



Should full threaded compression screws be used in adult femoral neck fractures?



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ABSTRACT

Introduction: Operative treatment consisting of fracture reduction and fixation, or arthroplasty to permit early patient mobilization, continues to be the treatment of choice for most femoral neck fractures. Options for internal fixation have included a variety of implants; however most recent reports and textbooks cite parallel multiple cancellous screws as the surgical technique of choice.

Methods: The study was prospective, randomized and IRB approved. Inclusion criteria included skeletal maturity, closed femoral neck fracture without concomitant fractures or injuries with complete charts and adequate radiographs obtained from the initial injury till the last follow-up. Forty-four patients were enrolled in this study during one-year period at two university centers. 22 were randomized to be treated with full threaded, cannulated compression screws (Acutrak 6/7, ACUMED) (Group 1) and the other 22 with 16 mm partial threaded, 6.5 mm or 7.3 mm cannulated screws (SYNTHES) (Group 2). Three or four screws were used in both groups according to fracture type and surgeon's preference. Data evaluated included surgical time, fluoroscopy time, fracture type, radiological outcome, complications and functional status using the Harris Hip Score.

Results: Both groups were comparable in terms of age and gender. There was not a significant difference in terms of surgical time, follow-up period, fracture type, or fluoroscopy time. There were eight complications in Group 1 and two in Group 2 ($P = 0.049$). Time to union was significantly longer in Group 1 ($P = 0.001$). However, Hip Scores were not significantly different in both groups ($P = 0.20$).

Conclusion: When compared with full threaded compression screws, partial-threaded cannulated screws provides a shorter union time and less complication rate while providing equivalent functional results in adult femoral neck fractures.

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Introduction

The prevalence of hip fractures is increasing rapidly, with nearly 280,000 cases reported each year within North America [1,2]. By the year 2040, the number of people aged 65 or older will increase from 34.8 million to 77.2 million, and the number of hip fractures is probably to exceed 500,000 annually with an estimated annual health care cost of at least \$9.8 billion [1,3]. Approximately half of these hip fractures will be intracapsular fractures of the neck of the femur [4].

Operative treatment consisting of fracture reduction and fixation, or arthroplasty to permit early patient mobilization, continues to be the treatment of choice for most femoral neck fractures [3]. Techniques range from internal fixation with multiple cancellous lag screws and sliding hip screws for nondisplaced fractures to multiple cancellous lag screws, sliding hip screws, hemiarthroplasty, and total hip replacement for displaced femoral neck fractures [5–8]. Options for internal fixation have included a variety of implants [9,10], however most recent reports and textbooks cite parallel multiple cancellous screws as the surgical technique of choice [6–8,11–13]. Potential advantages of multiple screws over arthroplasty include short duration of surgery, limited surgical trauma and preservation of the native hip joint [7,8]. The failures after multiple screws may be due to the patients' low bone mass with reduced mechanical strength, and the vulnerable blood supply to the femoral head [14].

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A Cochrane review reported 29% nonunion and 8% avascular necrosis [15] following these fractures. Outcomes after cancellous screw fixation are highly dependent on surgical expertise and the quality of the reduction [6].

Recently we have used two different cannulated compression titanium screws (full threaded versus partial threaded) in the surgical treatment of the adult femoral neck fractures. To our knowledge, there is no report comparing the functional and radiological outcome of full and partial threaded cannulated compression titanium screws in the treatment of the adult femoral neck fractures. We therefore compared (1) surgical and fluoroscopy time, (2) fracture type, (3) radiological outcome at the latest followup, (4) complications, (5) functional status by Harris Hip Score (HHS) at latest followup in patients who had their fractures stabilized with either full threaded or partial threaded cannulated compression titanium screws.

Patients and methods

We conducted a prospective, randomized, IRB approved study comparing full threaded, cannulated compression screws (Acutrak 6/7, Acumed[®], USA) versus 16 mm partial threaded, 6.5 mm or 7.3 mm cannulated screws (Synthes[®] Oberdorf, Switzerland) for femoral neck fractures from May 2009 to May 2010. We excluded patients with pathological fractures, skeletal immaturity, open fracture, polytrauma who had an Injury Severity Score of greater than 16; and patients who had a severe concomitant medical condition (Grade V American Society of Anesthesiologist Score). We then randomized patients into two groups using random allocation software [16]. Group 1 included patients who were treated with full threaded, cannulated compression screws (Acutrak 6/7, Acumed[®]) whereas Group 2 consisted of patients that were managed with 16 mm partial threaded, 6.5 mm or 7.3 mm cannulated screws (Synthes[®]). We did not perform a priori power analysis and consider this as a pilot study. The patients were not blinded to their treatments. All patients were followed up until fracture union or a revision operation was performed. The minimum followup was 12 months in both groups. No patient was lost to follow-up to the end of first year. The groups were comparable with regard to all demographic and background data (Table 1). The fracture types were graded according to Pauwels' classification [17].

