Ganz Approach

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Clinical Experience of Ganz Surgical Dislocation
Approach for Metal-on-Metal Hip Resurfacing

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Abstract: Although the posterior approach is the most commonly used for hip resurfacing, concerns remain in terms of risk of femoral neck fracture secondary to an osteonecrotic event. The purpose of this study was to look at the short-term results of metal-on-metal hip resurfacing done by the vascular-preserving surgical approach as developed by Ganz in 116 hip resurfacing arthroplasties performed in 106 patients (86 men, 20 women; mean age, 46.5 years; range, 19-62). At a mean follow-up of 38.3 months (range, 12-84), Harris Hip Scores improved significantly from 53.1 to 90.16 (P < .001). There were 10 nonunions (8.7%) and 21 hips (18.3%) requiring screw removal for painful bursitis. Two hips underwent conversion to total hip arthroplasty: one at 18 months for femoral loosening and one at 7 years for acetabular loosening. Although the trochanteric slide approach as developed by Ganz provides excellent exposure to the hip joint and preserves femoral head vascularity, it does carry some inherent morbidity in regard to the greater trochanter.

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Hip resurfacing arthroplasty is an older procedure that has been reintroduced with improved clinical performance due to improvements in metallurgy/design of the bearing surfaces [1] as well as component fixation [2,3].

By far, the most common approach used by surgeons performing hip resurfacing arthroplasty is the posterior approach [4-7]; however, concerns remain with respect to the consequences of compromising femoral head vascularity and the risk of femoral neck fracture [8-10].

Consequently, other surgical approaches such as the Ganz surgical dislocation technique [11] as well as the anterolateral approach [12], which have been shown to preserve femoral head vascularity [13], could minimize the risk of femoral neck fracture [14,15]. By preserving the posterior soft tissue envelope, the obturator externus tendon prevents overstretching of the ascending branch of the medial circumflex artery, which is the main blood supply to the femoral head [9,16].
The trochanteric slide osteotomy or surgical dislocation approach developed by Ganz is an excellent approach that provides complete visualization of the femoral head and neck as well as the acetabulum and has been used extensively in joint preservation surgery of the hip [11,17-19]. Early clinical experience with this approach has shown to be safe and effective with risk of nonunion being 1% with late removal of internal fixation being the most frequent reason for reoperation [17]. In addition, this approach referred to as the trochanteric slide has been used in the field of joint arthroplasty [20,21] and acetabular fracture [22] surgery to optimize surgical exposure. The purpose of this article is to report on the early clinical experience of the Ganz surgical dislocation approach for metal-on-metal hip resurfacing.

Materials and Methods

From August 2001 until June 2007, 116 hip resurfacing arthroplasties were performed on 106 patients using the surgical dislocation approach as described by Ganz et al [11]. There were 86 men and 20 women with an average age at surgery of 46.5 years (range, 19-62 years). The mean body mass index was 26.27 (range, 18.24-38.82). There were 13 patients who underwent bilateral resurfacing arthroplasties. The underlying diagnosis in the patients leading to the need for surgery was degenerative osteoarthritis in 86 patients, osteonecrosis in 6 patients, developmental dysplasia of the hip in 5 patients, posttraumatic osteoarthritis in 4 patients, and 2 patients with Legg-Calve-Perthes disease. There was also 1 patient each with a diagnosis of rheumatoid arthritis, inflammatory arthritis, and slipped capital femoral epiphysis. All of these surgeries were performed at by a single surgeon, and the resurfacing prosthesis used in all cases was the Conserve Plus (Wright Medical Technology, Memphis, Tenn). The acetabular component is cementless and made of an all cobalt chrome alloy with a porous beaded surface for osteointegration. The femoral component was cemented in all cases. All patients were treated with a resurfacing arthroplasty using the trochanteric slide approach. This approach has been described in detail for both joint preservation [11] as well as hip resurfacing [14] surgery. It involves placing the patient in the lateral decubitus position and using an incision that is centered over the greater trochanter angling slightly posteriorly. After the iliotibial band is divided, the posterior border of the medius is identified along with the junction between the minimus and piriformis tendon. Then, the osteotomy sight is marked with a cautery ensuring that a cuff of the medius is left attached to the main trochanteric fragment. This is critical in maintaining soft tissue integrity of the trochanteric wafer and avoiding penetration into the femoral neck and the branch of the medial femoral circumflex artery supplying the retinacular vessels. The osteotomy itself runs from just distal to the vastus tubercle to just lateral to the medial portion of the medius. Before performing the osteotomy, the greater trochanter ispredrilled for screw placement so that reduction of the osteotomized fragment will be more accurate at er on. After the osteotomy is performed, the vastus lateralis is elevated distally, and the remainder of the medius attachment is elevated off the major fragment of the trochanter. Care at this point is taken to keep the piriformis tendon attached to the femur. Dissection and elevation are...
continued until the trochanteric wafer along with the vastus lateralis and medius attached can be flipped anteriorly, thus exposing the capsule of the hip joint.

