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TECHNIQUE TIP

Modified Extended Trochanteric Osteotomy

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ABSTRACT

Trochanteric osteotomy, the most extensile approach, is a valuable tool for difficult primary and revision total hip arthroplasties (THAs). Extended trochanteric osteotomy (ETO) is helpful in revision and extraction of well-fixed cemented as well as uncemented fremoral components, facilitates in cement extraction, and also in enhancing acetabular exposure. Tradional posterolateral ETO is initiated at the posterior aspect of the femur.

We describe a modification of ETO by an anterolateral approach. The advantage of this approach is that as it preserves an intact musculo-osseo-muscular sleeve comprising of gluteus medius and minimus, greater trochanter, and vastus lateralis it allows physiological reconstruction of hip's soft tissue envelope and thus prevents proximal migration, nonunion of the osteotomy, and abductor lurch, which are the commonest complications associated with an ETO.

Anterolateral exposure of hip joint and anterior fibers of gluteus medius, minimus, and capsule reflected as cuff and limbs of osteotomy are marked, and after completing the osteotomy with the help of osteotomes passed from posterior to anterior, the fragment is hooked open on its anterior muscular hinge. Osteotomy is fixed with the help of three to four cerclage wires depending on length of osteotomy.

Full-weight bearing and abduction against gravity are only allowed after confirming radiological union of the osteotomy.

Keywords: Abductor lurch, Extended trochanteric osteotomy, Linea aspera.

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BACKGROUND

At present, primary total hip arthroplasty (THA) is generally performed via a posterior, anterior, antero-lateral, or direct lateral approach without the use of a trochanteric osteotomy. However, trochanteric osteotomy, the most extensile of approaches, remains a valuable tool for difficult primary and revision THAs.[1]

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In primary THAs especially in cases of ankylosis or fusion of hip, protrusio acetabuli, proximal femoral deformities, severe developmental dysplasia, or abductor muscle laxity resulting in global instability, a trochanteric osteotomy is helpful in dislocation and enhancing exposure.

Extended trochanteric osteotomy (ETO) is helpful in revision and extraction of well-fixed cemented or uncemented femoral components. Removal of well-fixed proximally coated femoral components is aided by the use of flexible osteotomes or a Gigli saw passed medially around the prosthesis if the geometry permits. A well-fixed, extensively coated prosthesis can be extracted by sectioning the prosthesis at the junction of the tapered and cylindrical portions and using trephines distally.[2] The trochanteric osteotomy also greatly facilitates removal of cement through direct visualization in routine revisions. Acetabular exposure can also be greatly enhanced by doing the osteotomy and then retracting the osteotomy fragment anteriorly and the proximal femur posteriorly. In the presence of a varus deformity in the proximal femur (i.e., apex lateral bowing of the proximal femur due to remodeling of the proximal femoral bone), because of the failed femoral component *in situ*, ETO is a must. Any attempt to ream the canal without the osteotomy will result in eccentric reaming and reamers can perforate the lateral cortex at the apex of this deformity. With the aid of the ETO, direct access to the diaphysis is provided, which allows straight reaming of the diaphysis for revision stem insertion. However, the ETO requires use of a distal fixation femoral component design so as to obtain fixation in the femur distal to the osteotomy.

The traditional posterolateral osteotomy is initiated along the posterior aspect of the proximal femur. The posterior soft tissue attachments of the short external rotators and capsule can be left intact but are generally released for improved exposure. Once the posterior aspect of the proximal femur is exposed to the desired extent from the greater trochanter, a Homan retractor is placed anteriorly in the submuscular position at the level of the anticipated transverse portion of the osteotomy. Vastus muscle is elevated in this region to provide adequate exposure. The initial cut is made from the posterior aspect of the greater trochanter and continues distally along the posterior femur to the preoperatively determined distance. The transverse portion is then cut to include approximately one-third of the femoral diaphyseal circumference. The anterior limb is then cut by passing the

saw, burr, or osteotome from posterior to anterior. Once the osteotomy is complete, the osteotomized fragment is carefully elevated, exposing the underlying femoral component or cement mantle.

We describe a modification of the ETO done through an anterolateral approach. The advantage of this approach is that as it preserves an intact musculo-osseo-muscular sleeve comprising of gluteus medius and minimus, greater Trochanter, and vastus lateralis, it allows physiological reconstruction of hip's soft tissue envelope and thus prevents proximal migration, nonunion of the osteotomy, and abductor lurch, which are the commonest complications associated with an ETO.

