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Hip dysplasia in the young adult

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Current Concepts Review

Hip Dysplasia in the Young Adult

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- Hip dysplasia is a leading precursor of osteoarthritis and is seen in 20% to 40% of patients with osteoarthritis of the hip.
- An increase in mechanical stress on the cartilage matrix with failure of the acetabular labrum represents the major pathomechanism of degeneration.
- Because the prevalence of associated femoral deformities is high (>50%), the structural anatomy of the dysplastic hip must be assessed in multiple planes using radiographs and, if needed, advanced imaging modalities.
- Acetabular osteotomy (periacetabular and/or rotational) is the most commonly used procedure for the treatment of the majority of dysplastic hips in adults.
- Modern total hip replacement remains an excellent option for the more arthritic joints. Difficulties can arise from anatomical abnormalities and previous operations.

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Descriptive Epidemiology

Refinements in understanding the etiology of secondary osteoarthritis have highlighted developmental dysplasia of the hip (DDH) and femoroacetabular impingement as leading precursors[1,2]. According to some estimates, DDH is involved in 20% to 40% of patients with osteoarthritis of the hip[3-5]. Despite the widespread screening for hip dysplasia at birth and during infancy, a substantial number of cases are not diagnosed until adulthood, with an estimated prevalence of 0.1% of the U.S. adult population[6,7]. Female sex, primiparity, breech position, and family history are known risk factors for hip dysplasia[8-10]. The lack of early intervention resulting from delayed diagnosis can lead to early onset of hip osteoarthritis and subsequent total hip replacement, although mild acetabular dysplasia has a variable and mostly benign natural history[11-14].

According to a study of 3620 subjects conducted by Gosvig et al.[15], the prevalence of dysplasia was 4.3% (fifty-eight of 1332) in men and 3.6% (eighty-two of 2288) in women. Jacobsen and Sonne-Holm[16], in a cross-sectional survey of 2232 women and 1336 men, found a prevalence that ranged from 5.4% to 12.8%, depending on the radiographic index applied. In both of these studies, the patients were asymptomatic.

It is generally acknowledged that if DDH is recognized early, surgical correction of the abnormal anatomy diminishes the risk of osteoarthritis[12,13].

Pathomechanism and Natural History

In patients with hip dysplasia, the typically shallow acetabulum leads to an increase in mechanical stress on the cartilage matrix, which can be beyond the physiologic level of tolerance[14]. Dysplastic acetabuli are not only deficient in a single plane or dimension but also are globally deficient both in shape and orientation, with the width remaining comparable with that of the nondysplastic acetabulum but with increased length and

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decreased depth. This leads not only to the classic anterior insufficiency but also, potentially, to lateral, posterior, or global deficiency[17]. Even with mild hip dysplasia, the poor coverage of the femoral head, the relative lateralization of the hip center of rotation, and the smaller contact area between the femoral head and the dysplastic acetabulum can produce an asymmetric concentration of force across the hip joint and secondary articular cartilage and labral damage[18-20]. The acetabular anomaly is usually accompanied by abnormalities of the proximal part of the femur, in which the femoral head is usually small and often aspherical with increased anteversion and neck-shaft angle (valgus)[21]. In a recent study, Henak et al.[22] demonstrated that, in patients with a dysplastic hip, the acetabular labrum plays a greater role as a load-bearing structure and the labrum supported substantially more load than in normal hips.

The natural history of DDH has been well evaluated in the literature[11-14,23-25] and has been noted to lead to the development of radiographic osteoarthritis in 25% to 50% of patients by a mean age of 50.3 years. More specifically, Wiberg[14], in his study about congenital subluxation of the hip, noted that all of his patients with definite subluxation showed evidence of osteoarthritis by the age of fifty to sixty years. Murphy et al.[11] followed the contralateral hip in 286 patients who had had a total hip arthroplasty for osteoarthritis secondary to dysplasia and observed that no patient in whom the hip survived into the seventh decade of life had a lateral center-edge angle of <16°, an acetabular index of >15°, or uncovering of the femoral head of >31%. Cooperman et al.[26] followed thirty-two hips with a Wiberg angle of ≤20° for twenty-two years, and almost all patients had osteoarthritis at the time of the final follow-up when they were a mean of sixty-five years old. Moreover, early osteoarthritis appears to be more highly associated with anterior acetabular coverage deficiency than it is with lateral acetabular deficiency[27]. Most recently, acetabular retroversion has also been observed in patients with DDH[28]. Mast et al.[29] studied the radiographs of 153 patients with DDH who were seen because of hip pain, to determine the usual version of the socket. Retroversion of the hip socket was noted in one in three hips. The same finding was highlighted by Li and Ganz[30], with a lower prevalence of one in six hips (Fig. 1). It is important to mention that classic acetabular dysplasia and acetabular retroversion represent two distinct acetabular pathomorphologies. Retroversion in DDH is now mostly considered to represent posterior insufficiency and differs from a nondysplastic retroverted acetabulum that may be associated with impingement[31,32].

