Dynamic hip screw blade fixation for intertrochanteric hip fractures

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ABSTRACT

Purpose. To assess the one-year outcome of a dynamic hip screw (DHS) blade in the treatment of AO/OTA 31-A1 and 31-A2 intertrochanteric hip fractures.

Methods. 35 men and 65 women aged 47 to 100 (mean, 83) years underwent fixation with a DHS blade for A1 (n=47) and A2 (n=53) intertrochanteric hip fractures after a low-energy injury. Patients were operated on within 48 hours of admission. Anteroposterior and lateral radiographs were examined for the tip-apex distance and femoral shortening. Potential complications were looked for, including implant migration, cut-out, loosening, or breakage. Functional outcome was based on the Parker mobility score.

Results. The 30-day and one-year mortality rates were 5% and 20%, respectively. At the one-year follow-up, 81 patients were available, and all fractures had healed without varus deformity. The mean tip-apex distance was 14.1 (range, 5.7–31.1; SD, 4.3) mm. The mean femoral shortening was 4.9 (range, 0–20.2; SD, 4.8) mm. The mean Parker score decreased to 3.8 at one-year follow-up from 5.9 before injury (p<0.001). There was one loss of fixation secondary to a non-traumatic subcapital fracture at 3 months, for which a bipolar hemiarthroplasty was performed.

Conclusion. The DHS blade system is effective in treating AO/OTA 31-A1 and 31-A2 intertrochanteric hip fractures and results in a low complication rate.

Key words: bone plates; bone screws; hip fractures; orthopedic fixation devices; osteoporosis

INTRODUCTION

For geriatric intertrochanteric hip fractures, internal fixation enables early mobilisation and prevents complications related to long-term confinement to bed.1–8 The dynamic hip screw (DHS) is recommended for fixation of relatively stable fractures.9 Its postoperative cut-out rate ranges from 1 to 6%.7,10,11 Cephalomedullary devices are recommended for treatment of relatively unstable fractures,12 especially in the absence of lateral or posterior-medial buttressing.
In osteoporotic bone, a helical blade design removes less bone and provides enhanced anchorage and rotational stability within the femoral head, compared to a lag screw. This leads to greater resistance to implant cut-out. This blade design used in some cephalomedullary nails has achieved promising results.\(^7\)\(^{13-15}\) Blade fixation instead of screw fixation in the femoral head has also been applied to the DHS system for improved fixation in osteoporotic bone, as proven by biomechanical studies.\(^7\)\(^{16,17}\) The purchase mechanism comprises 4 helical-shaped blades at the implant head. The shaft is compatible with the barrel of the standard DHS side-plate. Unlike the DHS, the DHS blade is impacted into the cancellous bone by hammer strikes. Free rotation of the head can be locked after instrumentation. We assessed the one-year outcome of a DHS blade in the treatment of AO/OTA 31-A1 and 31-A2 intertrochanteric hip fractures.

**MATERIALS AND METHODS**

From September 2007 to April 2008, 35 men and 65 women aged 47 to 100 (mean, 83; standard deviation [SD], 8) years underwent fixation with a DHS blade for A1 (n=47) and A2 (n=53) intertrochanteric hip fractures (according to the AO/OTA classification) after a low-energy injury. Those with pathological fractures secondary to tumour or infection or those with polytrauma or previous ipsilateral hip surgery were excluded, as were those with A3 intertrochanteric fractures.

Patients were operated on within 48 hours of admission. A single injection of cephaloridine or vancomycin was given 30 minutes before incision as prophylaxis. Patients were placed supine on a traction table under spinal or general anaesthesia. Under image intensification guidance, closed reduction was performed using traction and slight internal rotation. Reduction was satisfactory when there was smooth medial and anterior cortical bony buttressing. Varus misalignment of the neck-shaft angle was avoided. For unsatisfactory closed reduction, a mini-open assisted reduction was performed through the lateral incision, using bone hooks or bone spikes to leverage the fracture into reduction. A guide pin was inserted aiming at a centre-centre position with a 135°-angle guide. After measuring the required blade length (75–100 mm), the femoral neck was prepared with a special DHS blade triple reamer and the DHS blade (Synthes, Bettlach, Switzerland) was hammered in. A 4-holed 135°-angled plate was used. With traction released, the blade within the femoral head was locked to prohibit rotation of the proximal fragment.

