Is Abductor Lurch a certainty after Extended Trochanteric Osteotomy?

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Abstract

Objective: Many studies assessing the outcomes of extended trochanteric osteotomy (ETO) and its role in revision total hip arthroplasty (THA) have shown ETO to be an extremely useful tool in femoral stem explantation and reducing intra-operative fractures. However, the sagittal plane of the osteotomy means detachment of the abductor mechanism insertion and possible muscle injury. The removal of the trochanter also alters the horizontal offset of the affected hip. This can have an effect on hip biomechanics and result in a trendelenburg gait. We studied a small group of patients at our center for the incidence of abductor insufficiency post revision THA when combined with ETO.

Methods: 25 patients scheduled for revision THR with an average age of 55 years were assessed for abductor insufficiency pre-operatively. Patients underwent revision THA performed by the senior author with use of an ETO for femoral stem explantation. Hip Harris scores, anteroposterior and lateral radiographs of the affected hip were taken pre and postoperatively at 6 weeks, 3 months, 6 months, 1 year and 2 years. Post oprative patients were assessed for abductor weakness, gait pattern and a trendelenburg test.

Results: Four osteotomy segments migrated more than 2mm on post-operative radiographs. The mean Harris Hip Score improved from 35 to 81.4. A positive trendelenburg's sign was noted in 14/25 patients. All patients had ≥5mm decreased horizontal offset.

Conclusion: There is a significant incidence of abductor insufficiency in patients who have undergone ETO. It must be further evaluated to determine the cause to reduced horizontal offset or muscle injury.

Keywords: Hip Replacement; Extended trochanteric osteotomy; Revision hip replacement; Abductor lurch; Trendelenburg gait

Introduction

Revision hip replacement is on the rise due to many factors, from peri-prosthetic fractures to implant failure [1]. Elderly patients with an active lifestyle are outliving their implants. Revision surgery is both demanding to a surgeon and a patient to remove the implant with minimal bone loss and implant a new stable prosthesis avoiding fractures [2,3].

A revision surgery has three components, removal of the existing implant, preparation for the existing bone for the new implant and finally implantation of the new prosthesis. Younger et al [3] reported the technique of Extended Trochanteric Osteotomy (ETO) in 1995 for explantation during revision total hip replacement. ETO has shown reasonably good results in literature. With good fragment vascularity and surface area it shows good healing as well as provides visibility of acetabulum. Other proximal femoral osteotomies have shown higher complication rates than ETO [4,5].

Complications of extended trochanteric osteotomy reported in literature include nonunion of the fragment (1%-3%), fractures (4%-20%), upward migration of the osteotomized fragment (0%-1.2%), infection (1%-3%), and stem subsidence [6,7]. There are no studies in literature reporting on abductor lurch following an extended trochanteric osteotomy.

The abductor mechanism is a second order lever arm governed mainly by the gluteus medius and gluteus minimus as well as the tensor fascia latae. These muscles attach to the greater trochanter and may be damaged or become inefficient following an ETO. This can happen due derangement in the muscle power, length and

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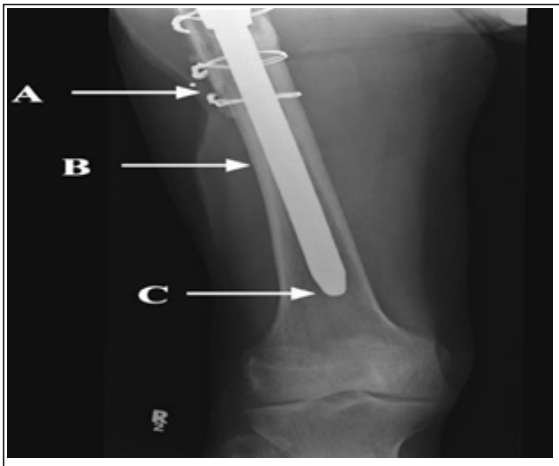

