed satisfactorily and had no complications, such as cut-out in most cases. However, there was one case of breakage of the implant and one case of non-union at the 3-month period during the follow-up check-up. Amongst all patients, 77 cases were successfully reduced with traction on a fracture table under fluoroscopy; the others were opened to correct the displacement. The average operation time was 35.5 min, and the mean bleeding amount was 150 ml (including operative blood loss and wound drainage). The mean image intensifier time was 5 min and the mean length of incision was 9 cm.

Conclusion: The PFLCP can be a feasible alternative to the treatment of pertrochanteric fractures. Treatment with a PFLCP can provide good-to-excellent healing for pertrochanteric fractures, with a limited occurrence of complications.

Introduction

Pertrochanteric femoral fractures are one of the most common fractures in old patients, affecting approximately 300,000 people every year.[8] The reported mortality rate of pertrochanteric femoral fractures ranges from 4.5% to 22%.[6] Early operative treatment for pertrochanteric fractures is a widely accepted approach. The aim of the surgery is to achieve initial stability and early mobilisation of the patients to avoid complications, such as thrombophlebitis, pulmonary embolism, urinary and lung infection and ulcers.[13,15] However, traditional devices, such as dynamic hip screws (DHSs), angular blade plates and intramedullary nails, can only provide limited treatment for pertrochanteric fractures. For example, the reoperation rate of DHS and intramedullary nails is reported to be 8.2%[24] and 3–12.7%,[24,1,3,5,22,32] respectively.

The locking compression plate was introduced about a decade ago as a new implant that allows angular-stable plating for the treatment of complex comminuted and osteoporotic fractures.[7,11,12,29,35] Although the locking compression plate can

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* Corresponding author. Tel.: +86 18862315621.
E-mail address: wodaoshi@sohu.com (J.-Y. Sun).

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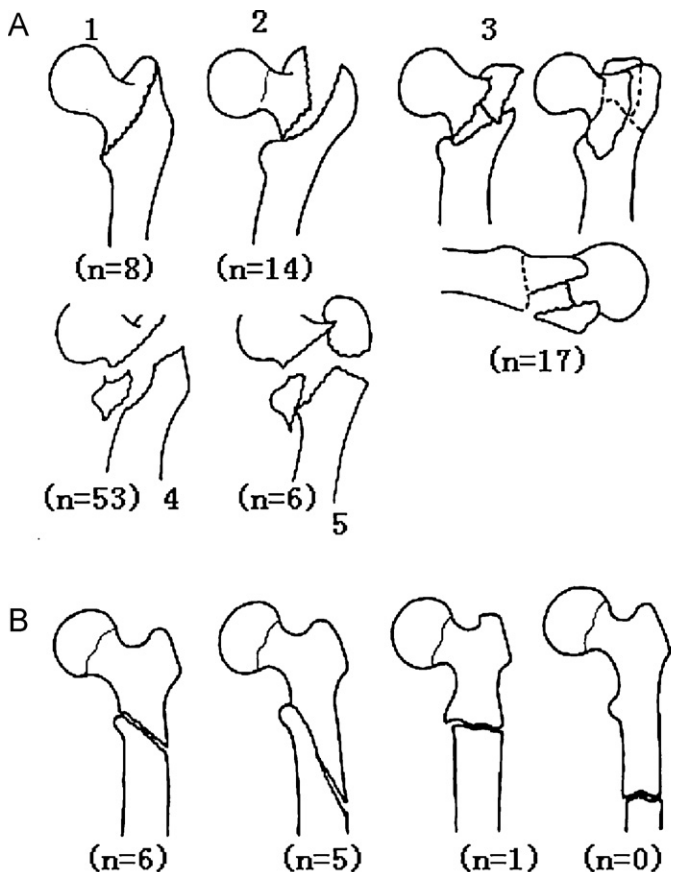

Fig. 1. (a) The Jensen classification of intertrochanteric fractures (1980). Types 1 and 2 are stable; types 3, 4, and 5 are unstable. Cases of each type of fracture are shown with numbers in brackets. (b) The Zickel classification of subtrochanteric fractures into spiral (short and long) and transverse (proximal and distal) types (1980). Cases of each type of fracture are shown with numbers in brackets.

provide good-to-excellent treatment for complex fractures in different anatomic regions, there are only a few reports on the treatment of pertrochanteric fractures using this novel technique.

