Audit-induced change reduces complications of the Ganz trochanteric flip approach

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ABSTRACT

INTRODUCTION The Ganz trochanteric flip approach aims to avoid the potential risk of avascular necrosis in hip conserving surgery and may reduce the risk of femoral neck fractures, neck thinning and femoral head implant migration in hip resurfacing. Our initial audit revealed the complications of non-union and trochanteric screw irritation to be associated with this approach. We, therefore, modified our selection criteria and re-audited our results.

SUBJECTS AND METHODS The initial audit (IA) ran between January 2003 and November 2007 after which an age limit of 50 years was recommended. The re-audit (RA) ran between November 2007 and December 2008 where one of the senior authors stopped using the approach in the over 50 year age group whilst the other senior author continued on selected patients over 50 years.

RESULTS There were 545 hips in the IA and 152 hips in the RA group. The incidence of non-union decreased in the RA after the change of selection criteria (6.2% [IA] vs 1.3% [RA]). In both audit groups, the incidence of non-union increased with age, and in the RA no non-unions were observed under the age of 50 years. The incidence of screw irritation and the necessity for removal remained relatively unchanged (20.7% [IA] vs 28.3% [RA]) with a combined incidence of 22.4%.

CONCLUSIONS The trochanteric flip approach to the hip can be used safely with an acceptable complication rate in young adult impingement and resurfacing surgery. Caution must, however, be exercised in patients over 50 years of age as they have a higher incidence of trochanteric non-union. In addition, all patients should be consented for the possibility of screw removal as a second procedure.

KEYWORDS

Ganz trochanteric flip – Audit – Complications – Non-union – Screw irritation

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The Ganz trochanteric flip approach provides extensive exposure to the acetabulum and femoral head in procedures in which femoral head blood supply should be preserved. This approach aims to avoid the potential risk of avascular necrosis in hip-conserving surgery and may reduce the risk of femoral neck fractures, neck thinning and femoral head implant migration in hip resurfacing. For this reason, it is an essential approach in hip impingement and acetabular fracture surgery. This approach is used in our unit to treat femoro-acetabular impingement (FAI) by surgical hip dislocation and to perform hip resurfacing arthroplasty.

Non-union of the trochanteric osteotomy is a recognised complication of this approach.¹ An initial audit of our first 4 years' experience identified trochanteric non-union and screw irritation as the predominant complications associated with this approach when used in our unit. We, therefore, modified our age-selection criteria and present our re-audited results.

Subjects and Methods

All patients who underwent a Ganz trochanteric flip approach between January 2003 and December 2008 were reviewed retrospectively during the course of the initial and re-audit process. Patients who underwent hip resurfacing or FAI surgery during this time were included in the study. All patients in the audit were only operated on by the two senior author surgeons (MN and EDF) using the surgical technique as described by Ganz.¹ All resurfacing procedures used the uncemented Cormet 2000 implant (Corin Ltd, Cirencester, UK). Postoperative routine was identical in both audits. Patients were initially mobilised partial weight-bearing (10 kg) with the avoidance of active hip abduction. At 6 weeks, trochanteric osteotomy union was assessed radiologically. If satisfactory, full weight-bearing and active hip exercises were commenced at this stage.

The initial audit ran between January 2003 and

November 2007 which revealed an increasing incidence of trochanteric non-union with age. The re-audit ran between November 2007 and December 2008 where one of the surgeons (MN) ceased using the approach for hip resurfacing in patients over 50 years whilst the other surgeon (EDF) continued to use it in highly selected cases over 50 years after careful consultation.

Results

The initial audit consisted of 503 patients (545 hips), with the re-audit consisting of 152 patients (152 hips).

In the initial audit, there were 291(58%) males and 212 (42%) females. Overall, 362 procedures were undertaken for hip resurfacing, and 183 for FAI. The mean age was 45 years (range, 10–68 years). The mean age of the resurfacing group was 52 years (range, 24–68 years) and the FAI group was 39 years (range, 10–65 years).

The re-audit group consisted of 72 (47%) males and 80 (53%) females. In this cohort, 46 procedures were undertaken for hip resurfacing and 103 for FAI. The mean age was 36 years (range, 11–61). The mean age of the resurfacing group was 46 years (range, 19–61 years) and FAI group was 32 years (range, 11–61 years).

There were 34 trochanteric non-unions (6.2%) in the initial audit and two trochanteric non-unions (1.3%) in the re-audit. The age distribution and incidence of trochanteric non-union is shown in Table 1. The majority of non-unions in both audits were shown to be in the over 50 years age group (initial audit, 77%; re-audit, 100%), with the incidence of non-union increasing with age.

All trochanteric non-unions in both audits were refixed. Three patients in the initial audit group required a third fixation procedure to achieve union. One patient remains with a persistent trochanteric non-union. In the re-audit group, both cases of non-union were revised and achieved union. (Figs 1 and 2)

In the initial audit, 113 hips (20.7%) required removal of screws for trochanteric and psoas discomfort, compared to

Figure 1 An example of trochanteric non-union with the Ganz osteotomy.

43 hips (28.3%) in the re-audit. The combined incidence of screw-related discomfort necessitating screw removal for the entire series was 22.4%.

There were no incidences of deep infection, dislocation or neuropraxia.

