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Effectiveness of controlled telescoping system for lateral hip pain caused by sliding of blade following intramedullary nailing of trochanteric fracture

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ABSTRACT

Introduction: The purpose of this study was to demonstrate the effectiveness of controlled telescoping system for lateral hip pain caused by sliding of the blade following intramedullary nailing of trochanteric fractures.

Materials and methods: A retrospective cohort study was performed to compare the controlled telescoping system (Compression Hip Nail; CHN) with the conventional sliding system (Proximal Femoral Nail Antirotation; PFNA) for trochanteric fractures. 74 cases in the PFNA group and 77 cases in the CHN group were included from two university hospitals in this study. All patients had a minimum of 12-month follow up period. Lateral hip pain was evaluated and operation time and blood loss during the surgery were measured. The fracture classification was evaluated. The quality of postoperative reduction and other complications after surgery were also evaluated and tip-apex distance (TAD), telescoping and lateral protrusion of the blade and lag screw were measured.

Results: The mean age was 78.5 years in the PFNA group and 74.7 years in the CHN group ($p = 0.25$). The mean telescoping was 19.2 mm in the PFNA group and 10.7 mm in the CHN group ($p < 0.001$). The mean length of lateral protrusion was 10.5 mm in the PFNA group and 2.5 mm in the CHN group ($p < 0.001$). Twenty-eight patients in the PFNA group complained of lateral hip pain, whereas 12 patients in the CHN group did ($p = 0.002$). These four variables showed statistically significant differences between the PFNA and CHN groups ($p < 0.05$). The length of lateral protrusion was the only variable significantly related to lateral hip pain through multivariate logistic regression analysis ($p = 0.045$).

Conclusions: The degree of lateral protrusion was mainly related to lateral hip pain. Therefore, controlled telescoping would help to decrease lateral hip pain by decreasing the lateral protrusion beyond the lateral femoral cortex.

Introduction

Most trochanteric fractures require surgical treatment. Internal fixation with a sliding hip screw after anatomical reduction has traditionally been the treatment of choice [1]. These days, intramedullary nails have become the implant of choice for some orthopedic surgeons for trochanteric fractures [2,3]. Both options employ the central concept of allowing the fracture fragment to impact, achieve bone-on-bone stability, and reduce chances of implant failure; so-called "controlled collapse" during fracture healing [4].

Some complications such as cutout or cut through, femoral neck shortening and lateral migration of the blade or hip screw as well as nonunion, malunion, wound infection and medical complications can occur following operations for intertrochanteric fractures [5–7]. Among these complications, lateral migration of the blade or lag screw is expected during fracture healing through controlled collapse after the operation using an intramedullary nail for intertrochanteric fractures. However, there is controversy about the effects of lateral migration of the helical blade, which is the most common mechanical complication, on the clinical outcome after operations for trochanteric fractures [6–8].

Therefore, we tried to investigate the correlation between lateral hip pain and lateral prominence of the blade or lag screw

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through sliding during fracture healing after operations for trochanteric fractures using intramedullary nails. We attempted to demonstrate the effectiveness of controlled telescoping system for lateral hip pain caused by sliding of the blade following intramedullary nailing of a trochanteric fracture.

Materials and methods

We performed a retrospective cohort study to compare the controlled telescoping system with the conventional sliding system using a blade for trochanteric fractures following institutional review board approval (IB-3-1408-026). The surgeries were performed at two university hospitals from November 2012 to January 2014 by three experienced surgeons. The inclusion criteria included 1) trochanteric fracture, 2) no other fractures on the lower extremities, contralateral hip or pelvis, 3) treatment with either Proximal Femoral Nail Antirotation (PFNA; Synthes®, Oberdorf, Switzerland) or Compression Hip Nail (CHN; TDM®, Seoul, Korea), 4) confirmation of union with minimum 12 month follow-up after surgery and 5) no other complications except lateral hip pain. The exclusion criteria included 1) unstable vital signs or Injury Severity Score of more than 15 at admission, 2) pathologic fracture and 3) not reached skeletal maturity. According to those criteria, 74 cases in the PFNA group and 77 cases in the CHN group were included in our control group and study group, respectively. Two implants with different cephalomedullary nail systems were used (Fig. 1); one had conventional sliding system with a blade angle of 125° (Proximal Femoral Nail Antirotation; PFNA; Synthes®, Oberdorf, Switzerland) and the other had controlled telescoping system with a lag screw at 125° (Compression Hip Nail; CHN; TDM®, Seoul, Korea). PFNA was chosen as an implant of comparing group because the PFNA is a widely used cephalomedullary nail with proven excellent track record for treatment of hip fractures. The operation setting and the way of fracture site reduction and nailing of CHN were similar to PFNA except set screw insertion to catch the outer barrel firmly for telescoping between the lag screw and outer barrel. The outer barrel of CHN has small bump on lateral end to prevent buried end of the tail under lateral femoral cortex. All patients were discharged within 2 weeks of surgery and followed our routine rehabilitation protocol.