Clohisy et al. showed that proximal femoral deformities were present in 92.6% of the 108 hips treated for symptomatic acetabular dysplasia, with 48% of the hips having coxa valga (44%) or coxa vara (4%)[21]. They also found that femoral head asphericity was present in 72% of the hips and reduced head-neck offset in 75%. They concluded that identifying and treating these proximal femoral abnormalities may optimize joint congruency and therefore minimize secondary impingement after reorientation of the acetabulum.

In dysplastic sockets, the acetabular labrum is often hypertrophic, probably in response to the increased load experienced by

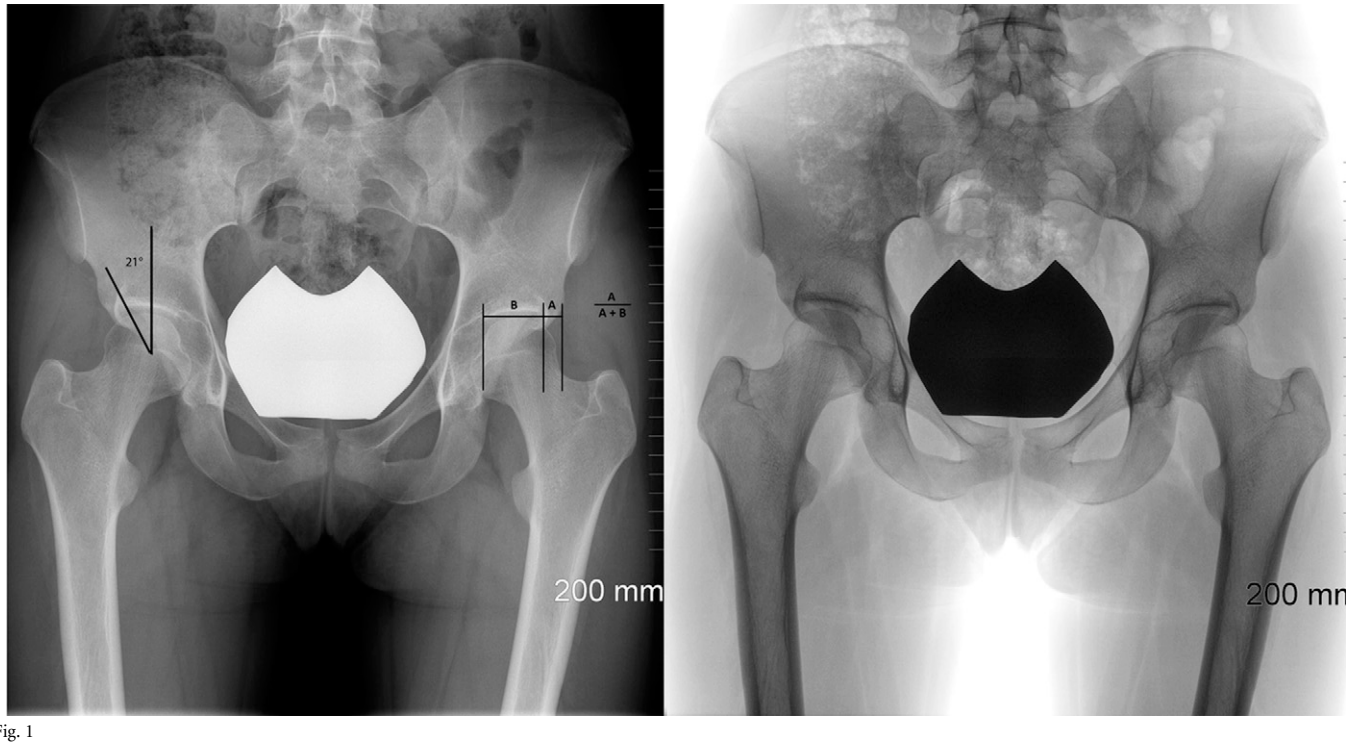

Fig. 1

Anteroposterior pelvic radiograph (left image) of a twenty-three-year-old woman with three years of persistent pain in the right hip. The lateral center-edge angle was 21°. Measurement of the femoral head extrusion index is shown on the left hip. The inverted (right) image shows the crossover sign.

