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Original research

Use of locking plates for fixation of the greater trochanter in patients with hip replacement

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ABSTRACT

Background: Fixation of the greater trochanter with total hip replacement is challenging and associated with short- and long-term complications. Locking plate technology has been used for fixation of other bones and may be applied successfully in trochanteric fixation. The purpose of this retrospective study was to analyze the utility of the use of trochanteric locking plates in total hip arthroplasty (THA) patients.
Methods: From 2004 to 2014, 32 procedures were performed to fix the greater trochanter in patients with trochanteric fracture, osteotomy, or nonunion in the setting of THA. The median age at the time of surgery was 69 years. This was a primary arthroplasty in 8 of the patients, conversion from prior hip surgery in 5, and a revision in 19. The greater trochanter was fixed with locking plate alone in 15 hips and with the addition of a single cerclage cable in 17 hips. Patients were followed clinically and radiographically until healing occurred. The median duration of radiographic follow-up was 41.6 months (range: 10-112 months).
Results: Osseous union occurred in 29 (90.6%) of 32 hips. The median Harris hip score was 94 (range 54-100, standard deviation = 10.4) at latest follow-up. Complications included broken hardware in 5 (15.6%) patients, of which 3 underwent subsequent hardware removal. Two additional patients elected hardware removal due to trochanteric pain.
Conclusions: Locking plate technology is a successful method of fixation of the greater trochanter in patients with THA. Postoperative trochanteric pain and reoperation for hardware-related issues remain a challenge.

Introduction

Fixation of the greater trochanter in total hip arthroplasty (THA) is desirable not only after osteotomy but also in many cases of acute fracture or nonunion. There are a surfeit of specific trochanteric fixation methods described in the literature, but no one method has been conclusively shown to be advantageous [1]. The method chosen should achieve the surgical goal of allowing the greatest chance of healing and at the same time be easiest for both surgeon and patient. Stable, reliable fixation should be attained with earliest possible full weight bearing and active abduction. In addition, minimizing or eliminating the use of multistrand metallic cables is desirable [2-4].

There are a number of short- and long-term complications associated with traditional greater trochanteric fixation including trochanteric pain syndrome, nonunion, Trendelenburg limp, THA instability, generation of third body debris in the joint, and bone loss from metallic and secondary polyethylene debris [1-5]. Locking plates were introduced as an alternative method of fracture fixation elsewhere in the body in the late 1990s [6,7] and allow screws to lock into the plate, enhancing stability even with unicortical fixation [7]. Locking plates were first reported for trochanteric fixation in 2009 [8], and this study reports the first complete case series.

Our central research question focuses on the success of locking plate technology in greater trochanteric fixation. The primary outcome measure was trochanteric union. Secondary measures

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were pain, presence of a limp, hip function, and complications, including those specifically related to the hardware.

We included all locking plates used for trochanteric fixation in this study because of the relative rarity of this surgery; prior to the availability of a specifically designed trochanteric plate, we used a tibial locking plate. Results for both plates are examined and considered individually and together.

Material and methods

Patients

Our institutional review board approved this study. All patients requiring trochanteric fixation by the senior author (BJM) between November, 2004, and July, 2014, who were followed for a minimum of 10 months were included. The patient group consisted of 10 males and 22 females. The median age at the time of trochanteric fixation was 69 years (average 68.4, range 47-85 years, standard deviation [SD] = 10.4 years). The median BMI was 28.3 kg/m^2 (average 26.5, range 18-39 kg/m^2, SD = 5.5 kg/m^2). Eighteen procedures were on the left hip and 14 were on the right.

There were 8 primary hip replacements, 5 conversions, and 19 revision hip replacements. Eleven surgeries were indicated for treatment of trochanteric fractures, 6 for trochanteric osteotomy, and 15 for trochanteric nonunion in the setting of failed THA.

Patients requiring trochanteric fixation were identified by clinical presentation and radiographic findings on plain anteroposterior and lateral hip radiograph. Fractures (11/32) fell in 2 categories: trochanteric periprosthetic with a prior THA (Vancouver [9] A_G, n = 9) and trochanteric periprosthetic in patients during THA (Vancouver [9] A_G, n = 2). Periprosthetic fracture patients with prior THA (9/32) were offered fixation only after failing nonsurgical management with an abductor brace and touch-down weight bearing. Despite this treatment, progressive migration of greater than 2 centimeters, continued significant pain and/or limp, or THA instability occurred. Intraoperative fracture patients (2/32) had a large trochanteric fragment that could not be treated with cerclage fixation alone and excluded minor trochanteric tip or calcar fractures. Osteotomy patients (6/32) included 1 who underwent trochanteric advancement and 5 who has standard trochanteric osteotomies for exposure. This group did not include extended trochanteric osteotomies, where simple cerclage wire fixation was thought to be adequate. For patients with trochanteric nonunion (15/32), the decision to proceed with fixation of the greater trochanter was determined by proximal trochanteric migration of greater than 2 centimeters, significant pain and/or limp, or THA instability. Fixation was also considered in cases of nonunion at the time of THA revision for other reasons.