Patients were admitted to the emergency department after injury, and after stabilization of their physiological condition, they were transferred to the orthopaedic ward. Definitive surgery was performed as soon as possible but within 48 h after injury in all patients. Three experienced orthopaedic trauma surgeons (GO, NO, KA) performed all operative procedures. Patients were positioned supine on a radiolucent table. The choice of anesthetic method was made by the anesthesiologist. Closed reduction under C-arm control with manual traction and rotation of the injured extremity was performed in every patient in both groups before fixation. Postoperatively, all patients had antibiotic prophylaxis for 48 h and

deep vein thrombosis prophylaxis for 4 weeks. The postoperative rehabilitation protocol was identical for both groups. Weight-bearing was not allowed for at least 6 weeks. After then, patients were permitted for gradual weight bearing as tolerated. Formal therapy was instituted, working on muscle strengthening, conditioning, and hip and knee ROM exercises.

Patients were evaluated at 6 weeks, 12 weeks, 6 months, and 1 year. Perioperative and postoperative data were recorded, including surgical times (from skin to skin), fluoroscopy times, and complications. Functional state and mobilization were also evaluated by the HHS [18] scaled from 1 to 100. Radiographs consisting of AP and lateral views of the hip and femur were obtained at the second postoperative day and every followup visit. One of us (HKT) not involved in surgical management of the patients evaluated all the patients and latest radiographs. All radiographs were uploaded to a DICOM viewer software (Angora Viewer V.1.65; Datamed, Ankara, Turkey) that allows precise measurement of length and angles. Malunion was defined as angulation or rotational deformity of more than 10° or shortening of the limb of more than 1 cm when compared with the uninjured side. Nonunion was defined as radiographic lucency around the implants, persistent fracture line that failed to show progressive healing after 9 months, loss of fixation, and pain associated with radiographic findings described above during walking at latest followup (Fig. 1A–E and Fig. 2A–D).

We used the chi-square test and Mann–Whitney *U* test to compare the proportions of the following variables between groups: sex, fracture classification, and time to union. Student's *t*-test was used for determining any differences in age, operative and fluoroscopy times, and followup times between groups. The unpaired *t*-test was used to compare HHS between groups. We performed statistical analyses using SPSS1 Version 16.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was defined as *P* value of less than 0.05.

Results

In total 44 patients participated in this study, 22 in each group. The average age of patients in Groups 1 and 2 was found to be 41.5 ± 13.9 and 42.7 ± 12.9 , respectively. There was no significant difference in age between groups ($P = 0.75$). Seventeen out of 22 (77%) of patients in both groups were males ($P = 1$). The average followup in Group 1 and Group 2 was 14.7 ± 2.3 and 14.4 ± 2.3 months, respectively. No significant difference was found in followup time between groups ($P = 0.64$). The average surgical time in Groups 1 and 2 was 75.2 ± 14.8 and 72 ± 12.3 min, respectively ($P = 0.45$). The average fluoroscopy times (Group 1: 1.45 ± 0.23 min; Group 2: 1.3 ± 0.25 min) was found to be similar ($P = 0.57$).

We found no difference in fracture types according to Pauwels' classification (Group 1: 2 Type 1, 10 Type 2, 10 Type 3; Group 2: 2 Type 1, 7 Type 2, 13 Type 3) ($P = 0.631$). There were 8 complications (4 nonunions and 4 delayed unions) in Groups 1 and 2 complications (1 nonunion and 1 varus malunion) in Group 2. This difference in complications was found to be significant ($P = 0.049$). Time to union in Groups 1 and 2 was observed to be 7.5 ± 2 and 5.4 ± 1.6 months, respectively ($P = 0.001$). At the latest followup, HHS (Group 1: 84.7 ± 14.4 ; Group 2: 89.2 ± 8.3) was found similar ($P = 0.209$) between the two groups.

Discussion

A hip fracture is a burden to patients due to pain, loss of function, or even death. Moreover, it is a burden to society because of the extensive use of resources needed for treatment and rehabilitation of patients and due to permanent disability [19]. Femoral neck fractures account for nearly half of all hip fractures

Table 1
Demographic and perioperative data of patients with femoral neck fracture treated with full threaded or partial threaded cannulated compression screws.

Demographic variable	Group 1 (n=22)	Group 2 (n=22)	P value
Age (years) [*]	41 (21–70)	42 (23–64)	0.75
Sex (number of males/females)	17/5	17/5	1
Side (number of right/left)	10/12	9/13	0.86
Followup (months) [*]	14 (12–18)	14 (12–18)	0.64
<i>Perioperative variable</i>			
Operation time (min) [*]	75 (56–89)	72 (58–85)	0.45
Fluoroscopy time (min)[*]	1.45 (0.66–1.72)	1.3 (0.66–1.88)	0.57

^{*} Values are expressed as mean, with range in parentheses.

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