Session 13: Revision THR: Surgical Technique Video Vignettes

Learning Objectives
Upon completion of this activity, participants should be able to:

1. Learn methods of surgical approach to the patient undergoing revision that allow component removal and insertion.

2. Describe techniques of implant removal: both acetabular component removal and femoral stem removal.

3. Understand implant re-insertion: current thoughts on acetabular and femoral component insertion techniques.

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Exposure: Anterolateral Approach

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The anterolateral approach to the hip involves detachment of the anterior portion of gluteus medius from the trochanter and anterior exposure of the joint. Derived from the Watson-Jones approach described for hip fracture in 1935, and adopted by Burwell and Scott for endoprosthesis insertion in the early 1950s, this approach was popularized for total hip arthroplasty in the 1970s by Müller.

Surgical technique involves a lateral decubitus position, with the upper operated limb draped free. The skin incision is made directly lateral or with a slight posterior curve, and a split is made in the tensor fascia lata and gluteus maximus exposing the trochanter. The anterior 30% to 40% of the gluteus medius attachment to the trochanter is elevated via a curving subperiosteal incision. A vertical split is made proximally in the gluteus medius
and should extend no more than 3 cm above the acetabular rim (or 5 to 6 cm above the
trochanteric tip) in order to avoid injury to the superior gluteal nerve. The gluteus
minimus is detached from the trochanter and the hip capsule is incised in a T-fashion for
later repair or it is excised. The hip is dislocated anteriorward by flexing the hip and
externally rotating the leg while holding the limb in an adducted position. This allows the
leg to be brought over the front of the table and the foot and lower leg to be placed in a
sterile pocket clipped to the side of the operating table. The femoral neck is
osteotomized; the femur can be mobilized and retracted posteriorward. The rim of the
acetabulum can be well visualized and exposed and preparation of the acetabulum is then
accomplished from the abdominal side of the patient. Preparation of the femur is best
done on the opposite dorsal side of the patient to allow clear access down the canal of the
femur. Following arthroplasty, the capsular flaps can be repaired; the gluteus minimum is
repaired to the trochanter if the tissues are substantial enough to be repairable with direct
suture to bone. The gluteus medius flap is repaired very carefully back to its trochanteric
bed using either sutures passed directly through bone or through drill holes if the bone is
too hard to allow direct passage by needles. Generally, a nonabsorbable large-diameter
suture is utilized for this critical step. Fascial, subcutaneous, and skin closure can proceed
in a routine fashion.

Advantages of the anterolateral approach include avoidance of direct exposure of the
sciatic nerve, and facilitation of head exposure with less risk of avascular necrosis during
head-preserving procedures by avoiding the circumflex vessels posteriorly. Another
virtue is excellent acetabular exposure, as the surgeon views the acetabulum directly on
face allowing ease of bone defect or deformity treatment and ease of accurate acetabular
component positioning. There is a reduced dislocation rate compared to the posterior
approach (particularly if a meticulous repair of the external rotators is not performed after
the posterior approach.).

Disadvantages of the anterolateral approach are potential risk to the superior gluteal
nerve and slower recovery by a few weeks of abductor muscle strength. In addition, the
overhanging trochanteric tends to facilitate not only varus stem positioning but stem
flexion. Hand-in-hand with a decreased risk of posterior dislocation is the increased
chance of anterior instability of the hip.

Extensile versions of this approach include that popularized by Hardinge, where the split
in the gluteus medius is extended distalward, encompassing the anterior portion of the
vastus lateralis. This musculotendinous sleeve is elevated in subperiosteal fashion off the
bone and is reflected anteriorward allowing excellent exposure of joint. Numerous other
variations have been described, which vary based on the location of the longitudinal split
in the musculotendinous sleeve overlying the trochanter. It is important to note that distal
extension of the split in the musculature reduces the risk of inadvertent proximal
extension of the split into the gluteus medius, thus reducing the risk of injury to the
superior gluteal nerve. Another variation involves osteotomy of an anterior wafer of
greater trochanteric bone to facilitate reattachment of the gluteus medius and vastus
lateralis musculotendinous sleeve. Whatever variation is used, at the superior rim of the
acetabulum as further acetabular exposure is sought, it is important to elevate the gluteal
musculature up off of the bone rather than continuing to split the muscle sleeve proximally, again to avoid injury to the superior gluteal nerve. Posterior retraction of the femur allows access to the acetabulum anteriorly and tends to minimize the risk of traction injuries to both the sciatic nerve and the superior gluteal neurovascular structures during manipulation and retraction of the femur.

**Extended trochanteric osteotomies** are possible as a variation of this anterolateral approach. A transverse osteotomy, incorporating the majority of the trochanter, can be accomplished from anterior to posterior, allowing opening of the femoral canal for cement component removal; and finally, a lateral to medial split in the proximal femur, with elevation of the anterior half of the upper femoral segment, has been popularized by Wagner and can allow excellent access to the more distal femoral canal to facilitate implant or cement removal avoiding posterior dissection and detachment of the external rotators.