The surgeon who performed operation evaluated his own patient's lateral hip pain caused by the tail of the blade or lag screw after surgery during the follow-up period athis out-patient clinic. Lateral hip pain was classified as when the patient had local tenderness in the area of the blade or lag screw tail to differentiate from pain due to other causes. We measured the operation time from skin incision to completion of wound closure and blood loss during the surgery through the weight of blood collected within gauzes and a plastic bag located under the operation field. The weight of the plastic bag and dried gauzes was subtracted from the total weight of the plastic bag and gauzes after surgery to measure the amount of bleeding. Irrigation was not performed for exact measurement of bleeding during the surgery. We categorized the fractures into three groups (A1, A2 and A3) according to AO-OTA classification [9]. We also evaluated the quality of postoperative reduction and other complications after surgery and measured tip-apex distance (TAD), telescoping and lateral protrusion of the blade and lag screw for all patients.

Radiographic measurements

The TAD and telescoping value were measured according to the methods described by Baumgaertner et al. [10] using immediate postoperative radiographs and Gardner et al. [11] using last follow-up radiographs. Telescoping was defined as the distance from the lateral border of the nail to the blade or lag screw end along the superior border (Fig. 2). Lateral protrusion of the blade and lag screw were defined as the distance from the lateral cortex of the femur to the blade or lag screw end along the superior border (Fig. 3). The quality of postoperative reduction was graded as good, acceptable, and poor on immediate postoperative radiographs (Table 1) [12]. We defined the normal alignment on anteroposterior view as no varus or within 10° valgus compare to opposite site.

All measurements were performed using picture archiving and communication system (PACS, Marosis 5.4.9.34 version, Infinitt, Seoul, Korea) by two orthopedic trauma surgeons and one orthopedic senior resident. The mean value of the three observers' measurements was used for statistical analysis.

Statistical analysis

Clinical information including age and gender, the kind of implant, lateral hip pain caused by the tail of the blade or lag screw after surgery, operation time, blood loss during the surgery, fracture type, quality of postoperative reduction, TAD, telescoping and lateral protrusion of the blade and lag screw were subjected to statistical analysis (IBM® SPSS version 19). We used Chi-Square test and Student's *t*-test to demonstrate the significant differences

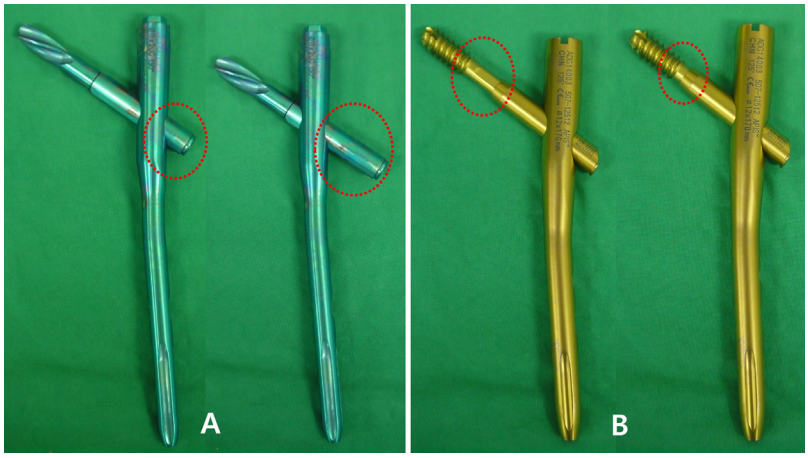

Fig. 1. Two implants with different cephalomedullary nail systems and the locations of the sliding mechanism (circle with dotted line); Proximal Femoral Nail Antirotation; PFNA; Synthes®, Oberdorf, Switzerland (Fig. 1-A) and Compression Hip Nail; CHN; TDM®, Seoul, Korea (Fig. 1-B).