TABLE I Summary of the Radiographic Measurements in the Assessment of Dysplasia*

	Anteroposterior Radiograph	False-Profile Radiograph	Lateral Radiograph
Normal	LCEA of 25°-35°, Tönnis angle of 0°-10°, femoral neck-shaft angle of 120°-135°, and extrusion index of <10%	ACEA of 25°-35°	Spherical femoral head (α angle of <50°)[126]
DDH	LCEA of <20°, Tönnis angle of >10°, valgus femoral neck-shaft angle of >135°, varus femoral neck-shaft angle of <120°, extrusion index of >25%, fovea alta, and broken Shenton line	ACEA of <20°	NA

*LCEA = lateral center-edge angle (Wiberg), ACEA = anterior center-edge angle (Lequesne), and NA = not applicable.

the front of the acetabulum to improve femoral head coverage and maintain joint lubrication[33]. This hypertrophic labrum can be remarkably effective at maintaining the mechanical equilibrium and preventing symptoms until adulthood[34]. The damaged labrum may also act as a valve leading to the development of ganglion cysts, in a similar process to that which causes subchondral cysts. A stress rim fracture may also develop at the periphery of the acetabulum, producing a so-called os acetabuli[34]. True os acetabuli (calcification of a detached labrum) is morphologically similar, but the orientation of the cartilaginous growth plate is more parallel to the joint surface caused by the failure of the ring apophysis to fuse because of the increased stress on the rim[35].

Clinical and Radiographic Evaluation

Clinical Evaluation

The clinical presentation of acetabular dysplasia can vary, but the most common symptom is groin pain[34]. Nunley et al.[36] documented the onset of symptoms as insidious in 97% of patients, and 77% of the patients walked with a demonstrable limp, in which the pelvis dropped toward the unaffected side when weight-bearing on the affected limb (the Trendelenburg gait pattern). In other patients, the trunk lurched toward the affected side (abductor lurch) when the affected limb was in the stance phase of gait. On examination, range-of-motion testing is generally normal, although the involved hip may be stiff in abduction and extension because of tight adductor and hip flexor muscles or if there is severe subluxation of the hip.

Nakahara et al.[37], in a comparison of the range of motion and computed tomography (CT) scans of fifty-two dysplastic hips and seventy-two normal hips, found that with maximum flexion and external rotation, extra-articular impingement was more frequently seen in the group with dysplasia. The authors postulated that the shallower acetabulum and greater femoral neck anteversion contributed to the increased maximum range of motion in DDH, predisposing to extra-articular posterior impingement.

Imaging

The structural anatomy of the dysplastic hip must be assessed in multiple planes using radiographs and, if needed, advanced imaging modalities because of the high prevalence (>50%) of associated femoral deformities. The diagnosis of hip dysplasia can be made on a well-centered anteroposterior radiograph of the pelvis by measuring the lateral center-edge angle (LCEA) of Wiberg[14] (Fig. 1). Currently, there is little disagreement that an LCEA of ≥25° is considered normal, values of <20° are consistent with dysplasia, and those between 20° and 25° are judged by some authors as being transitional[14]. Femoral head coverage can also be measured with the acetabular index of depth to width, i.e., the extrusion index, described by Heyman and Herndon[38]. A vertical center-anterior margin angle, also known as anterior center-edge angle of Lequesne and de Seze[39], quantifies anterior coverage of the femoral head by the acetabulum. The anterior center-edge angle (ACEA) is measured on a lateral or so-called false-profile radiograph (Fig. 2). An ACEA of >25° is considered a normal anterior acetabular coverage. An ACEA measuring <20° is considered diagnostic of dysplasia[40-42]. The normal femoral neck-shaft angle in adults

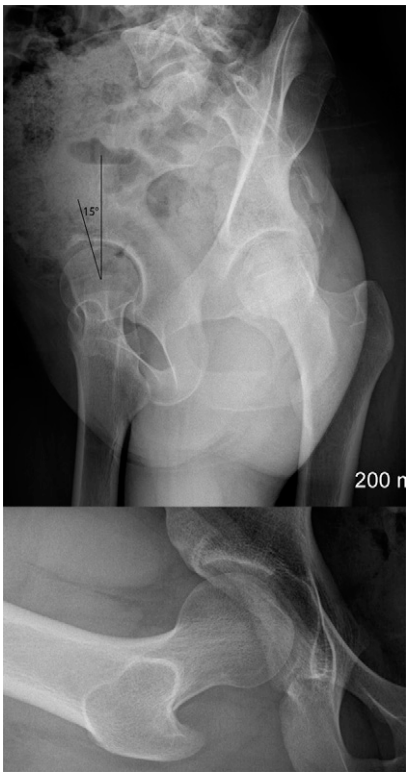

Fig. 2

False-profile radiograph showing a vertical center-edge angle of 15°. The lower inset is a Dunn lateral radiograph of the right hip showing a good femoral head-neck offset.

