The Adolescent and Young Adult Hip Unit at Children's Hospital Boston: Anatomy and Physiology of a Hip Joint Preservation Practice

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BACKGROUND

The Adolescent and Young Adult Hip Unit at Children's Hospital Boston (CHB) was founded on the premise that optimum patient care, teaching, and research in the areas of diagnosis and treatment of hip conditions in this age group has particular relevance to hip disease across the entire age spectrum. The Hip Unit is a closely-knit interdisciplinary group of clinicians, researchers, and non clinical staff dedicated to hip joint preservation.

In North America, most osteoarthritis (OA) in the hip is secondary to developmental deformity. Aronson reported that about 43% of hip OA was associated with dysplasia, 22% secondary to Perthes disease, and 11% secondary to slipped epiphysis, with less than 20% considered to be "primary."[1] In the early 1990's, Ganz began to suspect that many non-dysplastic hips that ultimately developed OA, despite not having obvious slipped epiphysis or Perthes, had a mechanical etiology for their progressive dysfunction. The subsequent elegant body of work from Ganz and coworkers led to the formulation of femoroacetabular impingement (FAI) as a frequent cause of OA in the hip, usually occurring in the non-dysplastic hip, but sometimes in dysplastic hips as well.[4] The subsequent characterization of relatively subtle forms of FAI seems to have confirmed, at least in North America, Dr. William Harris's adage, "Primary osteoarthritis of the hip must be extremely rare, if indeed it exists at all."[5]

Osteoarthritis of the hip remains a common cause of disability, not infrequently limiting function even in young adult patients. More than 300,000 total hip replacements are performed in the U.S. annually, mostly for symptomatic osteoarthritis. While total hip replacement (THR) is effective in relieving symptoms, its prosthetic nature renders it vulnerable to failure over time, with revision expected to be necessary, particularly in the young, active patient.

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THE HIP UNIT AT CHB

Biologic measures to prevent and treat OA are philosophically attractive. Such biologically-based joint-preserving surgical treatments are the foundation of the therapeutic programs in our hip unit. Patients requiring prosthetic arthroplasty are referred elsewhere. Consultation and referrals to the unit are encouraged for any patient with a hip problem for which a joint-preserving option exists.

In 2008, approximately 275 external referrals to the Adolescent and Young Adult Hip unit at CHB were evaluated through the submission of clinical data. The evaluation process typically involves an initial screening of data, not only to confirm the appropriateness of the referral to our joint-preserving practice, but also to maximize the efficiency of appointments, since most patients seen require some form of scheduled direct cartilage imaging, e.g., MRI, as well plain radiographs for optimal analysis of their problem.

About 200 new patients were given appointments. The majority of those not given appointments were given a second opinion without a visit as a courtesy to the consulting physician. At least 30 patients in this group were felt to be so clearly arthritic that THR was recommended without personal evaluation.

Of the new patients seen in 2008, the age range was 1 to 54 years, with mean age 25 years. In patients who appeared for evaluation, the most common single diagnosis was hip dysplasia (38%), usually first diagnosed after maturity. The second most common diagnosis was idiopathic FAI (29%), followed by slipped epiphysis and sequelae (13%), Perthes disease (8%), and osteonecrosis (4%).

THE EVALUATION PROCESS IN THE HIP UNIT

In addition to careful clinical assessment and routine radiographic imaging, an important element in analysis of complex hip problems in the young patient is the direct imaging of cartilage. We have developed and applied the dGEMRIC technique to the hip, using IV gadolinium to obtain highly useful information not only on the structure of the labrum, but even more importantly to assess noninvasively the loss of glycosaminoglycan from the articular cartilage as a marker for the amount of mechanical damage.[6] We have used dGEMRIC as an adjunct to determine whether the borderline patient with dysplasia may be a candidate for joint preserving surgery.[2] Similar studies on patients with impingement are also under way.

SURGICAL ACTIVITY

Over a 12 month period, 71 periacetabular osteotomies (PAO's) were done. Additionally, 43 surgical dislocations, many with simultaneous femoral osteotomies were accomplished. An increasing number of hip arthroscopies are now being done, with more than 100 done annually.