Discussion

The Ganz trochanteric flip approach preserves the blood supply to the femoral head and neck, provides a safe method of dislocation of the femoral head, spares the musculotendinous units around the hip, and tends to provide a more complete exposure of the acetabulum compared to the anterior, anterolateral and direct lateral approaches with an almost 360° visualisation of the femoral head.¹ Rehabilitation is, however, delayed with this approach as the patient is required to partially weight-bear for 6 weeks. Earlier mobilisation than this has been shown to increase the risk of screw breakage and non-union.^{2,3} Trochanteric non-union is a recognised complication of this procedure. Ganz *et al.*¹ reported a 1.4% osteotomy non-union rate in a series with a mean age of 33 years (range, 16–58 years) where the approach was used predominately for FAI surgery. Killampalli *et al.*² reported a revision of trochanteric

Table 1 The number and percentage of trochanteric non-unions requiring refixation per age group

Age group	Initial audit	Re-audit
Under 20 years	0/27 (0%)	0/20 (0%)
20–29 years	1/44 (2.2%)	0/31 (0%)
30–39 years	1/81 (1.2%)	0/35 (0%)
40–49 years	6/128 (4.6%)	0/39 (0%)
50–59 years	16/188 (8.5%)	2/24 (8%)
60 years and above	10/77 (12.9%)	0/3 (0%)
Total	34/545 (6.24%)	2/152 (1.32%)

Figure 2 The patient required refixation using three screws, union achieved.

fixation in four patients (4%) in a series of hip resurfacings using this approach where the mean age was 56 years (range, 21–74 years). Khan *et al.*⁴ described two cases (8.3%) of trochanteric non-union when comparing this approach with a modified anterior lateral approach for hip resurfacing where the mean age was 53 years. Our study demonstrated an initial non-union rate of 6.2% (mean age, 45 years) which improved to 1.3% (mean age, 36 years) following a change in our age-selection criteria. It can be seen that the risk of non-union increased with age in both cycles of our audit (Table 1), which suggests that the bone quality and rate of healing is compromised with advancing age. Interestingly, all three data sets of Khan, Killampalli and our initial audit demonstrated similar non-union rates (4–8.3%) with comparable higher mean ages (range, 45–56 years). When comparing Ganz *et al.* and our re-audit data, lower non-union rates (1.3–1.4%) were seen within a younger cohort of patients (range, 33–36 years). We, therefore, suggest that there is a low risk of complications with this approach under the age of 40 years. Patients aged greater than 50 years require careful counselling and consenting for this procedure and the risk versus the potential benefit of using this approach needs to be carefully weighed. In

patients of greater than 60 years of age, we suggest that an alternative, such as the posterior or modified anterolateral approach⁴ should be used.

Killampalli *et al.*² reported four patients (4%) with pain due to the prominence of the screw heads in healed osteotomies that later required screw removal. Ganz *et al.*¹ and Khan *et al.*⁴ did not comment on this complication in their papers. Our initial audit and re-audit found this figure to be much higher (20.7% and 28.3%, respectively) with an overall figure for the entire series of 22.4%. We, therefore, suggest that all patients undergoing this approach be consented for postoperative screw removal at a later date.

The Ganz trochanteric flip approach is based on detailed anatomical studies of the blood supply around the hip. The main blood supply to the femoral head and neck is from the deep branch of the medial femoral circumflex artery (MFCA).^{5,6} This is variable, but terminates in vessels overlying the proximal border of quadratus femoris and the tendons of the obturator internus and gemelli before perforating the joint capsule. Notzli *et al.*⁷ and Steffen *et al.*⁸ demonstrated that perfusion to the femoral head is maintained after surgical dislocation using the Ganz trochanteric flip approach. When compared to the anterolateral approach, similar preservation of oxygenation was observed; however, the trochanteric flip approach demonstrated less variation throughout the procedure.^{8,9} The anterolateral approach appears to preserve the blood supply to the femoral head and neck; however, the blood flow in the femoral head is dependent on intra-operative leg positioning,^{9,10} suggesting that branches of the MFCA may be temporarily occluded during this approach. The majority of hip resurfacings historically have been performed by a posterior approach. It has been shown following a hip resurfacing, that it is essential that the residual bone retains its load transmitting properties in order to fulfil its mechanical function.¹¹ The majority of revisions of hip resurfacings are reportedly secondary to an atraumatic fracture of the femoral neck.^{12–16} Although these complications have not been directly linked to the posterior approach in any clinical study, there is a concern that the posterior approach can cause a reduction in femoral head vascularity.^{9,10,17–19} Little *et al.*¹¹ reported that, on finite element analysis studies, there is a minimal potential for femoral neck fracture under physiological loading conditions simulating normal gait in a correctly aligned implant. Necrotic bone has been shown to have substantially lower mechanical properties than vitalised bone,¹⁶ and these fractures have been attributed to weakening of the bone secondary to devascularisation.²⁰ This weakening of the construct could result in early failures secondary to resorption^{20–22} or later fatigue failure and femoral head collapse.²¹ Therefore, it can be postulated that, preferentially, the vascularity of the femoral head should be preserved in order to ensure longevity of these implants by using either the Ganz or modified anterolateral approach.

Conclusions

This completed audit loop has demonstrated that this surgical approach can be used safely with an acceptable complication rate in young adult hip preserving and resurfacing surgery, but should be used with caution in those over 50 years. A change in age-selection criteria has reduced the complication rate 5-fold to an acceptable level.

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