Fixation of Chevron Trochanteric Osteotomy With Two Wire Loops In Isolated Acetabular Component Revision

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The use of two wire loops for fixation of the trochanteric fragment after Chevron osteotomy in revision THA achieves stable fixation with minimal hardware.

The use of greater trochanter osteotomy in total hip arthroplasty (THA) remains controversial. Supporters of the technique maintain that it offers wide exposure of the hip, allows easier dislocation of the femoral head, offers better visualization of the acetabulum, reduces the risk of complications related to femoral reaming and cement removal, and allows easier insertion of the femoral and acetabular prostheses.1-3 Moreover, this approach allows potential advancement and lateralization of the trochanteric fragment, thereby increasing the abductor lever arm and improving soft-tissue tension about the hip.

The disadvantages of trochanteric osteotomy include increased operative time and blood loss, and complications such as nonunion of the osteotomy with resultant abductor weakness and increased incidence of instability and painful trochanteric bursitis.4,5 There also is increased postoperative pain and possibly increased rehabilitation time after a trochanteric osteotomy.5

Different types of trochanteric osteotomy techniques and several methods of trochanteric fragment reattachment have been reported in an effort to reduce the incidence of complications such as nonunion and bursitis.6-11

The wide unobstructed view achieved through trochanteric osteotomy is indispensable in revision cases and outweighs the potential disadvantages of the technique. We routinely use chevron trochanteric osteotomy for exposure in revision THA and use two wire loops for the fixation of the trochanteric fragment.

This article presents a technique used in isolated acetabular component revision, where the retained femoral stem renders passage of the wire loops more difficult than in the case of an empty medullary canal.

-operative technique

With the patient in the lateral position, a straight lateral incision is made beginning 2 cm cephalad to the tip of the greater trochanter. The fascia lata is divided longitudinally in the line of its fibers. The origin of vastus lateralis muscle at the vastus ridge is identified; the muscle is released sharply at its origin and reflected inferiorly for 1-2 cm. The osteotomy of the trochanter is then performed using an oscillating saw about 5 cm from the tip of the trochanter (Figure 1). The osteotomy is V shaped and has equal limbs, forming a biplane angle of 120° between them with the convex side facing laterally (Figure 2). After completion of the osteotomy, the trochanteric fragment is reflected upwards and the hip is dislocated.

The acetabular prosthesis is revised and the trochanteric fragment is then reattached using a 18 G monofilament stainless steel wire. Two holes are drilled, each on one side of the femoral prosthesis, corresponding to the limbs of the biplane angle formed by the osteotomy (Figure 3). The first wire is passed through these holes and is twisted to form a small loop on the lateral side of the femur (Figure 4).

A third hole is drilled medially to the femoral prosthesis in
Figure 1: The proposed location of the trochanteric osteotomy. Figure 2: The shape and orientation of the completed osteotomy. Figure 3: Two holes are drilled, each on either side of the femoral prosthesis. Figure 4: The first wire loop is passed through the holes and a small loop is created on the lateral cortex of the proximal femur. Figure 5: A third hole is drilled through the calcar, medially to the femoral prosthesis and the second wire is passed through it. The first wire is passed through two holes in the trochanteric fragment. Figure 6: The first wire is brought over the trochanteric fragment, through the small loop on the lateral side of the femur and it is tightened. Figure 7: The second wire is tightened over the greater trochanter and over the first wire. Figure 8: The final construct with the trochanteric fragment reattached to the femur is shown.
an anteroposterior (AP) direction, through the calcar femorale; the second wire is passed through this hole. Two more holes are drilled in the trochanteric fragment in line with the abductor muscle insertion and corresponding to the limbs of the biplane angle. The first wire is passed through these holes and then is brought over the trochanteric fragment and through the small loop on the lateral side of the femur (Figure 5). The wire is tightened and its edges are cut patients were available for follow-up. Both clinical and radiographic evaluation was performed at 6 weeks, 3 months, 6 months, 1 year postoperatively, and at yearly intervals thereafter. Clinical evaluation included determination of the Harris hip score, both preoperatively and at most recent follow-up. A score of 90 to 100 points was considered excellent; 80 to 89 points, good; 70 to 79 points, fair; and ≤69 points, poor.

Radiographic evaluation included an AP hip and pelvic radiograph and a true lateral radiograph of the replaced hip. Mean preoperative Harris hip score was 60 points (range: 10-80 points) and mean postoperative score was 82 points (range: 45-100 points). Eighteen patients (32.1%) had an excellent result, 22 (39.3%) had a good result, 12 (22.4%) had a fair result, and 4 (7.1%) had a poor result.