Figure 1: A-B: Scratch Fit
B-C: Distal Fit

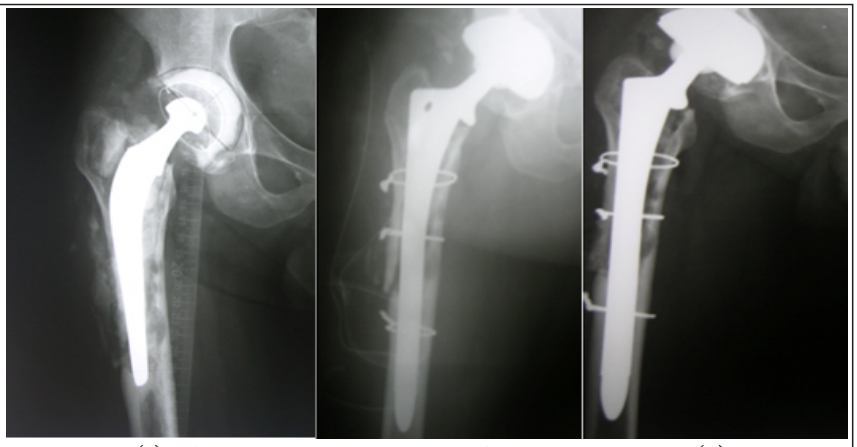

Figure 2: (a) infected Right THR with weak femoral lateral cortex (b) Revision THR with ETO Post op day 0 (c) Revision THR post op 3 months showing good healing and callus at osteotomy site.

moment arm length (horizontal hip offset).

The purpose of this study is to review a series of ETO done in our institution to determine the risk of complications associated with the procedure, with special attention to abductor lurch after union of the osteotomy.

Material and Methods

Between January 2007 and May 2012, 25 extended trochanteric osteotomies were performed at our institute by the senior author. There were 14 male and 9 female patients. The average age of the patient was 55 years (range 40-72 years) at the time of revision. The average length of follow up was 2 years and no patients were lost to follow up. All patients underwent an ETO as part of their revision for indications of aseptic loosening in 80% (20 patients) and septic loosening in 20% (5 patients).

Anteroposterior pelvic radiographs and lateral radiographs of the affected hip were taken pre-operatively at 6 weeks, 3 months, 6 months, 1 year and 2 years post-operatively. The pre-operative radiographs were assessed to plan the order of surgical events and bone involvement if a debridement was indicated. Patients were assessed for abductor weakness pre-operatively assessing gait pattern and a Trendelenburg test.

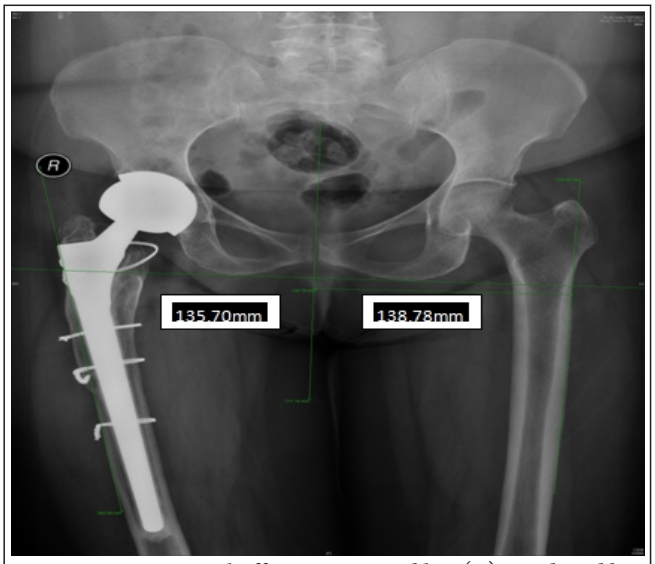

Figure 3: Horizontal offset on operated hip (R) is reduced by 3mm.

The surgical procedure was performed in a lateral decubitus position. The affected hip was approached through an anterolateral approach. The ETO was performed to a minimum length of 10 to 12cms, care was taken to keep the abductors and vastus lateralis attached to the osteotomy fragment to ensure preservation of vasculature. The vastus lateralis was exposed from the linea aspera and the perforators of the profunda femoris artery are ligated. The osteotomy was performed in the lateral one-third of the femur and oblique cuts are taken so as to obtain a 'U' shaped transverse profile (Fig.1). This was done to improve stability as well as exposure, care was taken to obtain a smooth curve distally in order to avoid a stress riser. A scratch fit length of at least 2 diameters below the osteotomy was obtained and an extensively porous-coated, distal fixing, cementless stem was used. A minimum of 2 cables (range 2 - 4 cables) was used to fix the osteotomy fragment. No strut allografts were used. Post operative patients were permitted to touch weight bearing and restricted from active abduction exercises for a period of 6 weeks.

All patients were radiographed and evaluated for trochanteric pain, thigh pain, Trendelenburg test and Hip Harris score at 6 weeks, 3 months, 6 months, 1 year and 2 years post-operatively.