Operative technique

All patients were positioned in the lateral decubitus position on a standard operating room table, and a posterior approach was used. The pelvis was stabilized by a Wixson 2 hip positioner (Innomed, Inc., Savannah, GA), and all patients received preoperative antibiotics. The entire extremity was draped using sterile technique, with skin barrier placed to the knee. The incision was extended laterally so that the vastus lateralis muscle could be reflected anteriorly.

Fixation technique has been previously described [10]. Briefly, the origin of the vastus lateralis was dissected from the trochanteric vastus ridge and the epimysium of the muscle incised 0.5-1.0 cm anterior to the intermuscular septum posteriorly. The muscle belly was then reflected anteriorly, with care not to devitalize the muscle. The bone was then prepared after exposure and provisional fixation achieved. Since it has become commercially available, a Zimmer NCB (Zimmer, Inc., Warsaw, IN) periprosthetic trochanteric extension plate and short femur plate assembly have been used (10/32 plates in this study; Fig. 1). The proximal plate was placed directly over the tendinous attachment of the abductor muscles. Distally, the plate was placed directly over the lateral femoral cortex. After the plate was prepared by linking the trochanteric attachment to the NCB (Zimmer, Inc.) plate, anteroposterior coverage was maximized proximally and distally. Multiple proximal locking 3.5 screws were placed in the trochanter, alternating anterior and posterior location to maximize host/plate contact. Alternatively, a nonlocking screw may be used to compress the plate against bone prior to locking screw placement. Next, a compression (distal) or interfragmentary screw (proximal to distal) was placed, followed by the distal locking screws. Of note, the screw placement distally (anteriorly or posteriorly to the prosthesis) is facilitated by multiaxial (30 degrees) placement options. Specialized drills may also be used without risk of compromising the mechanical integrity of the cement mantle, if the reconstruction is cemented [11]. An intraoperative anteroposterior radiograph of the femur was obtained after fixation; fluoroscopic images were not required. After intraoperative radiographs confirmed satisfactory fixation, locking caps were placed over the distal polyaxial screws to convert them to locking mode.

Bone grafting was considered if appropriate: bulk allograft was considered for proximal screw fixation if severe osteolysis was present in the trochanter (4 cases) [8]; autograft from reamings was used at the fixation site if available (8 cases). No allograft struts were used, as we did not wish to impede vascularity at the junction of the trochanter and femoral bone. The vastus lateralis was then draped over the plate and the epimysium repaired posteriorly. The origin was sewn down proximally anteriorly and posteriorly to the plate with interrupted absorbable sutures.

Although ideal screw number has not been established, we currently use maximal fixation in the proximal trochanteric fragment and distal fixation with a minimum of 3 bicortical and 1 unicortical screw. Cable augmentation is not necessary with this construct, in our experience.

Earlier in the case series, a tibial locking plate with cable augmentation distally was used [12]. We no longer use this plate (we exclusively use the NCB plate with trochanteric extension [Zimmer, Inc.]) but believe that both types of plate should be evaluated in this review; as locking plate trochanteric fixation is a unique concept and this is the first comprehensive analysis of this technique. We feel that the NCB (Zimmer, Inc) plate construct is superior to usage of the tibial plate because: (1) it is contoured to fit the femur; (2) it is thicker and therefore more stiff (allowing for avoidance of cable augmentation and enhanced locking fixation with larger locking screws); and (3) it has the capability for wide and narrow trochanteric plates, right and left sides, and variable lengths.

Postoperative care and follow-up

Postoperatively, patients maintained touch-down weight bearing for 4 weeks, followed by partial weight bearing for 2 weeks. Active abduction exercises were avoided for 6 weeks.

Clinical follow-up intervals were 1 month, 2 months, 1 year, and every 5 years for prosthesis surveillance. Radiographic follow-up, specifically anteroposterior and lateral hip radiographs, was obtained at 1 month, 1 year, and every 5 years thereafter. In some cases in the present cohort, more frequent follow-up was obtained if symptoms or radiographic changes warranted.

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