Introduction
Interest in acetabular dysplasia in adults has increased as its surgical treatment has advanced and as the understanding of young adult hip disorders has grown. It is an important cause of hip pain, often affecting young women at a time when they must be active for employment, parenthood and sports and leisure activities. Symptoms may be experienced for many years before osteoarthritis develops, and it is important that an accurate diagnosis is made so that treatment opportunities are not missed. Acetabular dysplasia describes an underdeveloped or shallow, upwardly sloping acetabulum, which may occur with varying degrees of deformity of the proximal femur such as excessive femoral neck anteversion, coxa valga or femoral neck cam deformity. Historically, developmental dysplasia of the hip (DDH) was thought to occur in 1 in 1000 live Caucasian births, but the criteria for its definition are controversial. The number that will require treatment can be as high as 5 in 1000 live births. The condition may be the result of in utero positioning, with hip flexion and adduction stretching the posterior hip structures. This results in a spectrum of disorders from neonatal hip instability, joint subluxation and frank dislocation, through to adolescent and adult dysplasia. Risk factors for hip dysplasia include joint hypermobility, a large neonate, or small uterus, when there is an increased risk of DDH to the first-born child. A breech presentation increases the risk of DDH to more than 40%; even after normal ultrasound screening the risk is 29%. Children, particularly daughters of fathers with DDH, have 12 times the risk of developing the condition themselves. While these risk factors, or a history of childhood dysplasia, may be present in adolescent or adult patients, at least 40% of cases with DDH have no identifiable risk factors. DDH more commonly affects the left hip and more than 80% of cases occur in females. The deformity is bilateral in 40%, with varying severity on either side. It is also important to appreciate that not all acetabular dysplasia is due to DDH. A concave acetabulum cannot develop without a concentric force being exerted by a reduced femoral head. Acetabular development may be affected by a variety of conditions including cerebral palsy, hereditary motor and sensory neuropathy, poliomyelitis, hyperlaxity, and Down’s and Ehlers-Danlos syndromes. Skeletal dysplasias, proximal femoral focal deficiency and Perthes’ disease can also affect acetabular development, while the triradiate cartilage can be injured by sepsis or trauma, which can also cause incomplete lateral acetabular growth.

Pathology
In a dysplastic socket, the acetabular labrum hypertrophies in response to the increased load experienced by the front of the acetabulum in order to improve femoral head coverage and maintain joint lubrication. This labral hypertrophy can be remarkably successful at maintaining the mechanical equilibrium and preventing symptoms until adulthood. Eventually, in response to the higher level of stress, the anterosuperior labrum tears. The articular cartilage is exposed to forces above its normal tolerance and symptoms develop. In a similar process to that which causes subchondral cysts, the damaged labrum may act as a valve, leading to the development of ganglion cysts. Dysplasia should always be considered when cysts are seen on magnetic resonance imaging (MRI). A stress fracture may also develop at the periphery of the acetabulum producing an ‘os acetabulare’.

Restoration of the biomechanical environment can prolong the life of the articular cartilage, provided that it is not irreversibly damaged. It thus seems logical that surgical correction should not be delayed once symptoms have developed. It should, however, be noted that some patients only display symptoms once the hip has developed significant osteoarthritis and there may then not be the opportunity for surgical correction. Corrective surgery on asymptomatic adults is not justified, as the onset and progression of osteoarthritis in dysplastic hips is unpredictable in the absence of subluxation.

Clinical assessment
Patients describe a sharp, activity-related groin pain, which increasingly affects their lifestyle. Initially, it may only affect running and sporting activities but, as symptoms progress, travel, employment, childcare and even sedentary activities may be affected. The onset of pain may be insidious. Alternatively, it may start acutely after a period of increased activity, such as race-training or following an active holiday. Pregnancy and weight gain may also cause a dysplastic hip to deteriorate.

Symptoms may be exacerbated by rising from a seated position, climbing in or out of a car, going down stairs, or sudden rotational movements. These symptoms arise from the anterior labral tear and adjacent articular cartilage damage and, therefore, are very similar to those of femoroacetabular impingement (FAI). Instability, weakness, the feeling of a ‘dead leg’, and trochanteric symptoms because of abductor dysfunction may be additional features of the dysplastic hip. Patients may also

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describe clicking at the front of the hip, commonly originating from the psoas tendon.