TABLE II Summary of Mid-Term to Long-Term Outcome of Intertrochanteric Surgery

Study	No. of Hips	Procedure*	Results*	Mean Follow-up (Range) *(yr)*	Level of Evidence
Ito et al.[60] (2005)	55	Varus ITO	Satisfactory for 42%	17 (6-28)	Therapeutic Level II
Zweifel et al.[127] (2011)	52	Varus ITO	Total hip arthroplasty delayed >10 yr in 42% of patients	17.8 (15-31)	Therapeutic Level II
Zaoussis et al.[128] (1984)	70	Rotational ITO	Satisfactory for 75%	8 (6-15)	Therapeutic Level III
Tönnis[44] (1990)	136	Rotational and varus ITO	Satisfactory for 90% after rotational ITO and for 16% after rotational and varus ITO	NA†	Therapeutic Level IV

*ITO = intertrochanteric osteotomy. †As it was a multicenter study, the data were not available (NA).

has been reported to range from 120° to 135°[43]. The weight-bearing acetabular index (the Tönnis angle), or horizontal "toit externe" angle, quantifies the slope of the weight-bearing surface of the acetabulum or sourcil[44]. This angle is formed between a horizontal and a tangential line extending from the medial to lateral edges of the sourcil; values of >10° are consistent with DDH (Table I).

Nötzli et al.[45] described the abnormal superior position of the fovea capitis femoris on magnetic resonance imaging (MRI), also referred to as *fovea alta,* in the adult dysplastic hip. The angle (called delta) formed between a line drawn from the center of the femoral head to the medial edge of the sourcil and to the superior edge of the fovea capitis femoris should be ≤10°. In surgical planning, joint congruity and subluxation are two additional important radiographic factors. The Shenton line (an arc drawn from the medial aspect of the femoral neck through the superior margin of the obturator foramen) is a reliable and accurate radiographic marker to detect superior femoral head subluxation[46]. For joint congruity, Yasunaga et al.[47] developed a classification system with four grades: excellent, indicating the subchondral plates of the acetabulum and the femoral head are parallel and the joint space is uniformly maintained; good, the subchondral plates of the acetabulum and the femoral head are not parallel, but the joint space is maintained; fair, partial narrowing of the joint space; and poor, partial loss of the joint space.

More recently, the three-dimensional reconstruction capabilities of CT scans have enabled a more precise evaluation of the severity of acetabular dysplasia[48-52], and they can contribute to preoperative planning[50]. The addition of arthrography to CT was demonstrated to be a sensitive and reproducible method for assessing substantial articular cartilage loss in patients with DDH[53], although CT-based assessment of hip dysplasia has the disadvantages of radiation exposure of the patient and relative insensitivity to early changes of cartilage damage. Reported MRI findings of labral disease in hip dysplasia include morphologic alterations, such as labral hypertrophy and tear, labral intrasubstance signal change, and labral chondral junction disruption[54]. The position of the fovea capitis femoris can be easily determined using the delta angle measurement on MRI[55]. Advanced biochemical MRI techniques, such as delayed gadolinium-enhanced MRI of cartilage (dGEMRIC), T2 mapping, and T1 rho, can reveal biochemical changes of the articular cartilage (loss of proteoglycan content and collagen damage) in the hip and therefore have the potential to detect early chondral injury in dysplastic hips before radiographically noticeable osteoarthritis[56]. Of these imaging techniques, dGEMRIC has been the most extensively studied in regard to hip dysplasia and has been shown to be highly sensitive to arthritic changes as well as to symptoms[57]. Also, a correlation has been found between the dGEMRIC value and the severity of dysplasia as measured with the LCEA[57] and a predictor of failure after periacetabular osteotomy[58].

Surgical Management and Indications

Femoral Osteotomy

The rationale for the use of realigning varus and/or valgus osteotomies is to reduce stress throughout the cartilage surfaces in a hip that is compromised mechanically[59]. Ito et al.[60] stated that intertrochanteric osteotomy is worthwhile in hips with Tönnis grade-0, 1, or 2 osteoarthritis with a spherical femoral head and mild dysplasia (Table II). Despite the excellent results of this procedure, a recent survey by Haverkamp et al.[61] showed that, even among experts, the use of intertrochanteric osteotomy in isolation for the treatment of hip dysplasia is declining. The decision for an added proximal femoral osteotomy after periacetabular osteotomy is often done in surgery in order to optimize joint congruency and/or range of motion. It is important to consider that decreased femoral anteversion has a greater effect on hip motion than decreased acetabular anteversion and is occasionally found in patients with hip dysplasia[62]. This led to the so-called periacetabular osteotomy-first principle that dictated the sequence of early combined procedures, especially those without femoral obstacles to acetabular correction (extra-articular impingement)[63]. Trousdale et al.[64], who reported a combined surgery rate of nearly 30% among hips with an osteoarthritis grade of >1, noted that survivorship decreased with increasingly degenerative changes. However, they did not specifically assess the subgroup with additional intertrochanteric osteotomy. Clohisy et al.[63] demonstrated that combined procedures for complex deformities with lower clinical scores provide outcomes similar