CLINICAL EXPERIENCE

Periacetabular Osteotomy to Treat Acetabular Dysplasia

Over the past several years, the Bernese PAO has been our most frequently performed procedure, with nearly 1000 hips operated on to date.[3] Our middle-term results of PAO performed for developmental dysplasia, with minimum follow-up five years, document a 10 year survival rate of more than 80%.[7] Patients free of radiographic OA had the highest likelihood of an excellent result, but even many patients who had cartilage space narrowing on preoperative x-rays did very well. Patients with both incongruity and cartilage space narrowing to less than 2mm had a 50% risk of THR and are thus considered questionable candidates for PAO. In every patient with arthrosis or incongruity being considered for PAO, we feel dGEMRIC analysis is useful in decision making for or against joint preservation.[2]

A recent study of our older dysplasia patients treated by PAO after age 40, and those of collaborators in the ANCHOR Group confirms that the same general predictive factors are relevant.[8] If no radiographic arthrosis is present, and congruity is good, a satisfactory outcome of pain relief for many years can be expected.

The PAO procedure is now routinely performed using a patient-friendly surgical approach, the direct anterior approach that does not damage the abductor muscles.[9] PAO usually is combined with an anterior arthrotomy to examine the rim and labrum, and to treat any cam impingement present. This arthrotomy thus reduces the risk of not treating a subtle anterior labral lesion, and of creating anterior impingement.

Patients after PAO routinely are discharged in about 6 days, partial weight-bearing on crutches. As bone healing occurs, more weight-bearing is allowed, with full weight bearing by 2 to 3 months. Driving is possible in many patients by 3 weeks after surgery.

Ganz et al. have reported satisfying 20 year results after PAO, with Kaplan-Meier survivorship at roughly 65% at 20 years.[10] We have many patients doing well more than 15 years after the surgery, which was first done in our unit in 1991 (Figures 1 & 2).

In those patients requiring THR after PAO, no particular problems exist, since the surgical approach is different, and acetabular bone stock usually has been improved greatly by the PAO.

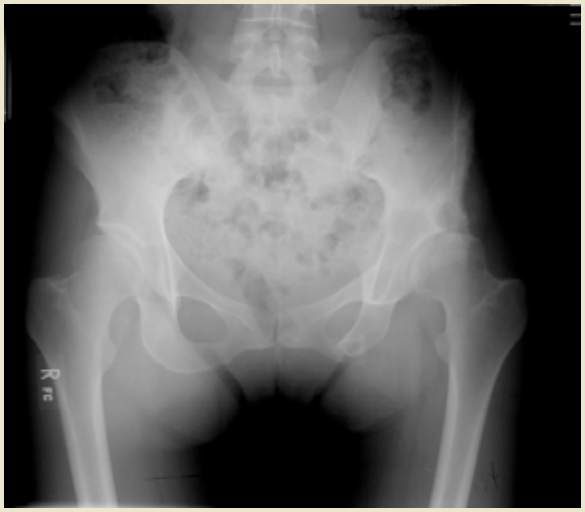

Figure 1. This patient is a 40 year-old female who had previously undergone a triple osteotomy for the left hip at age 25, which had failed to relieve her pain. At her first presentation to CHB at age 40, she had excellent range of motion in both hips, despite a large left supraacetabular cyst, left hip joint space narrowing with subluxation, bilateral dysplasia, and left acetabular retroversion. Her abduction view confirmed good congruence.

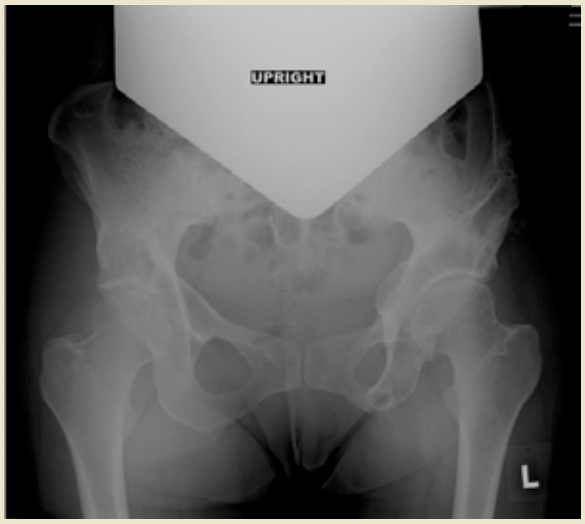

Figure 2. Excellent result 15 years after bilateral PAO's, now age 55. The patient has no symptoms and is fully active. The left periacetabular cyst has disappeared, and her motion is normal with no limp.

SUMMARY

The Hip Unit at CHB employs an integrated multidisciplinary approach to achieve improved outcomes of hip joint preserving surgery to prevent and treat OA. Earlier diagnosis and appropriate timely correction of the predisposing developmental conditions is crucial. PAO to correct acetabular dysplasia has been an early successful model. A similar experience is growing with the broad field of FAI.

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