Immediate post-operative radiographs were performed to

ascertain the length of the osteotomy and the amount of 'scratch fit' or 'distal-fit' obtained. Scratch-fit was defined as the length of the stem in contact with both medial and lateral cortices on the antero-posterior radiograph or with the anterior and posterior cortices on the lateral radiograph. Distal-fit was defined as the length of stem extending beyond the osteotomy (Fig. 1). The osteotomy fragment was considered united when bridging callus was seen crossing 3 cortices on AP radiographs. Migration of the osteotomy fragment was assessed by measuring the distance from the tip of the greater trochanter to a horizontal line drawn across the top of the obturator foramina. This measurement was assessed in all post-operative and serial follow-up radiographs.

Results

Union was achieved in all patients at a mean time of 9.57 weeks (range 8-30 weeks). The longest time taken to union was 30 weeks for an infected hip in an elderly woman.

The average length of the osteotomy segment was 139 mm (range 108mm–198mm) and the mean scratch fit length obtained was 80.25mm (range 67 – 90mm). The mean implanted stem length was 245mm.

Four (16%) of the osteotomy segments migrated greater than 2mm (range 3-5mm) on post-operative radiographs. The mean pre-operative hip harris score was 35 (range 22-55) and post operative was 81.4 (range 69-95).

A positive Trendelenburg's sign was noted in 14 patients (56%). Further evaluation revealed all 14 patients had more than 5mm of decreased horizontal offset with the maximum decrease of 10mm. All of these patients had less than 10mm of shortening and abductor power was found to be 4/5 according to MRC scale.

One patient with an osteoporotic, infected hip sustained a trochanteric fracture for which additional stabilization using a plate was required. One patient had an anterior dislocation at 6 weeks post-operatively, which was managed with a head and liner change. This patient had no further episodes of instability at 2 years follow-up. Two out of the twenty-five patients had a serious discharge post-operatively which resolved with wound care.

Discussion

ETO has proven to be an extremely helpful method in accessing the distal aspects of a femoral stem fixation during revision arthroplasty. Literature shows that union rates are excellent [8–10] and this is demonstrated in our study as well. ETO has shown to be a valuable precaution to reduce the incidence of intraoperative fractures thus giving better post-operative outcomes [9].

A study done by Noble et al [11] showed that femoral torsional strength is decreased by 73% after ETO therefore there is a theoretically a higher chance of postoperative fracture. However, the predictable outcomes of ETO ensure the surgeon is able to access the medullary canal and removed well fixed components satisfactorily. Good surgical technique and care to preserve blood supply ensure the osteotomy fragment remains vascular thus giving good results in both cemented and cementless explantation [2,5–7]. Fig. 2 shows a case of aseptic loosening, poly liner wear and a weak lateral femoral cortex where ETO was done to prevent cortical breach during explantation giving a better post- operative result.

Conventional trochanteric osteotomies have many more complications when compared to ETO, such as non-union, migration of osteotomized fragment and improper explantation of cement. In 1987 Wagner described the transfemoral osteotomy in a coronal plane [12] which may have spared the abductor mechanism to some extent. later Younger et al described the ETO in a sagittal plane to spare the abductors [2], this then became the gold standard despite a complication rate of 24% reported by Mardones et al [7]. Of all the complications considered abductor insufficiency has not been reported in relation to ETO. From previous studies the good union rates and incidence of trochanteric migration have been reproduced in our study, though a significant number of patients had a post-operative abductor insufficiency leading to a Trendelenburg gait after union of the osteotomy site. This has not been reported as a complication in previous studies. Further evaluation showed these patients had a decreased horizontal offset of more than 5mm the maximum being 10mm (Fig. 3). Abductor muscle power was 4/5 as per MRC grading. Both power of the muscle and horizontal offset can individually or together contribute to a lurch. This

makes it difficult to isolate the sole cause. The offset could be better restored by using a modular stem so as to restore the levers moment arm length.

As abductor lurch has not been reported in literature as a complication of ETO it may be worth studying against a control group in revision hip arthroplasty groups to look at the prevalence of abductor insufficiency.

Conclusion

We were able to use ETO as an effective tool in revision hip arthroplasty. In accordance with literature it aided in explantation and offered predictable outcomes in terms of union, trochanteric migration and functional hip scores. However, in our study more than half the patients suffered from an abductor lurch, attributed to the ETO. This may be due to the reduced horizontal offset or muscle power. The horizontal offset being governed by the implant or migration of the fragment and muscle power reduced due to prolonged time to revision surgery or iatrogenic surgical injury. We conclude that the incidence of abductor lurch in ETO must be studied further with a control group to improve further the outcomes of ETO.

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