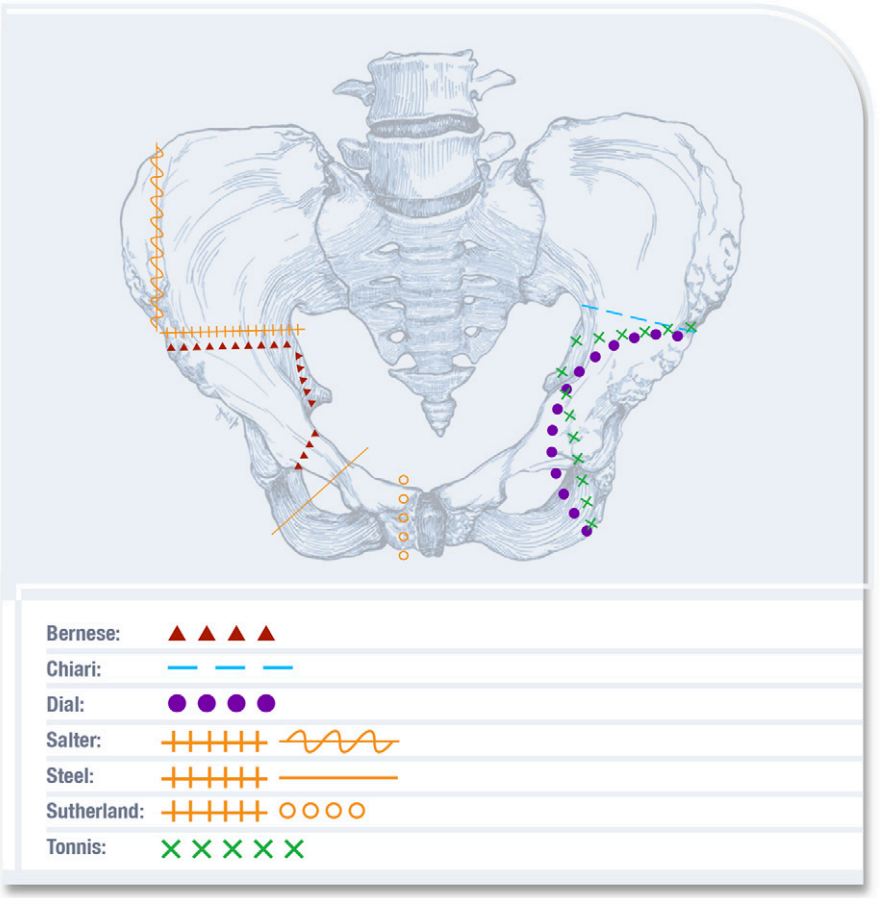

Fig. 3
Illustration of the various pelvic osteotomies used to treat hip dysplasia.

to those after isolated periacetabular osteotomy for simpler deformities.

Pelvic Osteotomy

There is a long history of reconstructive pelvic osteotomies in the treatment of acetabular dysplasia, which includes the Salter innominate osteotomy[65], double innominate (e.g., Sutherland[66]), triple innominate (e.g., Steel[67] or Tönnis[44]), spherical (e.g., Wagner[68]), pericapsular (e.g., Pemberton[69]), rotational acetabular osteotomies[70], and Bernese periacetabular osteotomy[71]. Shelf procedures and the Chiari osteotomy[72] are salvage operations that improve coverage of the femoral head by forming a new surface devoid of articular cartilage to support the femoral head and create a capsular arthroplasty, using iliac crest bone grafts or an osteotomized fragment of ilium, respectively (Figs. 3 and 4).

The Salter osteotomy, which was first described in 1961[65], is not recommended in skeletally mature individuals as it consists of a shift of the acetabular roof anteriorly and laterally, leading to acetabular retroversion. In older teenagers, the triple osteotomy (for example, the one described by Steel[67] in 1973) provides an effective correction of acetabular dysplasia; however, because the posterior column is osteotomized, the mobilization of the patient is restricted in the first four to six weeks. In a large, single-center series, eighteen (55%) of thirty-three patients without a total hip replacement showed signs of osteoarthritis at twenty-five years of follow-up[73]. In 1990, Tönnis[44] described a modification of the triple pelvic osteotomy, in which the ischial osteotomy was made closer to the acetabulum. This permitted greater acetabular coverage of the femoral head and, in particular, the translational movement in three planes. Long-term results showed measurements between 82% and 93% of normal and slightly pathologic values. Complete relief of pain was seen in 60.6% of patients.