The capsule is then incised in a Z-shaped fashion along the axis of the femoral neck. The capsule is elevated off the rim posteriorly proximally and off the proximal femur distally. One must avoid going posterior to the lesser trochanter to avoid damage to the main branch of the medial femoral circumflex artery. After this has been completed, the hip joint can be dislocated safely anteriorly. This provides excellent exposure to the femoral head, which is prepared before the acetabulum. After the resurfacing arthroplasty is performed, the osteotomy was refixed using two or three 3.5-mm screws in the first 60 hips and 4.5-mm screws for the remainder of the series. Postoperatively, all patients were instructed to be on limited weight bearing for 6 weeks or until evidence of healing of the osteotomy site was apparent on radiographic imaging.

Patients were assessed preoperatively, 6 weeks postoperatively, and 6, 12, and 24 months postoperatively. Patients were evaluated with the Harris Hip Score [23]. Complications and radiographic findings were recorded. Radiographic evaluation included cup inclination, anteroposterior (AP) and lateral femoral neck shaft angles, and AP and lateral femoral component stem shaft angles as described by Beaule et al [24]. The end point of the study was reoperation for any cause related to the prosthesis or the approach. The difference between the preoperative and follow-up hip scores was analyzed with paired Student t tests. Significance was determined to be $P < .05$.

Results

At a mean follow-up of 38.3 months (range, 12-84 months), 2 patients were lost to follow-up and 1 died at 6 months from causes unrelated to the intervention. For all 3 patients, the trochanter had healed. There were no femoral neck fractures: one for femoral component loosening requiring conversion to a metal-on-metal total hip arthroplasty at 18 months postoperatively in a patient with a diagnosis of osteonecrosis; one for aseptic acetabular loosening in a 50-year-old female 7 years postsurgery. The overall Harris Hip Score for the series improved significantly from 53.1 (range, 33.4-71) to 90.16 (range, 65.9-100; $P < .001$).

Radiographic Analysis

The mean femoral stem shaft angle was 138.3° (range, 122°-155°), and the mean acetabular component abduction angle was 38.7° (range, 30°-60°). There was no evidence of femoral component lucencies. Two patients had femoral neck narrowing at 2 years but with no clinical impact.

Complications

Two patients had a partial peroneal nerve palsy that recovered at 4 weeks. One patient had a superficial infection treated by irrigation and debridement. One patient had a component mismatch, which was revised to a larger acetabular shell and kept as a resurfacing. The patient is now 2 years postresurfacing with no further complications. One patient had loss of fixation at 3 weeks, which required reoperation and went on to heal with no complications. There were 10 nonunions (8.7%), with one associated with a fracture of the
greater trochanter. A total of 6 of the 10 went on to repeat surgery treated with screw fixation and tension band wiring at a mean time of 4 months (1.5-12 months) (Fig. 1). For those patients who did not have surgery, the average migration of the greater trochanter was 4 mm (range, 2-8 mm), with 2 patients showing partial resorption of the trochanteric fragment (Table 1).

None of the patients required the use of an assistive device for ambulation, and none had a Trendelenburg sign. However, because the treating surgeon did not see patients between the time of initiation of weight bearing around 8 weeks and the 6-month follow-up, it is not known if some of the patients exhibited a Trendelenburg gait between these 2 time points. Of the 115 hips, 21 (18.3%) had removal of the internal fixation due to persistent bursitis at a mean time of 12.3 months (range, 5-14 months). All patients that underwent a second surgery did well and are without complications. Two patients had 2 reoperations related to the greater trochanter: one for nonunion and one for painful internal fixation.

Discussion

The trochanteric slide approach is appealing for hip resurfacing not only because it preserves blood supply to the femoral head but also because it provides excellent exposure to the hip joint with minimal soft tissue disruption [11,14]. Most of the experience with this approach has been in joint preserving surgery of the hip with only a 1% nonunion rate and with removal of painful internal fixation being the most common cause of reoperation. However, in this series, our nonunion rate was high at 8.7% (10 of 115 hips), with 5.2% (6 of 115 hips) requiring surgery for the nonunion. Using a similar approach, Bal et al [25] reviewed 73 total hip arthroplasties performed through the trochanteric slide approach and reported a similar nonunion rate of 8% with an overall reoperation rate of 28% for hardware-related problems.

These problems included mainly painful trochanteric bursitis, as well as metallic debris from the wires and concerns of third body wear. Similarly, in our series, 18% of patients had subsequent screw removal, all of whom had complete relief of their trochanteric pain after the internal fixation was removed.

