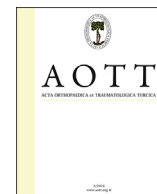




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Dynamic hip system blade versus cannulated compression screw for the treatment of femoral neck fractures: A retrospective study

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ABSTRACT

Objective: The aim of this study was to compare clinical outcomes of patients with femoral neck fractures treated with the dynamic hip system blade (DHS-BLADE) or cannulated compression screws.

Methods: Eighty-six patients with femoral neck fractures were treated by closed reduction internal fixation with a DHS-BLADE ($n = 42$; 18 males and 24 females; mean age: 56.3 years (37–87)) or cannulated compression screws ($n = 44$; 20 males and 24 females; mean age: 53.8 years (26–83)) between March 2011 and August 2013. The groups were compared with Harris hip score, operation time, surgical blood loss, incision size, hospital stay, and related complications.

Results: The average follow-up time was 27 months (range, 24–36 months). There was no significant difference for the operation time, incision size, hospital stay, and Harris hip score between the groups. Also, no statistically significant differences in the rates of nonunion (4.5% vs. 0) and avascular necrosis of the femoral head (9.1% vs. 7.1%) were observed. However, the screw group experienced significantly less surgical blood loss (32.4 ± 24.7 ml) than the blade group (87.2 ± 46.6 ml; $P = 0.041$). The incidence of femoral neck shortening above 10 mm in the screw group was significantly higher than that in the blade group (15.9% vs. 2.4%, $P = 0.031$). The blade group had a significantly lower incidence of screw migration than the screw group (4.8% vs. 22.7%, $P = 0.016$).

Conclusion: The DHS-BLADE and cannulated compression screws might be equally effective in terms of postoperative fracture union. However, the DHS-BLADE has advantages over cannulated compression screws for preventing femoral neck shortening, screw migration, and cut-out.

Level of evidence: Level IV, Therapeutic study.

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Introduction

The incidence of femoral neck fracture, accounting for 3.6% of all fractures and 53–56% of hip fractures,^{1,2} is increasing worldwide together with the trend of population aging.^{1,2} Numerous surgical techniques and implants have been developed and used for the treatment of femoral neck fracture, including the dynamic hip system blade (DHS-BLADE) and cannulated compression screw. However, a clear consensus has not been reached regarding which fixation technique can be used as the optimal management.

Cannulated compression screws are one of the most commonly used implants for the treatment of a fractured femoral neck, but are weak in terms of anchorage and holding, especially in patients with osteoporosis.³ Loosening of the cannulated compression screws and compression of the fracture site can lead to femoral neck shortening and compromised hip function. Conversely, the DHS-BLADE is a newly developed implant that has many advantages over the cannulated compression screw in terms of anti-rotation, cut-out, and anchorage.⁴ Compared with the lag screw, the helical blade design provides enhanced anchorage and rotational stability to the fractures and does not require removal of additional bone, which decreases the incidence of implant cut-out and improves the chances of good clinical outcomes.^{5,6} Unlike the DHS, the DHS-BLADE, which is inserted into the cancellous bone by the force of hammer strikes, is also superior to screw fixation in the femoral

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head, as proven by biomechanical studies.^{7,8} Also, free rotation of the femoral head can be locked after implanting the DHS blade. Additionally, the efficacy of the DHS-BLADE in the fixation of intertrochanteric fractures has been well established,⁹ but its use in femoral neck fractures has rarely been reported.¹⁰

Therefore, in the present study, based on the aforementioned considerations, we retrospectively evaluated the clinical results of femoral neck fractures surgically treated by internal fixation with either a DHS-BLADE or cannulated compression screws.

Materials and methods

Patients

During the period between March 2011 and August 2013, a total of 86 patients with femoral neck fracture who underwent internal fixation with a DHS-BLADE (depuysynthes) or cannulated compression screws (depuysynthes) were selected and included in our retrospective study. Patient age ranged from 26 to 83 years, with a mean age of 53.8 years. The inclusion criteria were as follows: 1) closed femoral neck fracture; 2) no fractures at other sites; 3) surgical treatment with cannulated compression screws or DHS-BLADE; and 4) follow-up time greater than 2 years. The exclusion criteria included: the presence of a pathological femoral neck fracture, previous femoral neck fracture, and surgical treatment with open reduction.