The rotational acetabular osteotomy has a long-standing history in Asia and was originally described by Ninomiya and Tagawa[74] as a spherical osteotomy providing a large surface area for healing and leaving the pelvic ring intact. Takatori et al.[75] reported the long-term results at a minimum of ten years after rotational acetabular osteotomy in thirteen severely dysplastic hips with subluxation in eleven women who were twenty to thirty-five-years old; all patients had minimal or no pain, and twelve of the thirteen hips showed no osteoarthritis.

Ganz et al.[71,76] developed a periacetabular osteotomy with orthogonal cuts, leaving the posterior column intact and not altering the shape of the true pelvis, which was first performed in 1982. Because this osteotomy is triplanar, it requires careful

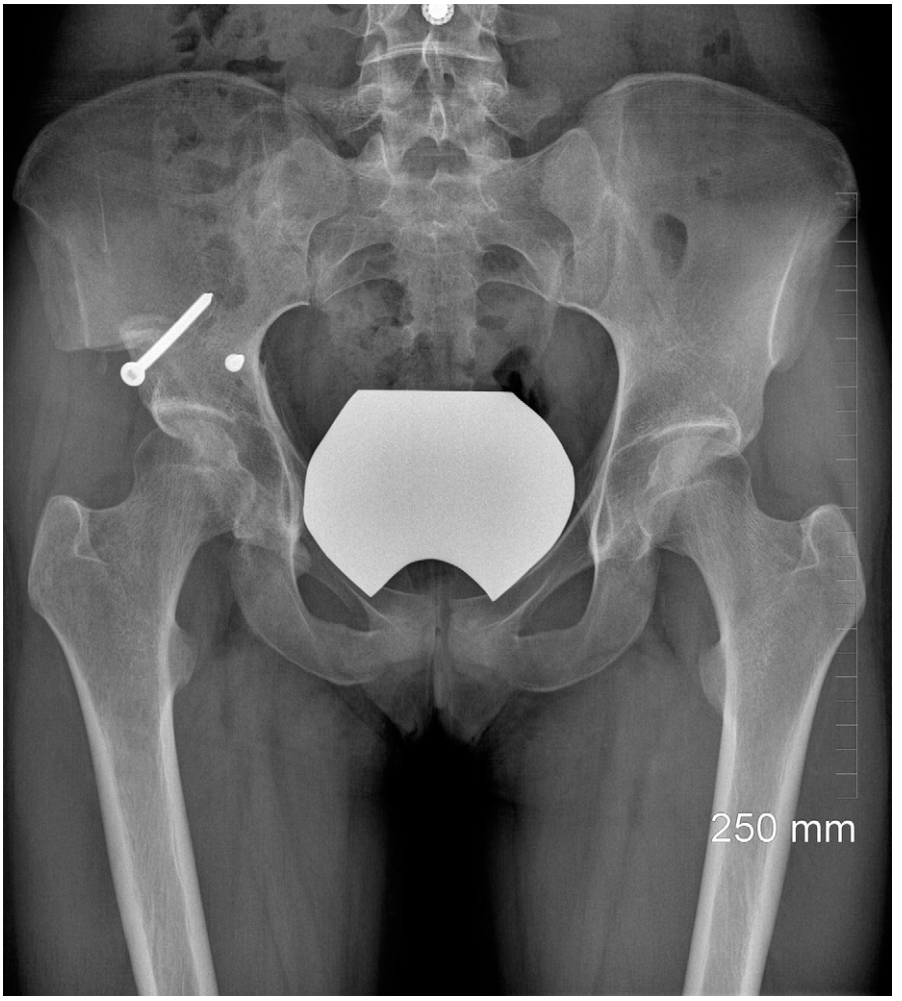

Fig. 4

Anteroposterior pelvic radiograph after a periacetabular osteotomy was done on the right hip with correction of acetabular retroversion.

three-dimensional planning and is technically more difficult; however, it also allows large corrections. Because of its capacity for large corrections, acetabular version needs to be carefully managed to avoid retroversion, which is already present in one in six patients with dysplasia[30,77].

At ten and twenty years of follow-up, this procedure showed good to excellent results in 73% and 60%, respectively, of the hips[78,79]. However, if hips with preoperative osteoarthritis were excluded, the results improved to 88% and 75%, respectively[78]. Factors associated with poor outcome included an older age, the severity of osteoarthritis, and evidence of labral pathology and poor acetabular index postoperatively.

These findings of poor joint congruity and the degree of arthritis as predictors of the short to mid-term outcome after periacetabular osteotomy have been reproduced by other groups[64,80-83].