**Summary**: The anterolateral approach and its several extensile variations provide an excellent means of accessing the hip joint for routine primary hip arthroplasty and for revision procedures. This is particularly helpful for acetabular reconstructions and management of major acetabular bone defects because of the excellent acetabular exposure provided. This approach may be recommended for the select subgroup of patients undergoing hip arthroplasty who are at much higher risk for dislocation. Examples include patients with Parkinson’s disease, dementia, or other neurologic impairment, such as spasticity, and femoral neck fracture patients undergoing hip arthroplasty, as the risk of dislocation has been documented to be higher in all of these groups. As such, it is reasonable for this approach to be in the armamentarium of all hip surgeons regardless of their preferred surgical approach for routine cases.

**Reference:**

**Exposure: PATH Approach**

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*Background and Premise*: Revision THA has traditionally involved wide exposure requiring extensive dissection. This means increased blood loss, prolonged pain, high rate of dislocation, extended disability, and extended recovery time as compared to primary THA.1-3 It is the purpose of this paper to introduce a soft tissue–sparing concept for use in a high percentage of revision THA cases that has the potential to improve these parameters. Newly designed instrumentation for acetabular preparation facilitates more limited surgical dissection while providing optimal access.
Methods and Materials: Using a percutaneously assisted technique, 216 consecutive revision THA cases were performed. Minimum 2-year follow-up review was carried out for 148 acetabular and 68 combined acetabular and femoral revisions using the proposed technique. Clinical and radiographic reviews were carried out for all patients.

Clinical Results: Mean postoperative Harris Hip Score was 87.5. Hospital stay ranged from 1 to 9 days with an average of 4 days. Acetabular component abduction angle ranged from 35° to 50°. Dislocation occurred in 3 patients (1.4%). Proximal DVT occurred in 1 patient (0.5%). There were no nerve injuries, infections, or reoperations.

Conclusions: A percutaneously assisted, soft tissue–sparing approach to revision THA employing the use of newly designed instrumentation can facilitate access and precision. The risks associated with extensive soft tissue dissection may be reduced.1-3

Clinical Relevance: The use of reengineered bone preparation and implantation instruments may reduce risk and accelerate recovery.

References:

Exposure: Extended Osteotomy

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Revision total hip replacement (THR) often typically requires the use of a more extensile surgical approach.1-7 Although the standard trochanteric osteotomy and trochanteric slide osteotomy techniques provide excellent acetabular exposure, they are associated with a high rate of nonunion and proximal migration of the trochanteric fragment in the revision setting.2,8-10 The use of extensile trochanteric osteotomies has increased commensurate with an increase in the number and complexity of revision THR.11-15

Extensile techniques include:
1) The classic ETO via a posterolateral approach7 or a modified direct lateral approach16
2) The transfemoral approach

These extensile osteotomy techniques create an intact muscle-osseous sleeve providing wide exposure of the acetabulum, facilitate femoral component exposure and removal of distally fixed cemented and cementless femoral components, aid in canal preparation and femoral reconstruction, and allow for correction of proximal femoral deformity. Osteotomy fragments are easily secured and may be advanced distally to achieve proper tensioning of the abductors. Recent literature demonstrates a relatively low rate of nonunion and associated with fewer intraoperative femoral fractures or cortical perforations, as well as decreased surgical time as compared with traditional intramedullary femoral revision techniques. The development of extensile approaches has significantly simplified the removal of solidly fixed components without compromising femoral bone stock.

Surgical indications include:

1) Removal of well-fixed cement mantles with a loose or well-fixed stem (in which retrograde cement removal would either be difficult or impossible)
2) Removal of extensively porous-coated or tapered cementless stems
3) Removal of a well-fixed cemented stem that is complicated by infection, where it is vital to extract all foreign material for successful infection treatment
4) Correction of proximal femoral deformity in conjunction with revision THR

References:


Session 13


**Implant Removal: Acetabulum**

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*Background:* The main indication for removal of any acetabular component is either for **septic** or **aseptic** modes of failure. The distinction between the two is essential in determining the extent of removal necessary. In situations of **sepsis**, complete removal of all foreign material is necessary in order to improve the prospects for complete eradication (“cure”) of infection. On the pelvic side, this may be permitted through usual direct approaches (anterolateral, posterolateral, or transtrochanteric). However, intrapelvic cement in the presence of sepsis can also necessitate a retroperitoneal
approach.\textsuperscript{1} Remember: in cases of \textit{sepsis}, the primary goal is eradication of infection, which is dependent upon thorough debridement and foreign body removal.

Implant and cement removal in the setting of \textit{aseptic failure} poses a different set of priorities. In this setting, a cemented or cementless implant is being removed and an implant revised with the expectation of some form of reconstruction. The usual situations which necessitate this include loosening, revision for instability, in addition to revision for progressive osteolysis.

Methods: Surgical Approach: As was described previously, the options include traditional posterolateral, the PATH approach, the anterolateral, trochanteric osteotomy or slide, extended trochanteric osteotomy, as well as transfemoral approaches. The use of the retroperitoneal approach for cement or implant removal is unique: either in the face of sepsis or in cases of intrapelvic migration. The decision to use general surgical or vascular surgery consultation is dependent upon individual comfort with the approach.