APPROACH

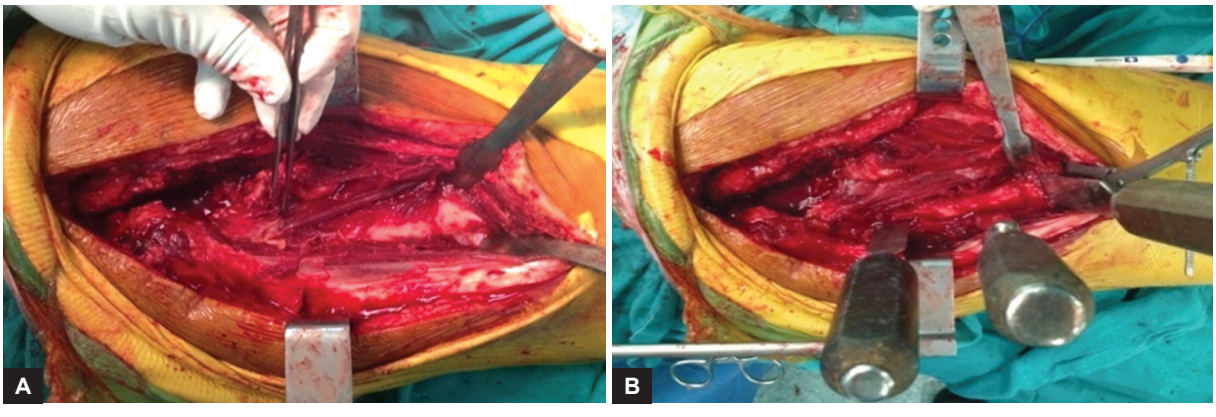
Anterolateral exposure to the hip is classically approached through the interval between the gluteus medius and the tensor fascia latae muscle. We routinely perform this approach by making a lazy S incision through the gluteus medius and the vastus lateralis, the SIGMA approach. The incision is made (proximal to distal) in the tendon and the distal fibers of the gluteus medius through its anterior third, then curving it anteriorly on the greater trochanter through the tendons of gluteus medius and minimums, and then curving it posteriorly and finally along the femoral shaft through the vastus lateralis. Proximally, the anterior fibers of the gluteus medius, the gluteus minimus and the capsule, and distally the vastus lateralis are erased and reflected anteriorly as one cuff using an electrocautery.

TECHNIQUE

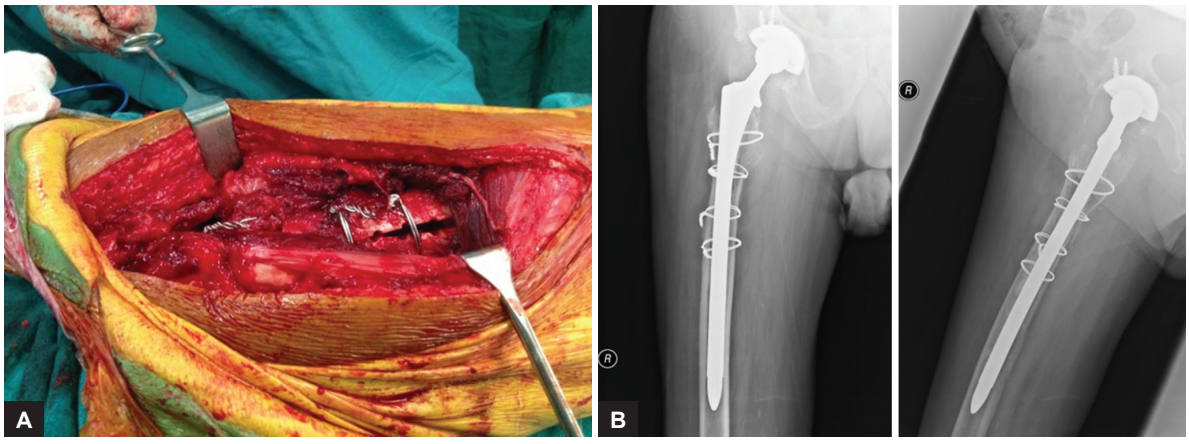
The length of the osteotomy is planned preoperatively as that which will provide adequate component exposure and maintain at least 5 cm of isthmic diaphyseal cortex for revision component fixation. Generally, the osteotomy is 12 to 15 cm long, measured from the tip of the greater trochanter. The distance from the tip of the greater trochanter to the distal extent of the ETO is measured with a magnified ruler on preoperative radiographs and recorded for intraoperative reference. The osteotomy may be done at any time during the procedure—before or after dislocation or after stem removal. The easiest time is after the stem has been removed; however, this is often not possible, so the osteotomy is usually done after dislocation but before stem removal. When dislocation is difficult, the ETO provides excellent exposure and can be helpful in dislocating a stiff hip.

