Minimal Incision Technique Using a Two-Hole Plate for Fixation of Stable Intertrochanteric Hip Fractures

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This article presents a minimally invasive adaptation of the sliding hip screw technique. This two-hole side plate construct for the repair of intertrochanteric hip fractures minimizes blood loss and soft-tissue dissection.

Hip fractures are a serious public health problem. The current incidence in the United States of approximately 250,000 hip fractures per year is projected, with an aging population, to double to approximately 500,000 by the year 2040.1 Predominantly an affliction of the elderly, 90% of hip fractures occur in patients aged >65 years.1,2 These patients commonly have poor bone stock, >1 medical comorbidity, and may be poor surgical candidates at the time of injury. Often, the hip fracture is the final insult toward that patient’s precipitous decline. Intertrochanteric fractures—a large percentage of which are unstable—comprise approximately 50% of all hip fractures.5

Successful treatment of these injuries depends on tailored medical management of the patient and proper surgical treatment—fracture reduction and stabilization.4 Stability of the fracture-implant assembly is contingent on at least five factors: bone quality, fracture pattern, reduction quality, implant design, and implant position within the bone.5 At surgery, only the latter three fall under the surgeon’s control and they must be optimized.

Numerous operative techniques and surgical instruments have been implemented in the management of hip fractures. The most widely used remain those that use some form of sliding screw in the design because they enable optimal collapse and compression at the fracture site.6 Recently, a new compression plating system has met with success in hip fracture treatment.3,6,7 It is purported to be a minimally invasive and biomechanically sound solution to these fractures. Additionally, intramedullary hip screws have been used successfully for comminuted intertrochanteric hip fractures.8

The Dynamic Hip Screw...
(DHS) (Synthes, Paoli, Pa) is one of the most popular and effective forms of the sliding hip screw device. To date, it has been used in a primarily open fashion with a relatively large exposure. A large exposure is necessary for the implantation of the traditional four-hole plating system. Recent biomechanical data, however, demonstrate equivalent peak load to failure results when comparing the two- and four-hole plates. We believe the two-hole side plate affords the surgeon the opportunity to implement a minimally invasive approach in the fixation of certain intertrochanteric fractures.

Minimally invasive surgical techniques as a whole have been shown to reduce operative complications and postoperative morbidity. We offer a mini-incision technique for the placement of the DHS in intertrochanteric and basi-cervical hip fractures. This technique uses a percutaneous insertion of the guide wire and a two-hole DHS plate. This minimally invasive DHS technique is advantageous in two ways: 1) it uses existing instrumentation with which the surgeon is familiar and confident, and 2) by reducing parameters such as blood loss, it makes the surgery more amenable to the typically frail, often medically unstable hip fracture patient. A retrospective review of 13 patients after DHS plating of intertrochanteric or basi-cervical hip fracture with the mini-incision technique is presented.

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Surgical Technique

After spinal anesthesia is administered, the patient is placed in the supine position on the fracture table. The lower extremity opposite to the fracture is placed in axial traction. Modest internal rotation often facilitates the closed reduction. Prepping and draping of the affected extremity is performed and a shower curtain is used.

Using fluoroscopic guidance, a threaded guide pin is percutaneously placed from the lateral femoral cortex across the fracture through the femoral neck and into the femoral head. Placement is confirmed with biplanar fluoroscopy. A depth gauge is used to measure the length of the guide pin. Hip screw size is chosen. The angle of the hip screw is determined from the anteroposterior (AP) fluoroscopic image. The angle between the guide wire and lateral femoral cortex is measured from the fluoroscopic image.

A 5-cm incision is made longitudinally around the percutaneously placed pin. The incision is carried down through the subcutaneous tissues and fat to expose the fascia lata. Fascia lata is incised.
in line with the skin incision. A periosteal elevator is used to longitudinally split the vastus musculature and expose the lateral femoral cortex.

A soft-tissue protector is inserted, the triple reamer is set to the proper depth, and reaming is performed over the earlier placed guide pin. The femoral neck and head is tapped and the hip screw is placed across the fracture into the femoral neck and head over the guide wire. The plate is pushed to bone as the soft tissues are retracted. The fixed angle, two-hole plate is impacted against the lateral femoral cortex using the channel stick impactor and a mallet. Position is confirmed using AP and lateral fluoroscopy. A 3.2-mm drill is used to insert bicortical screws through the two-hole plate.

Case Series

Patient Population

Thirteen consecutive patients with intertrochanteric (three-part \[n=7\] [OTA 31A2.1], two-part \[n=3\] [OTA 31A1.1, 31A1.2]) and basicervical neck \(n=3\) OTA 31B2.1) fractures treated with a 5-cm mini-incision technique for DHS compression plate insertion were prospectively followed. Average patient age was 82 years (median: 88 years, range: 57-99 years).