Here, we report the results of our clinical trial of pertrochanteric fractures treated with proximal femur locking compression plate (PFLCP) (Trauson or Kanghui, China). In the current study, we tested the efficiency of the PFLCP by assessing its ability to maintain radiographic reduction and evaluating its functional outcome according to time-course measurement after the fracture.

Patients and methods

A total of 110 patients (72 females and 38 males) with pertrochanteric femoral fractures received surgery treatment with PFLCP in our hospital from May 2007 to October 2009. The mean age of the patients was 75 (48–93) years. Pertrochanteric fracture includes both intertrochanteric and subtrochanteric femoral fractures: intertrochanteric fractures were classified according to Jensen (1980),[17] whereas subtrochanteric fractures were classified according to Zickel (1980).[37] The distribution of the fracture type is shown in Fig. 1. Detailed clinical conditions of all patients were recorded individually, including blood loss, drainage and length of incision. The duration of image intensification was also monitored. Patients were revisited at 6 weeks, 3 months, 6 months and 1 year after operation, with clinical and radiographic assessment of the progress of healing and complications.

Surgery technique

The PFLCP is a contact-limited, angular-stable plate designed for the treatment of complex, comminuted pertrochanteric fractures. The plate is anatomically precontoured to the metaphyseal zone of the proximal femur.[14] The four proximal threaded round holes distributed in a diamond shape in the plate are made of cannulated 6.3-mm locking head screws inserted at a predetermined angle of 130° in relation to the shaft of the femur (Fig. 2). The remaining 5–13 screw holes are classical LCP-combi-holes, which allow the placement of either a conventional screw (4.5 mm) or a locking screw (5.0 mm) at the level of the shaft (Fig. 2).[14]

The preoperational planning of fracture reduction and the selection of an appropriate implant length were performed with specific templates.[14] Surgery was performed with the patient lying on his/her back, either on a radiolucent operating table or on a fracture table in traction. For the latter option, closed fracture reduction was obtained before surgery under fluoroscopic view in the anteroposterior and lateral/axial views and subsequently secured in traction.[14] Achieving proper rotation of the femur with the patella in a horizontal position was important. In highly comminuted and unstable fractures that could not be adequately reduced by traction on a fracture table, we preferred free draping of the lower extremity in the supine position on a radiolucent operating table.[14]

A lateral longitudinal incision of about 6.0 cm was made low in the greater trochanter after the top of the greater trochanter was palpated by the surgeon's index finger. After a longitudinal incision of the iliotibial band, we split the fascia of the lateral vastus at its proximal insertion, and the muscle was flipped to visualise the lateral aspect of the proximal femur. The comminution zone needed to be avoided. Preserving the vascularity of the fracture was important. For complex and comminuted fractures that could not be operated as closed fracture reduction, we chose to open and correct displacement. Fracture reduction was verified by fluoroscopy in two X-ray views. When the fracture reduction was successfully operated, a guide wire was passed along the anterior surface of the neck and head on their midpoints to assess the angle of the femoral anteversion. The plate was slid distally on the submuscular plane using a distal counterincision (proximal incision 6.0 cm, distal incision 4.0 cm) at the level of the tip of the plate (Fig. 3). A 2.5-mm drill bit guide wire was inserted through a wire sleeve threaded through the four proximal holes. The guide wires were advanced to the subchondral bone of the femoral head. Their positions were confirmed by fluoroscopy in the anteroposterior and lateral/axial views. At this point, before placing the proximal locking head screws, it is crucial to ensure that the distal part of the plate was appropriately aligned to the femoral shaft. The proper screw length was determined by a measuring device over the guide wires. Four 6.3-mm cannulated locking head screws with self-tapping were then inserted. The plate was distally fixed with three to four additional bicortical locking screws. In the case of subtrochanteric comminution, at least two to three holes of the plate were left empty at the level of the fracture. This allowed a larger area of stress distribution on the plate and reduced the strain at the fracture, which could prevent implant failure after cyclic weight bearing.[14]

After the surgery, drain was removed after 48 h. All patients were encouraged to start active flexion and extension of the hip and knee at the affected side. Partial weight bearing started about 6 weeks after operation. Weight bearing was gradually increased to tolerance level.

Results

Amongst all the 110 patients, 108 (98%) were available for follow-up check-up at 6 weeks, 104 (95%) at 3 months, 100 (91%) at 6 months and 94 (85%) at 1 year (Table 1). The other patients were