Clinical examination may be surprisingly normal, although symptoms can usually be recreated by internal rotation and adduction of the flexed hip - the impingement sign. Other signs, such as an antalgic gait or a Trendelenburg sign, may only develop after activity. Shortening of the affected side may indicate subluxation, osteoarthritis or previous femoral osteotomy. Mild femoral overgrowth may also be present, and failure to identify this pre-operatively may lessen the effectiveness of acetabular correction, as the patient may stand with their longer leg adducted and continue to overload the lateral acetabulum; this is so-called long-leg dysplasia.

The range of movement of the hip is often preserved, although internal rotation in flexion may be painful. A reduced range of movement may indicate osteoarthritis. Instability may be demonstrated by apprehension on external rotation of the extended abducted hip. There may be additional signs of previous hip surgery, hypermobility, or underlying neurological disorder. In cases of gross uncovering, the femoral head may be palpable in the groin – the lump sign.

Imaging

A standing pelvic radiograph remains the most useful investigation to diagnose dysplasia. The lateral centre edge (LCE) angle is considered normal above 25°, borderline between 20° and 25° and dysplastic below 20°; the Tönnis (sourcil) angle is abnormal above 10°. Murphy, Ganz and Müller have shown the importance of these measurements by demonstrating the poor prognosis of patients with an LCE angle less than 16° and a sourcil angle greater than 15°.

The false profile view, also taken with the patient standing, provides a true lateral view of the acetabulum. It may show anterior subluxation and anterior deficiency, as measured by the anterior centre edge (ACE) angle, which has a similar normal range to the LCE angle. A functional pelvic view, taken supine with the hips in maximum abduction and with internal rotation, can demonstrate incongruence or a reduction of subluxation. Early degenerative change, cysts and acetabular and femoral version can be demonstrated on computer tomography (CT) scans. Three-dimensional CT reconstructions can be useful for analysing the deformity in cases of previous pelvic surgery and for identifying the cam on the anterior femoral neck. MRI can reveal labral cysts as well as excluding other sources of hip pain not demonstrated on radiographs, such as stress fractures or avascular necrosis.

Magnetic resonance arthrography (MRA) may have greater precision in the diagnosis of labral tears and in assessing the condition of the articular cartilage - it is seldom necessary in routine cases of dysplasia. The modality of delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) is sensitive to very early cartilage degeneration, and can be useful for identifying poor candidates for pelvic reorientation. If doubts persist about the condition of the articular cartilage, a more accurate assessment can be made with arthroscopy.

Treatment

It seems obvious that reorientation of the acetabulum to normalise joint-contact pressures would be most appropriate treatment, providing degenerative changes are not too advanced. Fortunately, dysplastic hips often become symptomatic well before arthritis has developed. Peri-acetabular osteotomy (PAO) is a very powerful means of relieving pain, improving or normalising function, and delaying or even preventing arthritis completely. When performed in specialist units, it is safe, predictable surgery which can be performed without allogeneic blood transfusion in three hours or less, and in under 90 minutes for minimally invasive techniques.

Corrective surgery should be offered when it is apparent to both the patient and the surgeon that symptoms are progressive and are not going to improve with conservative treatment. This requires careful judgement, and patients should be referred early. Even if an osteotomy is not required initially, it gives the patient an opportunity to become familiar with the procedure and the specialist institution, as well as to meet patients who have had the procedure. While the initial presentation may be acute and largely self-resolving, the situation seldom returns to normal, and often deteriorates. It is also important to appreciate that the aim of an osteotomy is prevention rather than cure, and therefore the level of symptoms required to justify an osteotomy is less than that required for arthroplasty.

In cases of mild dysplasia, hip arthroscopy is occasionally used to treat labral pathology. However the results are unpredictable and may lead to a worsening of symptoms, as the stabilising effect of the labrum may be lost. Arthroscopy may be used to assess the joint before an osteotomy. Femoral osteotomy is seldom used in isolation where PAO is available as it is less effective, does not address the main deformity, and complicates subsequent total hip replacement (THR). It can, however, be an additional procedure in the presence of incongruence or severe femoral deformity. THR remains the most appropriate treatment for the painful, arthritic, dysplastic hip, and the results are uncompromised by a previous PAO.

References


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