Postoperatively, full-weight-bearing walking was allowed.

Patients were followed up at 6 weeks, 12 weeks, 6 months, and one year. Anteroposterior and lateral radiographs were examined for the tip-apex distance\(^18\) and femoral shortening (Fig. 1). Potential complications were looked for, including implant migration, cut-out, loosening, or breakage. Functional outcome was based on the Parker mobility score,\(^19\) which quantifies the ability to walk inside the home and outdoors, as well as the ability to go shopping. Each activity was assigned a score (full score, 9) on the basis of its level of difficulty: 3 points indicated that the patient had no difficulty, 2 points indicated that the patient needed a cane or other assistive device, 1 point indicated that the patient needed help from another person, and 0 points indicated that the activity could not be performed. Outcome before injury and at the one-year follow-up was compared using the paired \(t\)-test.

**Figure 1** Measurement of femoral shortening.
RESULTS

The mean operating time was 40 minutes. The mean estimated intra-operative blood loss was 92 ml. There were no intra-operative complications. The mean length of hospital stay was 5.2 days. The 30-day and one-year mortality rates were 5% and 20%, respectively. At the one-year follow-up, 81 patients were available, and all their fractures had healed. The mean tip-apex distance was 14.1 (range, 5.7–31.1; SD, 4.3) mm. The mean femoral shortening was 4.9 (range, 0–20.2; SD, 4.8) mm. The mean Parker score was 5.9 before injury and 3.8 at one-year follow-up (p<0.001).

One patient endured loss of fixation secondary to a non-traumatic subcapital fracture at 3 months, for which a bipolar hemiarthroplasty was performed (Fig. 2). There was no blade cut-out. One patient developed a local infection and one a deep infection. No patient developed avascular necrosis of the femoral head, neurovascular complication, or clinically significant deep vein thrombosis or pulmonary embolism.

DISCUSSION

Intertrochanteric hip fractures are common and result in a heavy burden to the affected individuals and on society. Internal fixation enables early mobilisation. Sliding hip screws have been widely used but are associated with problems. The treatment of unstable trochanteric femoral fractures is challenging. The ideal implant should be easy to handle, enable immediately postoperative full weight bearing, and provide sufficient purchase in the femoral head/neck fragment to limit cut-outs secondary to varus-deviation and rotation.

For unstable trochanteric fractures treated with extramedullary devices such as the DHS, there were high cut-out and varus-displacement rates, wound problems, and infections. When fractures are stable, extramedullary devices appear superior to intramedullary ones. In a matched-pair study comparing the DHS and the Gamma nail for trochanteric hip fractures, the DHS group achieved better walking ability and a lower mortality rate. The sliding hip screw is superior to the intramedullary nails in terms of the lower complication rate.

Changing the screw design into a helical blade increases the contact surface area between the purchase-holding device and the cancellous bone of the femoral head. It compresses rather than removes the already limited amount of bone. As the core of such a device is small, once firmly locked it prevents rotation of the head/neck fragment around it. A DHS blade has better biomechanical anchorage than a DHS. Insertion of spiral blade does not require tapping, which means fewer working steps than with the conventional DHS.

The lag screw cut-out rate has been reported to be 2% when the standard DHS sliding hip screw was used in patients with A1 and A2 fractures, whereas the rate was 3.6% when the proximal femoral nail antirotation was used.

Subcapital fractures after treatment of intertrochanteric fractures were associated with fixed-angle devices such as the Zickel nails, Mclaughlin nail plates, Ender nails, and AO Blade plates. These sometimes occurred without overt trauma. A subcapital fracture following a healed trochanteric fracture is rare; its risk factors include advanced age, female gender, osteoporosis, smaller size of the femoral head and neck, and a basi-cervical type of fracture. In non-geriatric patients, the mean femoral shortening was 10.6 mm after fixation by a cephalomedullary nail and 22.2 mm after fixation by a DHS.
The DHS blade costs more than the standard DHS but considerably less than cephalomedullary devices, and can be used safely as an alternative to the DHS in treating AO/OTA 31-A1 and 31-A2 intertrochanteric fractures, while achieving improved fixation in osteoporotic bone. Nonetheless, cephalomedullary devices are indicated for the most unstable A3 fractures. Accurate fracture classification, preoperative planning, and meticulous fracture reduction are important.

REFERENCES