Based on the internal fixation devices used, the 86 patients were divided into two groups: 42 patients who underwent internal fixation with a DHS-BLADE formed the blade group and 44 patients who underwent internal fixation with cannulated compression screws formed the screw group. The Cannulated Screw group included 44 cases, 20 cases of which were male, 24 cases female. The age ranged from 26 to 83 years old, with an average 53.8 years old. According to Garden Classification, 20 cases belong to Type II, 16 cases Type III and 8 cases Type IV. The DHS-Blade group included 42 cases, 18 cases of which were male, 24 cases female. The age ranged from 37 to 87 years old, with an average 56.3 years old. And 24 cases belong to Type II, 13 cases Type III and 5 cases Type IV. The blade group and screw group included 14 and 16 patients with osteoporosis, respectively. This study was approved by the Ethics Committee of our hospital. All operations were performed by the same senior orthopedic surgeon in our department, and the mean time from trauma to surgical intervention (trauma-surgery interval) was 5 days.

Surgical procedures

For the blade group, the patients were in the supine position on a traction table after administration of general anesthesia. After femoral neck fracture reduction under C-arm control without capsulotomy, a guide pin was inserted into the femoral neck with a 135° angle guide. From the entrance point of the guide pin, a 4–5 cm skin incision was made distally to expose the lateral cortex of the femoral shaft. The length of the DHS-blade was determined to be 10 mm, which was shorter than the guide pin. We reamed the femoral shaft along the direction of the guide pin, and then the tip of the blade was positioned about 5–10 mm beneath the surface of the femoral cartilage. The side plates were placed closely to the bone surface and fixed with two locking screws. Finally, the screw caps and the blade were fastened.

For the screw group, closed reduction was performed under general anesthesia for patients in the supine position followed by percutaneous fixation with three cannulated compression screws. A guide pin was inserted with a lateral entry point at the median line of the lateral cortex, inferior to the greater trochanter. In the

anterior view, the guide pin was adjusted to be parallel to the neck-shaft angle and very near to the medial-inferior cortex of the femoral neck. In the lateral view, the guide pin was adjusted to be parallel to the anteversion angle and inserted directly in the center of the femoral head and neck. The head of the guide pin was positioned about 5 mm beneath the surface of the femoral head cartilage. Then a parallel device was located on the guide pin. Using the same method, another two guide pins were inserted superior to the first guide pin, parallel to the long axis of the femoral neck. The three guide pins formed an inverted triangle. Subsequently, the 7.5 mm cannulated compression screws were inserted along the guide pins with removing the guide pins.

Perioperative management

Low molecular heparin was administered subcutaneously to prevent deep vein thrombosis for a mean of 1 week after operation. Rivaroxaban was used as prophylaxis instead of low molecular heparin and continued for 35 days postoperatively. As early as 24 h postoperatively, patients were encouraged to sit on the bed and exercise lower limb muscle. From postoperative day 3, patients were instructed to ambulate along the bed. Weight bearing was started from 20 kg at postoperative 4–6 weeks with an incremental increase of 5 kg per week.

Outcome measurement

All clinical data for operative time, incision size, surgical blood loss, and hospital stay were recorded. It should be noted that the estimation of surgical blood loss involved estimating the amount of blood on the surgical gowns and drapes, in addition to weighing the sponges and estimating blood loss through suction drainage systems.^{12,13} Complications were monitored, including femoral neck shortening, screw-exit, cut-out, nonunion, and avascular necrosis. Femoral neck shortening was evaluated in the vertical plane (femur length decrease) (Fig. 1), which was categorized into four degrees: degree 0 (less than 5 mm shortening); degree 1 (5–10 mm shortening); degree 2 (10–20 mm shortening); and degree 3 (≥ 20 mm shortening).^{14,15} Hip function was evaluated using the Harris hip score.^{16,17} The results were categorized as excellent (90–100), good



Fig. 1. A line was drawn from the rotation center of the femoral head through the center of the femoral neck. The distance from the femoral head cartilage to the greater trochanter cortex was measured. Any difference between the injured and the uninjured side was considered indicative of femoral neck shortening.

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