Evaluation of Persistent Pain After Hip Resurfacing

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Abstract
Evaluation and treatment of pain following hip resurfacing arthroplasty can be challenging, even for the most experienced arthroplasty surgeon. As in any total hip replacement, there are a number of investigative tools at the disposal of orthopaedic surgeons to elicit the underlying causes of pain for diagnosis and treatment. A detailed history and physical examination are the most important first steps in the differential diagnosis of the intrinsic and extrinsic etiologies of hip pain. Serial radiographs from the time of surgery also should be reviewed and compared for changes indicative of loosening, migration, and osteolysis, in combination or alone. Diagnostic injections with local anesthetic agents additionally can be performed to localize the origin of pain. Bone scintigraphy, hip joint aspiration, and laboratory tests, including erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), should be requested routinely to exclude an occult infection. The use of ultrasound (US), magnetic resonance imaging (MRI), and even hip arthroscopy has been suggested as potential diagnostic tools when metal sensitivity is suspected. Relative to cause, femoral neck fractures and the possibility of metal hypersensitivity as sources of persistent groin pain should always be considered in metal-on-metal hip resurfacing. Additionally, iliopsoas tendinopathy and anterior impingement of the femoral neck are well-recognized causes of pain and should be included in the differential diagnosis. Surface arthroplasty is becoming an acceptable alternative to standard total hip replacement in young patients. It is increasingly essential to recognize the different causes of pain following resurfacing in order to make an accurate diagnosis and initiate timely, appropriate treatment.

Total hip arthroplasty (THA) has been shown to be a cost-effective procedure, providing symptomatic relief and high satisfaction rates. Modern metal-on-metal (MOM) hip resurfacing is an increasingly popular treatment approach and represents approximately 10% of all arthroplasties performed in countries where the procedure has been available for almost a decade. Hip resurfacing allows for more femoral bone preservation and is believed by many surgeons to offer lower dislocation rates, greater range of motion, increased activity levels, and ease of revision. Nevertheless, hip resurfacing remains a technically difficult procedure, requiring precision and proper implant alignment to avoid complications and prevent early failure. Patients occasionally complain of postoperative hip pain. Determining the cause or causes of pain after resurfacing is often clinically challenging. The following evaluation of different etiologies of persistent pain after hip resurfacing suggests potential diagnostic and therapeutic modalities for the management of early and late postoperative pain.

Evaluation of the Painful hip in Resurfacing Arthroplasty

Initial Evaluation
As in all total hip replacements, a number of investigative tools are available to elicit the underlying causes of pain. In the differential diagnosis of the intrinsic and extrinsic etiologies of hip pain, the most important first steps are a detailed history and physical examination. Several questions
will help narrow the differential diagnosis, such as what was the onset and timing of the pain, was there a pain-free interval after surgery, and determining whether the nature of the postoperative pain is different from that experienced preoperatively. Importantly, a thorough physical examination can identify common causes of local and referred pain, such as an inguinal hernia, trochanteric bursitis, peripheral vascular disease, and radiicular lumbar pain.

Serial radiographs from the time of surgery should be reviewed and compared for changes indicative of loosening, migration, or osteolysis. Diagnostic injections with local anesthetic agents also can be performed to localize the origin of the pain.6 There is little evidence to support the use of bone scintigraphy with Technetium-99 methylene diphosphonate (99Tc MDP) alone over serial radiographs in the diagnosis of infection or loosening.7 Although gallium citrate (67Ga) scanning has shown improved sensitivity and specificity compared to 99Tc MDP, Indium 111-labeled (111In) leukocyte scans are the preferred method to evaluate patients with pain after resurfacings.8-10 Hip joint aspiration11,12 and laboratory tests, including erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), should be requested routinely to exclude an occult infection.13 Other special examinations, such as magnetic resonance imaging (MRI) with metal artifact reduction sequences (MARS)14 or interventional procedures using hip arthroscopy,15 should also be considered to identify fluid collections, muscle inflammation, bone marrow edema, synovial abnormalities, damaged components, or implant loosening.

Potential Etiologies of Pain
Femoral Neck Fractures
Fracture of the femoral neck is one of the most common causes of early failure following hip resurfacing and can be a source of postoperative pain. The incidence of fractures with newer generation surface arthroplasties has been reported to be approximately 4%.16

There are a number of risk factors associated with the occurrence of femoral neck fractures. It is thought that females are almost twice as likely to sustain a fracture as males, this being possibly related to the lower bone density of females.17 Obesity also has been correlated with higher likelihood of femoral neck fractures, resulting from poor exposure during surgery, intraoperative notching, and varus orientation of the femoral component.16,18 Surgical technique is also of utmost importance to minimize the risk of neck fractures from varus positioning of the component,19 notching of the superolateral neck, incomplete seating, and improper impaction of the femoral implant.17,20

Acute femoral neck fractures following resurfacing are usually obvious, leading patients to seek urgent medical attention (Fig. 1). However, some fractures are occasionally preceded by a painful phase prior to fracturing.16 Occult fractures can also be a cause of persistent postoperative pain, and physicians should be able to recognize the potential risk factors and treat patients accordingly with either protected weight bearing21 or revision to THA.

