



Effect of fragmentary displacement and morphology in the treatment of comminuted femoral shaft fractures with an intramedullary nail



Shih-Jie Lin ^{a,1}, Chi-Lung Chen ^{a,1}, Kuo-Ti Peng ^a, Wei-Hsiu Hsu ^{a,b,*}

^a Department of Orthopedic Surgery, Chang Gung Memorial Hospital at Chia Yi, Chia Yi, Taiwan

^b Department of Medicine, School of Medicine, Chang Gung University, Tao-Yuan, Taiwan

ARTICLE INFO

Article history:

Accepted 10 October 2013

Keywords:

Reversed fragment
Femoral shaft
Fracture
Displacement

ABSTRACT

Objective: Our study aimed to determine whether the displacement and morphology of a fragment in femur fracture with Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association/32-B/32-C (AO/OTA/32-B/32-C) classification affect the outcomes following closed reduction and internal fixation with an interlocking nail.

Design: This was a retrospective study.

Setting: The study was conducted at a Level III trauma centre.

Patients: A total of 50 consecutive patients presenting femoral shaft fracture with AO/OTA-type 32-B/32-C were included in the present study.

Interventions: Patients were divided into two groups according to the displacement of the fragments. In the large displacement group, patients were further subgrouped according to whether a reversed morphology of the fragment was present.

Outcomes measurement: The radiographic union score of femur (RUSF), the mean union time and the re-operation rate were assessed.

Results: The union rate of small- and large-gap groups at 12 months postoperatively was 75.9% and 21.1%, respectively ($p = 0.000$). The mean union time of those union cases in these two groups was 7.8 and 13.0 months, respectively ($p = 0.000$). The union rate of the non-reversed and reversed groups at 12 months postoperatively was 30% and 11.1%, respectively ($p = 0.179$). The mean RUSF at 12 months in the non-reversed and reversed groups was 8.8 and 8.3, respectively ($p = 0.590$). However, we found that patients presenting a reversed fragment had an increased risk of more than one re-operation ($p = 0.030$).

Conclusions: A fragmentary displacement of >1 cm in AO/OTA-type 32-B/32-C femoral shaft fracture after nailing affected bone healing. Among the large-gap group patients, an unreduced reverse fragment presented a negative prognostic factor for re-operation.

Level of evidence: Prognostic level III.

© 2013 Elsevier Ltd. All rights reserved.

Femoral shaft fractures were not uncommon in adults who sustain high-energy trauma. Intramedullary nailing of the femur was suggested because of its satisfactory union rate under stable biomechanical circumstances [1–11]. Nowadays, closed reduction and internal fixation with an interlocking nail for fracture of the femoral shaft is generally accepted as a standard treatment and it has been extended to nearly all shaft fractures from the proximal to the distal femur [11,12]. However, shortening and malrotation for Winquist grade III/IV femur shaft fracture following closed

intramedullary nailing was still a challenging problem [16]. Standard open reduction was not suggested because complications such as a high rate of infection, delayed union and nonunion occurred [7,13–16]. Specifically, Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association/32-B/32-C (AO/OTA 32-B/32-C) femoral shaft fracture was demonstrated in 10.5–34% of all femoral fractures, and such a large butterfly fragment may result in technical difficulties in anatomical restoration such that the residual gap usually persisted after closed reduction [17,18]. Whether a residual gap after closed reduction results in a higher risk of nonunion in such a group remains unclear. Furthermore, the butterfly fragment occasionally represents a reversed morphology such that the endosteum turns inside out. It is possible that the reversed fragment may further affect bone healing because of vascular bed compromise and difficult callus bridging over fragment gaps. Hence, it is worthy of investigation

* Corresponding author at: Department of Orthopedic Surgery, Chang Gung Memorial Hospital at Chia-Yi, No 6, West section, Chia Pu Road, Puzih, Chia Yi Hsien 613, Taiwan. Tel.: +886 5 3621000x2855; fax: +886 5 3623002.

E-mail address: 7572@cgmh.org.tw (W.-H. Hsu).

¹ Both authors equally contributed to this work.

whether the reversed fragment results in a worse outcome. We hypothesised that a larger fracture gap would result in a decreased union rate after closed reduction. In addition, the re-operation rate could increase if the fragments become reversed.