1. Cemented Acetabular Component and Cement Removal
   Polyethylene-Prosthesis Removal
   Cement Removal
   - Loose Cement
   - Well Fixed Cement
   - Intrapelvic Cement

2. Cementless Acetabular Component Removal
   Indications: as with cemented sockets, indications include loosening, malposition leading to instability, sepsis, or ever more prevalent, revision for osteolysis.
   Approach:
   - Step 1: initiate the interface between implant and bone.
   - Step 2: “breakdown” the interface using curvilinear.
   - Step 3: using longer blades, complete the interface breakdown.
     1. Stay close to implant
     2. Areas difficult to reach are medial and inferior
     If too much resistance encountered, go back to handheld chisels/gouges and then re-attempt with extraction tool.
     Patience is a virtue!

References:

**Implant Removal: Femoral Component**

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**Background:** Femoral component removal with a well fixed cemented or press-fit component can be challenging in revision total hip replacement (THR). Extended trochanteric osteotomy (ETO) has been used to facilitate exposure and the removal of well-fixed femoral components, provide direct access to the diaphysis for distal fixation, allow for correction of proximal femoral deformity, and enhance acetabular exposure. ETO has been described using a standard posterior or modified direct lateral approach to the hip.

**Methods:** The following video will demonstrate the operative technique and tips regarding extended trochanteric osteotomy.

**Results:** Several large series reporting the results of ETO have been published. The advantages of performing revision total hip arthroplasty (THA) using ETO are mainly ease of implant removal, reduced operative time, reduced iatrogenic fracture and cortical perforation rate, and lower non-union rates compared to the standard trochanteric osteotomy. Union rates have been reported between 96% and 100%. The usual osteotomy length has been reported on average to be 13 to 15 cm. Osteotomy fixation has been shown to improve with cerclage cables as opposed to cerclage wires. Improved torsional control of the fragment has been shown to improve with 3 versus 2 cables, although the union rate did not correlate to the number of cables used in the series reported by Chen et al.
Complications were uncommon in all series. The most common complication was intraop fracture of the osteotomy fragment (1% to 5%). Also, postop fracture of the greater trochanter occurred in less than 1% of cases. Superficial femoral artery injury has also been reported as a complication of ETO.

**Conclusion:** ETO provides an improved method of femoral component removal in difficult cases in revision THA. Improved exposure provides better access to the femoral canal and acetabulum with lower non-union rates compared to standard trochanteric osteotomy.

References:

**Acetabular Insertion With Bone Grafting**

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**Insertion of a Fully Coated Femoral Stem**

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Reconstruction of the femur with proximal femoral bone loss is one of the primary challenges facing the revision hip surgeon. This challenge has stimulated the development of several new implants and techniques which have demonstrated a high rate of success. Distal femoral fixation with an extensively coated cylindrical stem has been the workhorse for revision of the femur and, as such, may be preferable to the increasingly popular modular revision systems. The purpose of this demonstration is to
discuss the indications and advantages for an extensively fully coated femoral stem, the risks of the surgical procedure and technical tips to help the surgeon avoid these complications.

References

Insertion of a Modular Tapered Stem

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*Introduction:* Monoblock cementless femoral components have been used extensively in total hip revision for decades with good to excellent results in most cases. There have remained, however, relatively frequent problems due to instability, intra-operative fracture, and leg-length inequality. 1-5 In this presentation, we will review the design and implantation technique of a modular, segmentally implanted revision stem system, which reduces irreversible decision points, thus allowing the surgeon to avoid most of the potential complications listed above. We will compare the outcomes observed with this devise and a monoblock devise, and identify potential shortcomings of the design.

*Materials and Methods:* We reviewed 30 revision total hip arthroplasties using a modular, segmentally implanted, partially HA-coated, titanium long-stem femoral implant between April 2005 and July 2008. All reconstructions involved severe bone loss or mal-alignment and were accomplished entirely without the use of augmentary bone graft. The patients' charts and radiographs were reviewed and compared to a similar cohort who had undergone reconstruction using a fully coated monoblock titanium device.

*Clinical Results:* Stable fixation was achieved in each case. Two stems have been removed; one for fracture nonunion and one for infection. Two other cases have been re-operated on for acetabular failures. There were no cases of subsidence. Mild trochanteric pain was seen in 2 cases. There have been no dislocations in this group. The modular
stem provided immediate stability and excellent short-term fixation in these reconstructions of severely diseased femurs.

**Conclusion:** The use of a modular, segmentally implanted femoral component resulted in the achievement of stable early fixation in each of these cases with severe bone loss requiring isthmic fixation. The technique allowing segmental implantation of the distal portion of the component with subsequent proximal body trialing potentially reduces the risk of intraoperative fracture, unexpected leg-length inequality, and instability.6

References:

**Case Presentation & Discussion Panel**
David K. DeBoer, MD; Kevin L. Garvin, MD; Arlen D. Hanssen, MD; David G. Lewallen, MD; Ormonde M. Mahoney, MD; Brad L. Penenberg, MD

Please note that not all article abstracts for this session were available at time of printing.