The vastus lateralis is elevated in the region of distal extent of the osteotomy and does not need to be elevated more proximally in the trochanteric region (TIP) (Figs 1A and B). The two longitudinal limbs of the osteotomy are marked one just parallel to linea aspera and the other anterior to it. The distal cut is made obliquely, from proximal to distal, perpendicular to the long axis of the femur, and approximately comprising a third or a fourth of the circumference of the femur. Before making the distal cut, a cerclage wire is placed distal to the osteotomy to reduce the risk of fracture (TIP). The posterior limb of the ETO is performed with a microsagittal saw or a high speed bur. The anterior submuscular portion of the osteotomy is initiated with a series of drill holes and completed with the saw. It is important to cut the bone in an oblique plane so that, even with the inevitable bone loss encountered when cutting through the bone, a tight seal and intimate bone apposition can be achieved when the osteotomized fragment is replaced (TIP). Proximally, the osteotomy must be angled medially at the level of the vastus tubercle of the greater trochanter to incorporate all of the greater trochanter with the osteotomy fragment.[3] Once complete, it is important to confirm that the corners of the osteotomy are complete with a thin 0.25″ osteotome. Two to three large osteotomes are then passed from posterior to anterior and the fragment is generally hooked open on its anterior muscular hinge exposing the underlying component or cement mantle.

After addressing the acetabulum, the new stem is inserted before the osteotomy is reduced. We use a



Figs 1A and B: (A) Vastus lateralis elevated only in the distal part for exposing the shaft in the region of preoperatively decided distal cut, and (B) after completing the osteotomy, two to three osteotomes are used and the osteotomy is hooked open on its anterior muscular hinge, exposing the underlying component or cement mantle



Figs 2A and B: (A) Osteotomy closed with cerclage wires in position, and (B) X-ray showing use of distal fixation stem and four cerclage wires *in situ*

cementless distal fixation revision stem and the length of the stem is dependent on the fact that it should have at least 4 to 6 cm of distal fixation distal to the tip of osteotomy. Hip stability is assessed with the osteotomy still open. After stability is ensured and the acetabular and femoral components are in place, including the liner and femoral head, the ETO is reattached. At the time of osteotomy repair, the medial surface of the trochanteric fragment often requires sculpting with a high-speed burr to accommodate the lateral profile of the revision femoral component (TIP).

Fixation

Relative reapproximation of the osteotomy fragment can be aided by abducting the leg and internally rotating the femur during osteotomy repair. The posterior limb of the osteotomy should be reapproximated, first leaving any longitudinal gap anteriorly. Once reduced, two to four wires are passed around the diaphysis and trochanteric fragment to secure the osteotomy. It is important to pass the wires in a submuscular fashion so as not to injure the vascular supply to the osteotomy site or inadvertently entrap neurovascular structures. The wires are generally passed in a posterior to anterior direction to avoid inadvertently injuring the sciatic nerve. If adequate bone is available medially, the proximal wire is placed on the calcar just proximal to the lesser trochanter. Under no circumstances should the wire rest on the prosthesis; therefore, if calcar bone is absent, only two wires should be used, or an allograft should be applied medially. The second wire is placed just distal to the lesser trochanter, and one additional wire is placed 2–3 cm proximal to the transverse portion of the osteotomy. Additional wires can be used depending on the length of the osteotomy (Figs 2A and B). The distal wire is generally secured tightly, the middle one not quite as tightly, and the proximal wire even more loosely. This sequence of graduated tightening is done to avoid fracture of the osteotomy at its most vulnerable portion, just distal to the vastus tubercle.

Complications

We have had encouraging results with osteotomy uniting in all the patients. Abductor lurch and intraoperative fractures can be other major complications associated with this procedure. Intraoperative measures to avoid fracture include release of the anterior capsular and scar tissues from the proximal trochanteric fragment to increase its mobility and gentle exposure of the acetabulum with broad retractors and gentle removal of retained cement from the trochanteric fragment. Depending on the fracture pattern and extent and stability of the fixation additional cerclage wiring, a trochanteric claw or locking plate can be used to manage these fractures.

Postoperative Care

Most patients are mobilized toe touch weight bearing the day after surgery with the help of crutches/walker. Active abduction is prohibited for 6 weeks and partial weight bearing is allowed after 6 weeks and continued till 3 months. Full-weight bearing and abduction against gravity are only allowed after confirming radiological union of the osteotomy.

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