More recent reports on the results of periacetabular osteotomy from independent centers have focused on determining what clinical factors affect not only joint survivorship but also patient function[64,79,84-91] (Table III). Independent, poor prognostic factors included an age of more than thirty-five years at the time of the periacetabular osteotomy and poor preoperative joint congruity. Garbuz et al.[92] investigated the quality of life in patients more than forty years old who underwent periacetabular osteotomy (twenty-eight subjects) or total hip arthroplasty (thirty-three subjects). Although the results of total hip arthroplasty were superior, the overall success of the periacetabular osteotomy suggests that this procedure still has a role in patients older than forty years. Similarly, Millis et al.[93], in a study of the results of periacetabular osteotomy in seventy patients (eighty-seven hips) with an average age of 43.6 years at the time of surgery, found that 24% (twenty-one hips) had undergone total hip arthroplasty within 5.2 years. The risk of total hip arthroplasty at five years after periacetabular osteotomy was 12% in hips with a preoperative Tönnis grade of 0 or 1 and 27% in hips with a Tönnis grade of 2. In a more recent study of the predictors of clinical outcome after periacetabular osteotomy, Beaulé et al.[94] found that a higher preoperative alpha angle was significantly associated with a lower functional score postoperatively, potentially indicating more severe articular damage persisting after surgical correction.

TABLE III Summary of Mid-Term to Long-Term Outcome After Periacetabular Osteotomy*

	Demographic Data			Mean Follow-up (yr)	Survivorship	Predictors of Failure†	Level of Evidence
	No.	Mean Age (yr)	Sex (F/M)				
Garras et al.[89] (2007)	52 patients (58 hips)	37.6	42/10	5.5	No survivorship data provided; 7.7% conversion rate to total hip replacement at 3 yr	None identified	Therapeutic Level II
Matheney et al.[79] (2009)	109 patients (135 hips)	25.7	95/14	9.0	96% at 5 yr and 84% at 10 yr	Age of >35 yr at time of surgery and poor or fair preop. congruency; probability of failure was 14% if no predictor present, 36% if one present, and 95% if both present	Prognostic Level II
Troelsen et al.[90] (2009)	96 patients (116 hips)	29.9	90/26	6.8	90.5% at 5 yr and 81.6% at 9.2 yr	CE angle of <0°, postop. sourcil width of <2.5 cm, presence of os acetabuli, and postop. distance to ilioischial line of ≥2.0 cm	Prognostic Level II
Steppacher et al.[78] (2008)	58 hips	29.4	45/13	20.4	93.2% at 5 yr, 87.6% at 10 yr, and 60.0% at 20 yr	Age of ≥30 yr preop., Merle d'Aubigné score of <14, Tönnis grade of ≥2, and postop. extrusion index of ≥20%	Prognostic Level III
Albers et al.[91] (2013)	147 patients (165 hips) in 2 groups, with 43 hips in Group I (optimal orientation) and 122 hips in Group II (impingement: retroversion and/or aspherical head)	29 in Group I and 28 in Group II	69%/31% of hips in Group I and 78%/22% in Group II	11.1	95.2% and 90.5% at 5 yr and 10 yr, respectively, for Group I, and 86.8% and 78.6% at 5 yr and 10 yr for Group II	Age of >30 yr preop., Merle d'Aubigné-Postel score of <15 points, preop. positive Trendelenburg sign, nonspherical head, preop. OA grade of ≥1, Severin grade of >3, excessive acetabular anteversion, acetabular retroversion, LCE angle of >22° (undercoverage), and no offset correction in a nonspherical femoral head	Therapeutic Level III

*Reproduced, with modification, from: Beaulé PE, Dowding C, Parker G, Ryu JJ. What factors predict improvements in outcomes scores and reoperations after the Bernese periacetabular osteotomy? Clin Orthop Relat Res. 2015 Feb;473(2):615-22. Reproduced with permission from Springer Science+Business Media. †CE = center-edge, OA = osteoarthritis, and LCE = lateral center-edge.

TABLE IV Hartofilakidis Classification*

Dysplasia (Type A)	Femoral head within acetabulum despite some subluxation, segmental deficiency of the superior wall, and inadequate depth of true acetabulum.
Low dislocation (Type B)	Femoral head creates a false acetabulum superior to the true acetabulum; there is complete absence of the superior wall and inadequate depth of the true acetabulum.
High dislocation (Type C)	Femoral head is completely uncovered by the true acetabulum and has migrated superoposteriorly; there is a complete deficiency of the acetabulum and excessive anteversion of the true acetabulum.

*Data are from Hartofilakidis et al.[111].

The shelf procedure was first described by König[95] in 1891 and is based on the construction of a shelf of bone over a reduced femoral head. Usually it is performed in children and adolescents. Fawzy et al.[96], in a study of seventy-six consecutive hips followed for a mean of eleven years after a shelf procedure, reported a survivorship of 86% and 46% at five and ten years, respectively. The Chiari pelvic osteotomy is considered a salvage procedure for dysplastic hips and works as a capsular interposition arthroplasty that should be considered when other preserving procedures cannot be performed[72]. The main difference, compared with the shelf procedure, is that the Chiari osteotomy allows the surgeon to achieve hip abduction. In a review of sixty-two Chiari osteotomies in adults, with a mean follow-up of 17.1 years, the survival rate (and standard deviation) was 84.4% ± 4.8% at ten years and 68.6% ± 7.1% at twenty years, with advanced radiographic osteoarthritis as the end point[97]. Compared with the shelf osteotomy, which had a survival rate of 37% at twenty years with joint replacement as the end point, the Chiari osteotomy appears to have a better survival rate of 68% at eighteen years in adults with DDH[98].