Although trochanteric osteotomy was a commonly used approach at the time of introduction for total hip arthroplasty [26], the reported rate of nonunion remained relatively high ranging from 4.2% [27] to 12.3% [28,29]. Consequently, most shied away from trochanteric osteotomies and moved toward the posterior and lateral approaches [29,30]. Others, however, modified the trochanteric osteotomy by keeping the vastus lateralis attached to the trochanteric fragment, counteracting the pull of the abductors and increasing compressive forces while decreasing shear forces [25,31] in the hope of minimizing the risk of nonunion. This is supported by the very low incidence of nonunion in patients undergoing this approach for joint preserving surgery of the hip [11,17,18,32] with a reported 1% to 2% incidence of nonunion. One possible explanation for the higher incidence of nonunion in joint arthroplasty surgery may have to do with poorer bone quality and healing potential in patients with arthritis who have not loaded their hip normally for a significant period. In addition, 2 of the nonunions did occur in patients who underwent bilateral hip resurfacing at the same setting making it difficult to maintain the restricted weight bearing. Although 2 other patients who had bilateral hip resurfacings at the same setting went on to union, it may
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DDH indicates developmental dysplasia of hip; OA, osteoarthritis.

Fig. 1. (A) A 39-year-old man 8 weeks post bilateral metal-on-metal hip resurfacing. (B) AP radiograph of the hip pretreatment and posttreatment of nonunion at 6 months post initial surgery and at 8 months post repeat operation.

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be advisable especially in female patients that a staged procedure would offer a more predictable outcome. Also from a technical standpoint, because the arthritic hip is usually fixed in external rotation, the osteotomized
fragment may have been uneven and too thin, making it susceptible to breakage and nonunion, in that respect the fragment should have a minimum thickness of 1 cm. Notwithstanding the need for reoperation in the presence of a nonunion, the impact on patient function and gait can be significant [28,33]. Both Amstutz and Maki [28] and Hamadouche et al [33] found that if the trochanteric migration is less than 1 cm, the impact on function is minimal to none, which was the case in our series, and is most likely due to the preservation of the vastus lateralis attachment. In addition, although difficult to assess radiographically, some of the patients may also have developed a fibrous union explaining their good to excellent function. More importantly, the predictability of trochanteric union after reoperation in our series was 100%, which is superior to what has been reported in the presence of stem total hip arthroplasty [33]. This is more likely due to the greater fixation available as well as the capacity to consistently generate compression at the site of the nonunion.

Despite the difficulties experienced with the trochanter, there were no femoral neck fractures. This is important to consider as well because femoral neck fractures still represent the leading cause of early failures after hip resurfacing [34,35]. Recent retrieval analyses have confirmed osteonecrosis as a cause of early failure, that is, femoral neck fracture [36,37], and although the etiology of femoral neck fracture is likely multifactorial, an osteonecrotic event secondary to compromised blood supply to the femoral head cannot be ignored [9,38]. Although the main argument for the use of the posterior approach has been the presence of a so-called intraossaeous blood supply to the femoral head [39], to date, the
current body of literature on femoral head blood flow in
the presence of arthritis has reemphasized the critical role
of the extraosseous blood supply from the ascending
branch of the medial circumflex as in the native hip joint,
as well as the lack of any substantial intraosseous blood
supply [8,10,12,40-42]. So how can we reconcile the
relatively low rate of femoral neck fracture with the use
of the posterior approach? As in osteonecrosis of the
native hip joint [43], a certain cell injury threshold must
be reached after hip resurfacing in order for femoral neck
fracture to occur. These insults are not limited to the
surgical approach but also femoral head preparation,
neck notching, and cement penetration [9]. Although all
of these factors play a role in the introduction of hip
resurfacing and incidence of femoral neck fracture,
surgeon experience as well as appropriate patient selec-
tion are critical [2,44]. Marker et al [44] reported a
significant reduction in their incidence of femoral neck
fracture with 12 of 14 occurring in the first 69 cases (17%
incidence) and only 2 in the subsequent 481 cases (0.4%
incidence). In addition, the area of fixation upon which
the femoral component relies (head/neck junction) most
likely differs from that of the epiphysis [9]. In a recent
article, Amarasekera et al [42] showed, using Laser
Doppler flowmetry, that there was a greater reduction in
blood flow to the femoral head/neck junction with the
posterior approach (40%) compared to the trochanteric
slide (11%) during hip resurfacing. However, these
changes were not as dramatic as in the femoral head
itself, where Beaule et al [41] noted a 90% reduction in
femoral head blood flow with damage to the extraosseous
blood supply. Finally, with the hip dislocated anteriorly
with the Ganz surgical dislocation approach, one can appropriately address the cam deformity [45] and minimize the risk of residual femoroacetabular impingement [46].

The Ganz or surgical dislocation approach provides excellent visualization of the hip joint for performing total hip resurfacing arthroplasty. It also has an advantage in that it preserves the main blood supply to the femoral head, thus potentially decreasing complications associated with the resurfacing procedure. However, because of the relatively high reoperation rate for this approach in joint arthroplasty surgery both in our study as well as in the literature, we no longer routinely perform it for hip resurfacing arthroplasty. The senior author now uses the anterior-Hueter approach for most hip resurfacings using an orthopedic traction table. Our current indications for the surgical dislocation approach for hip resurfacing are in the presence of a high-riding greater trochanter permitting distal transfer and when joint preserving surgery may be indicated.

References


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