No acetabular cup has been revised or deemed radiographically loose; however, although nonprogressive radiolucent lines <1 mm wide that did not extend in >2 De Lee and Charnley zones were observed in 35 (62.5%) of the cups.

**Complications**

The trochanteric fragment united in 49 (87.6%) of the 56 patients. Evidence of fibrous union of the trochanteric fragment was observed in 4 (7.1%) patients. In 3 (5.3%) patients, the fragment failed to unite but it was displaced <2 cm. All 3 patients with nonunion of the trochanter had a positive Trendelenburg gait but they were pain free and refused further treatment.

Other complications included wire breakage in 10 (17.8%) patients: 6 (10.6%) patients were asymptomatic, 3 (5.3%) had nonunion of the osteotomy, and 1 (1.8%) trochanteric bursitis. The patient with trochanteric bursitis responded well to conservative treatment. Heterotopic ossification (Brooker I-II) was observed in 7 patients (12.5%), but was asymptomatic and warranted no further treatment. No dislocations occurred.

**Discussion**

Although trochanteric osteotomy is rarely used today, it is an indispensable technique in difficult primary and in revision THA cases. Since Charnley described his flat cut osteotomy, the subsequent chevron type modifications and the different trochanteric slide partial osteotomy techniques all have been introduced to exploit the wide exposure offered by osteotomizing the trochanter, while avoiding complications such as trochanteric nonunion or abductor mechanism disruption.

Chevron type trochanteric osteotomy is superior to flat cut osteotomy in achieving better union rates. This is due to the inherent increased rotational stability, the larger cancellous bone surface, and the easier anatomic reattachment offered by this osteotomy.

Different trochanteric reattachment techniques using wires, screws, bolts, plates, cables, springs, staples, and metal mesh, achieve union of the greater trochanter in 84.6% to 97% of cases. The multitude of fixation techniques shows that unresolved problems exist, such as trochanteric nonunion and bursitis. From a clinical standpoint however, it is difficult to substantiate superiority of one trochanteric reattachment technique, because all studies are comprised of mixed patient populations, with different postoperative protocols in different settings. Furthermore, it has been shown that the use of systems that are superior to monofilament wire both in fatigue and static tensile strength and achieve clinically good union results, such as multi-strand cable systems, is not without problems in the clinical setting.

Trochanteric nonunion is an important complication that may lead to increased incidence of joint instability due to loss of abductor tension. Dislocation after THA however, is a multifactorial problem and migration of the trochanteric fragment up to 2 cm does not seem to increase its incidence. Osteotomy nonunion followed by migration of the greater trochanter >1 cm, usually results in abductor weakness proportionate to the degree of dis-
placement and it is associated with a positive Trendelenburg sign and gait.\textsuperscript{10,22}

In the present series, wire breakage occurred in the 3 nonunion cases but also in 7 more cases with uncomplicated union of the osteotomy. In the 3 cases that failed to unite, wire failure occurred within 6 weeks from the operation and may have contributed to nonunion. It seems that early, \(< 6\) weeks, trochanteric fixation failure may result in nonunion of the osteotomy.\textsuperscript{23} Although the 3 patients with nonunion of the trochanter had a positive Trendelenburg gait, they were pain free and refused further treatment.

Trochanteric bursitis can be a troublesome complication of trochanteric osteotomy and is related to prominent hardware that irritate locally. Although it may be tempting to attribute the patient’s complaints to this complication, one should not rush to remove the fixation devices. It has been shown that less than half the patients with trochanteric bursitis benefit from such a removal and it is suggested that this should be considered only after local anesthetic injection proves trochanteric bursitis to be responsible for the symptoms.\textsuperscript{24} The incidence of trochanteric bursitis in the present series was low and the patient responded to conservative treatment.

Heterotopic ossification, which is always a concern with trochanteric osteotomy,\textsuperscript{25} was evident in 7 patients in the present series. However, in all cases heterotopic ossification was mild (Brooker class I -II), did not cause any functional limitation, and did not require operative treatment.

**CONCLUSION**

The use of two wire loops for the fixation of the trochanteric fragment after chevron osteotomy in revision THA achieves stable fixation with minimal hardware. The technique presented here is easily mastered, reproducible, and uses equipment that is easily found in any orthopedic operating room. All that is needed is approximately 1 m of 18 G stainless steel monofilament wire, a simple drill and a wire-tensioning device. This allows for flexibility, especially in cases where the trochanteric osteotomy is not preoperatively planned, but a greater exposure is required intraoperatively. Furthermore, the cost of the hardware used is kept at a minimum compared with other commercially available trochanteric fixation systems, using cables, hooks, bolts, or plates. The technique presented here does not pre-dispose to trochanteric bursitis and does not require alterations of postoperative management.

**REFERENCES**