We cannot overemphasize that pelvic osteotomies such as the periacetabular osteotomy are demanding procedures with a substantial learning curve and risk of major complications[99-101].

Hip Arthroscopy

Poor short-term outcomes, including persistent pain and iatrogenic instability after labral debridement or capsulotomy, have been demonstrated in several studies in which patients with underlying DDH were treated with hip arthroscopy alone (rather than as an adjunct to open surgery)[102-104]. Byrd and Jones[105] reported on forty-eight dysplastic or borderline dysplastic hips (an LCEA of 20° to 25°) in patients with a mean age of thirty-four years (range, fourteen to sixty-four years) at the time of arthroscopy. Although they had an improvement in functional scores at one year, the scores had decreased at the two-year mark. Additionally, acetabular chondral and labral lesions, mainly located in the anterosuperior region, are common arthroscopic findings in up to 77.8% of hips with dysplasia[106,107]. Consequently, the role of hip arthroscopy as an adjunct to a pelvic osteotomy[108,109] continues to evolve until it will allow concomitant treatment of chondral and/or labral lesions, potentially improving the postoperative clinical function.

Recently, Domb et al.[110] described an arthroscopic approach for patients with mild dysplasia that includes labral repair augmented by capsular plication with inferior shift. They reported favorable results at the two-year follow-up for twenty-six patients with borderline dysplasia who were less than forty years old.

Total Hip Arthroplasty

A useful classification system for surgical planning is the one described by Hartofilakidis et al.[111,112], which encompasses three types of deformity in the adult hip, i.e., dysplasia, low dislocation, and high dislocation (Table IV). Difficulties can arise

TABLE V Grades of Recommendations for the Diagnosis and Treatment of Hip Dysplasia*

Recommendation	Grade
Diagnosis	
Hip dysplasia is a common cause of hip pain in young adults.	A
Intra-articular damage is common, with labral pathology frequently evident.	A
Hip dysplasia can present with a spectrum of osseous abnormality, including acetabular retroversion and proximal femoral deformities such as femoral head asphericity.	A
Treatment	
Osteotomies of the acetabulum are the most commonly used corrective procedures, with hip arthroscopy having an increasing role as an adjunct.	B
In patients more than thirty-five years old, total hip arthroplasty is an excellent treatment with a short recovery time.	B

*Grade A indicates consistent, good (Level-I) evidence for or against the recommendation, and Grade B indicates consistent, fair (Level-II or III) evidence for or against the recommendation, according to Wright et al.[129].

from anatomical abnormalities and previous operations. In a recent systematic review of the results of total hip replacement for hip dysplasia, Duncan et al.[113] found that a comparison of the groups that had or had not had a previous osteotomy failed to demonstrate any significant differences with respect to complications during the perioperative period. The consequence of previous operations on the outcome of a total hip arthroplasty is unclear[113]. Boos et al.[114], in a comparison of the results of seventy-four total hip arthroplasties performed after a previous osteotomy matched by diagnosis to a control group of seventy-four patients who had primary procedures, found no significant difference in the rate of perioperative complications or the rate of revisions. In a recent study, Migaud et al.[115] compared the results of total hip arthroplasty in 159 hips that had had conservative surgery for DDH (sixty-four had had pelvic osteotomy; eighty-one, femoral osteotomy; and fourteen, combined pelvic and femoral osteotomies) and in 271 hips that had not had prior operations. The results were comparable between the groups. Preoperative assessment is always important if the patient had a pelvic osteotomy performed because the position of the best available bone stock is altered. One of the most frequent complications of total hip replacement in patients with hip dysplasia is instability (0.9% to 11% in series ranging from twenty-three to 220 total hip arthroplasties)[116-120], and the overall rate of complications has been reported to range from approximately 15% to 40%[121-125].

Overview

The treatment of hip dysplasia in young adults remains a challenge. With the advent of advanced imaging techniques as well as surgical techniques such as the periacetabular osteotomy, the capacity to preserve the hip and its function for a substantial period is now well established (Table V). Continued refinements in diagnostic tools will better define the role of hip arthroscopy, which at this time remains ill-defined with a potential role as an adjunct to the periacetabular osteotomy. Finally, current techniques of total hip replacement remain an excellent option for hips with advanced changes and may be the preferable option in older patients with hip dysplasia. ■

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