Loosening of Components
Aseptic loosening of the femoral or acetabular components in resurfacing can be potential sources of pain.22,23 In a series of 400 hybrid surface arthroplasties, there were seven revisions reported that were due to femoral component loosening.22 The investigators recognized that female gender, large femoral head cysts, and small component size were major contributing factors to femoral stem loosening. Femoral radiolucencies, however, were asymptomatic in only one patient from this series.

Concerns of component wear are minimal in modern metal-on-metal surface arthroplasty.24 Other factors, such as cementing technique, may play a more important role in femoral component loosening. Hip resurfacing studies have shown extensive variability in the desired amount and distribution of cement.25,26 Insufficient cement penetration22 or thermal necrosis due to cement penetration25 also have been shown to result in component loosening.

Acetabular component loosening has recently been recognized as a potential cause of early and late postoperative pain. In one multicenter study, it was responsible for 71% of revisions in a series of 200 patients who underwent metal-on-metal resurfacing.21 Male patients and those with a greater body mass index (BMI) were more likely to develop loosening of the acetabular component. Revision surgery of only one of the components or conversion to a standard total hip replacement is usually recommended in the circumstances of a loose implant.

Metal Hypersensitivity
Metal hypersensitivity in patients undergoing hip arthroplasty with metal-on-metal bearings is well recognized and initially was described shortly after these implants were...
introduced. However, recent reports have associated metal hypersensitivity with joint effusions, enlarged bursa, rapidly progressive osteolysis, and persistent groin pain in patients who underwent modern resurfacing. The histological appearance of tissue surrounding failed metal-on-metal implants reveals an infiltrate of various immunologic cells, numerous endothelial venules, large fibrin exudate, and necrosis. The term aseptic lymphocytic vasculitis-associated lesions (ALVAL) has been used to describe these features.

The exact prevalence of these hypersensitivity reactions is unknown, partly due to the shortage of reliable investigative tools to confirm the diagnosis. In a series of 1300 MOM resurfacings, 12 hips were found to have pseudotumors from hypersensitivity reactions. The initial presentation of patients with pseudotumors included groin pain, spontaneous dislocation, neurologic symptoms, and a palpable mass. The investigators raised the suspicion of preoperative metal sensitization, given that all the pseudotumors occurred in females. In a separate series of 1500 patients, four patients with groin pain underwent exploratory surgery, confirming the diagnosis of a metal sensitivity reaction. These patients presented with typical features and equivocal test results suggestive of possible metal sensitivity.

Surgeons should be aware of the possibility of metal sensitivity in patients with groin pain that is otherwise unexplained. In the event that a hypersensitivity reaction is confirmed on histological examination, revision arthroplasty may be an option. Failure of nonoperative treatment usually requires surgical exploration with tendon release, removal of osteophytes and extruded cement, or revision of a malpositioned acetabular component.

**Hip Impingement**

Painful impingement between the acetabular rim and a stemmed femoral implant after THA has been well described. Impingement may be a cause of persistent groin pain after hip resurfacing and can be elicited during the physical examination using a provocative impingement test that combines hip flexion, adduction, and internal rotation. There are a number of factors that can result in impingement, including anterior protrusion of the femoral neck, bony deformity of the proximal femur, and component malalignment. The head-neck diameter ratio is considerably reduced in surface arthroplasty compared to standard THA, given that the femoral neck is retained. Various types of femoral head and neck abnormalities, such as the pistol grip, have been associated with femoroacetabular impingement (FAI) and early osteoarthritis. The asphericity of the femoral head and flattening of the head-neck junction typical of the pistol grip deformity will further contribute to prosthetic impingement because of the loss of anterior femoral head-neck offset ratio. Retroversion of the acetabular component or posterior translation and anterior angulation of the femoral implant also will cause the femoral neck to abut the acetabular rim, resulting in persistent pain postoperatively during hip flexion (Fig. 2).

Complete radiographic evaluation of orthogonal views is essential to identify anatomic abnormalities preoperatively and to exclude impingement postoperatively. The femoral head-neck offset ratio can be estimated from a cross-table lateral radiograph and a value less than or equal to 0.15 has been found to be consistent with FAI. Recognition of bony deformities prior to resurfacing and adequate correction at the time of surgery are the mainstay in the prevention of impingement and postoperative pain. Restoration of the head-neck offset can be achieved by slightly translating the femoral component anteriorly with posterior alignment. Excessive translation is limited by the amount of host bone and the thickness of the cement mantle required for fixation of the femoral implant. Orienting the acetabular component in sufficient anteversion may prevent impingement within the patient’s functional range. Over-sizing the femoral component entails a larger acetabular cup and unnecessary removal of bone stock around the acetabulum. Removal of femoral neck osteophytes and neck osteoplasty have been recommended to avoid postoperative impingement, although the former should be performed cautiously since it has been associated with femoral neck fractures.
Conclusions
As the indications for hip resurfacing continue to expand and the survival rates remain encouraging, more surgeons will be performing this procedure for young and active patients with osteoarthritis. Determining the source of hip pain following surface arthroplasty is challenging, and it is imperative to avoid the technical pitfalls that can result in postoperative pain and failure. Early recognition of other common causes of groin pain will also facilitate the initiation of appropriate treatment.

Disclosure Statement
None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

References

Figure 2 Component malalignment with an acetabular cup inserted in almost neutral version. Note anterior angulation of the femoral implant and large anterior femoral neck osteophyte.