Patients were assessed clinically via standard range of motion and functional parameters. Postoperative and last follow-up plain radiographs were examined for union and medial proximal femoral angle, tip-apex distance, and neck-shaft angle. In addition, estimated blood loss, operative time, incision size, and transfusions during hospital stay were recorded. A telephone interview was conducted with all living patients for which long-term clinical follow-up was not obtained. The interviewer asked patients to objectively state how far they could walk 1) with and without assistance, 2) with what type of assistance, and 3) in comparison to before surgery.

Results

Twelve of 13 patients had \(\geq 2\) medical comorbidities at surgery. One patient had an extensive medical history of coronary artery disease, hypertension, atrial fibrillation, congestive heart failure, and chronic obstructive pulmonary disease and died from complications resulting from aspiration pneumonia and heart failure in the hospital postsurgical fixation.

For all patients, incision size ranged from 4-6 cm (average: 5 cm). Average estimated blood loss was 41.9 mL (range: 20-50 mL) per surgery. No patient needed transfusion in the operating room. Average operative time was 61 minutes. Union was achieved in all patients who left the hospital (all but one). Average time to union in the six patients for which radiographic follow-up was obtained was 13 weeks (range: 7-24 weeks). Five patients received transfusions during their hospital stay. Of those patients, one received 2 U and the remaining received 1 U each. The patient who received 2 U of blood had

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extensive medical comorbidities.

All patients with long-term follow-up achieved ambulation comparable to preoperative function (2 were seen in clinic at 6- and 18-month follow-up, respectively, and 10 patients reported their function level per telephone interview 18-26 months postoperatively [average: 23 months]). No screw cut-out was observed.

Average extension/flexion, abduction/adduction, and internal/external rotation were full/100°, 37°/17°, and 17°/28°, respectively. Radiographic analysis revealed an average 72° medial proximal femoral angle (range: 62°-107°, normal: 80°-89°), 129° neck-shaft angle (range: 117°-136°, normal: 124°-136°), and 1.74-cm tip-apex distance (range: 1.16-2.57 cm, optimal <2.8 cm).

**Discussion**

Sliding hip screw use for the treatment of hip fractures is well established and widely practiced. However, although union rates may be high, some studies report up to a 60% loss of independent mobility 1 year postoperatively. These statistics force us to re-examine the reasons for this decline. Any surgery that necessitates transfusion, general anesthesia, or extended convalescence, especially in a patient population similar to the hip fracture population, presents a serious “hit” to the patient. Attempts at reducing the surgical trauma, blood-loss, and recovery time during the management of hip fractures would be beneficial.

Recently, Gotfried et al presented a percutaneous compression plating technique for intertrochanteric fractures. Promoted as a minimally invasive, biomechanically sound technique, it is not yet widely used by the orthopedic community. We offer a minimally invasive adaptation of an existing technology, the sliding hip screw. Blood loss is minimized with the insertion of a guide wire in a percutaneous fashion. Soft-tissue dissection is minimized with a two-hole plate and mini-incision.

Comparison with historical controls demonstrates initial promise for this minimally invasive technique. In a report that prospectively examined 100 hip fracture repairs (50 with a compression hip screw and 50 with an intramedullary hip screw), intraoperative blood loss and transfusion rates were higher for the compression hip screw and intramedullary hip screw groups. Intraoperative blood loss averaged 41.9 mL in the mini-incision cohort versus historical controls of 198 mL (compression hip screw) and 144 mL (intramedullary hip screw). Although the compression and intramedullary hip
screw groups necessitated an average of 1.2 U and 0.9 U of packed red blood cells, respectively, our cohort averaged only 0.38 units of packed red blood cells for the duration of hospital stay.

Average operative time was most similar to the compression hip screw group—57 minutes for the open incision compared to 61 minutes for the mini-incision—demonstrating that the mini-incision technique is no more time intensive than the traditional approach. In addition, approximately 30% of patients (14 in the compression hip screw group, 14 in the intramedullary hip screw group) underwent general anesthesia. In contrast, all 13 patients with mini-incision using the DHS were performed under spinal anesthesia. One should be cautioned, however, in drawing the conclusion that this technique facilitates the use of local anesthesia, as most all hip procedures can now be performed in a local fashion with a skilled anesthesia team. The increased incidence of local anesthesia use is thus more likely a function of anesthesia advancement since the time when the historical controls were performed.

Moreover, neck-shaft angle, medial proximal femoral angle, and tip-apex distance for our mini-incision cohort were all within acceptable limits. The normal neck-shaft angle and slightly lower medial proximal femoral angle illustrate the absence of angular deformity and some settling through the fracture. The tip-apex distances of all screws fell in a range in which no fractures had historically cut-out.

Conclusion

Dynamic hip screw plating for intertrochanteric (OTA 31A1.1, 31A1.2, 31A2.1) and basicervical (OTA 31B2.1) hip fractures using a mini incision is a viable alternative to the standard approach. Good clinical outcomes, excellent radiographic parameters, low overall transfusion rates and estimated blood loss, short operative time, and union were achieved in all patients.

References