Patient and methods

From January 2007 to December 2011, a retrospective cohort of patients presenting femoral shaft fracture with AO/OTA-type 32-B/32-C treated in our hospital was included in the present study. The excluding criteria were periprosthetic fracture in patients with implanted hip or knee prosthesis, underlying bony pathology, concomitant brain injury, open fracture and use of steroids or immunosuppressive agents. This study was approved by the Institutional Review Board of the authors' affiliated hospital. Through a careful review of medical charts and serial radiographs, parameters such as demographic data, fracture patterns, postoperative courses and union rates were recorded and analysed. Femoral shaft fracture was defined as the portion of bone between a point 5 cm distal to the lesser trochanter and a point 8 cm proximal to the adductor tubercle [19]. Fracture pattern was defined according to the Winquist–Hansen classification [8,16] and the AO/OTA classification [9,20]. All patients underwent locked antegrade reamed intramedullary nailing through a standard closed technique by the same team of surgeons [9,21]. Briefly, a patient was put in a supine position on a fracture table. The canal in an adult was prepared by reaming to 1.0 mm greater in diameter than the anticipated nail diameter, which was determined by a radiograph. In AO/OTA-type 32-B/32-C femoral shaft fracture, one proximal screw and two distal screws were inserted to maintain length and rotational stability. All reduction attempts were performed strictly by closed means. If a butterfly fragment was not reduced, a bridging nail would be applied with the fragment left in situ. The enrolled patients with femoral shaft fractures were subdivided into large- and small-gap groups according to the displacement of the butterfly fragment after the nailing procedure. The numerical value for the displacement of a butterfly fragment in millimetres was calculated as follows: $D_{\text{prox}} + D_{\text{dist}} - B_d$, where $D_{\text{prox}}/D_{\text{dist}}$ is the largest perpendicular distance of the proximal/distal end of fragments to the midline of the shaft measured from antero-posterior and lateral radiographs and B_d is the diameter of the shaft at the fracture site on the same radiographs. Those patients presenting a gap >10 mm between the butterfly fragment and reduced shaft were designated as the large-gap group (Fig. 1), and those with a gap ≤ 10 mm as the small-gap group (Fig. 2). Patients with a large-gap butterfly fragment were further subgrouped according to whether a reversed morphology of the fragment occurred (Fig. 3). A reversed butterfly fragment was defined as an inverted one with the outer cortex apposing the medullary canal in biplanar radiographs.

Clinical and radiological assessments were performed 1 week postoperatively. Antero-posterior and lateral radiographs were obtained every 3 months for at least 24 months or until bone union was attained. The main outcome was measured as radiological union score at 6, 9 and 12 months postoperatively and union time at the last visit. The radiographic union score of femur (RUSF) was determined in each follow-up radiograph. The RUSF was modified from the radiographic union score of the tibia system described by Whelan et al. [22]. Briefly, this scoring system was based on the assessment of healing at each of the four cortices visible on these projections (i.e., medial and lateral cortices on the antero-posterior plain film as well as anterior and posterior cortices on the lateral film) [22].

The radiographical union was defined as a bridging callus restored the continuity at the fracture gap with consolidation. The outcomes of treatment such as the RUSF, the mean union time and



Fig. 1. A 56-year-old woman sustained right femoral shaft fracture after closed intramedullary nailing. A long and displaced butterfly fragment presenting a >10 mm gap between the butterfly fragment and reduced shaft was demonstrated (A) anteroposterior view, (B) lateral view.

the re-operation rate were assessed. Failed union was defined by a disturbed consolidation of a fracture that needs re-operation or a prolonged healing time of >12 months [23,24]. Re-operation was performed if there was no progression of consolidation, if there was no bone bridging over bony gaps or if there was persistent local pain when weight bearing clinically after 6 months. The re-operation was performed with autogenous/allogeneous bone grafting. Additional plating for de-rotation was performed if excessive motion was noted over the fracture site in response to rotatory load. Dynamisation was not practised because of this comminuted fracture pattern.

Results

A cohort of 50 patients presenting 51 femoral shaft fractures was identified. Three patients were excluded because of a short follow-up <12 months. A total of 47 patients with 48 fractures



Fig. 2. A 27-year-old man sustained right femoral shaft fracture after closed intramedullary nailing. A minimally displaced butterfly fragment presenting a gap ≤ 10 mm between the butterfly fragment and reduced shaft was demonstrated (A) anteroposterior view, (B) lateral view.

Download English Version:

<https://daneshyari.com/en/article/3239485>

Download Persian Version:

<https://daneshyari.com/article/3239485>

[Daneshyari.com](https://daneshyari.com)