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Hip Dysplasia in Adults: Surgical Correction vs. Conservative Treatment Options

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ABSTRACT

Introduction: Developmental Dysplasia of the Hip (DDH) is an anatomical deformation resulting from abnormal formation of the structures that make up the hip joint. Due to abnormal biomechanics patients with hip dysplasia usually develop radiographic osteoarthritis.

Aim of the study: Despite the introduction of screening tests in children, DDH remains an issue among adults. For this group of patients, it is essential to begin treatment as early as possible to prevent early-onset osteoarthritis of the hip joint. Unfortunately, unlike in children, in adults it is often too late to implement non-invasive methods such as braces or orthoses. Therefore, in this study, we aim to describe other treatment options for adults with DDH, considering both surgical and non-surgical methods. In the following work, we present both the advantages and complications associated with these surgical methods. Additionally, we describe the non-surgical alternative method of progressive resistance training (PRT) and consider the possibilities of combining it with surgical techniques. We also discuss the potential for pharmacological treatments to reduce pain levels in patients.

Material and Methods: Review of studies available through open-access sources on PubMed, Google Scholar, and the National Library of Medicine.

Conclusions: The decision to quickly implement an appropriate treatment plan is crucial for improving the patient's quality of life. The choice of treatment method should consider the patient's age, the severity of the disease, and their individual preferences. Adults with DDH are most often qualified for surgical procedures, which include periacetabular osteotomy (PAO), arthroplasty, and total hip replacement (THR). However, for some patients, surgical procedures may be contraindicated or impossible, and in such cases, other non-invasive methods, such as resistance training or appropriate pharmacotherapy, should be considered.

Keywords: *hip joint, osteoarthritis, surgery, conservative therapy, hip, Surgical Correction*

INTRODUCTION

Pathophysiology

Hip dysplasia is an anatomical deformation resulting from the abnormal development of the bones and structures forming the hip joint. Patients with this condition most often have a too shallow acetabulum and reduced contact between the acetabulum and the femoral head. This leads to mechanical overload on the cartilage matrix. (1) Due to abnormal biomechanics and the shear forces acting on the joint cartilage, about 25–50% of patients with hip dysplasia develop radiographic osteoarthritis by the age of 50.(2)

Epidemiology

Hip dysplasia (DDH) is the most common perinatal anatomical abnormality of the hip joint (3). The incidence of the disease in children without risk factors is estimated at 11.5/1000 live births, with a higher risk in girls (4). The disease manifests itself in the early stages of life and, if detected early enough, can be effectively treated. Neglecting the treatment of the disease in childhood can lead to residual childhood developmental dysplasia, which, together with juvenile acetabular dysplasia, is the main cause of hip dysplasia in adults. (5)

Despite appropriate screening tests, many cases still remain undetected. This poses a threat to the health and full fitness of patients, because treatment should be introduced before the 12th week of life, when the child's hips are still susceptible to changes. Additionally, some patients may develop residual hip dysplasia even after successful treatment in childhood (19% of patients treated with the Pavlikau harness and 22–33% of patients treated with closed or open reduction. (6)

Effects of the disease

Hip dysplasia (DDH) in adults can lead to degenerative joint disease (OA), which may cause joint discomfort, limited mobility, and pain. Patients may experience femoroacetabular impingement (FAI) or symptoms related to this condition. They often report pain resulting from improper contact between the head of the femur and the acetabulum, leading to friction within the joint. The forces generated by this friction can further damage the cartilage and worsen the pain.

Due to the progressive nature of the disease, it is important to perform the necessary tests as soon as possible, assess the stage of the disease, and implement a treatment plan tailored to the patient's specific needs.

Scales used to describe Hip dysplasia

1. **LCEA scale**

   The LCEA (lateral center-edge angle) scale describes the degree of coverage of the femoral head by the acetabulum on an X-ray. A normal angle is 25-40 degrees and indicates that the femoral head is properly covered by the acetabulum. An angle of less than 20 degrees indicates inadequate coverage of the acetabulum (e.g. DDH) leading to reduced contact surfaces, increased contact stresses and damage to the labrum or cartilage. (7)Angles between 25-25 degrees indicate subtle changes and borderline hip dysplasia. Evaluating the hip using the LCEA scale is essential when diagnosing hip dysplasia in both children and adults.

2. Crowe classification

The Crowe classification allows to determine the degree of hip dysplasia in adults. It is used in adult patients to assess the degree of displacement of the femoral head relative to the hip socket. The classification is made by taking measurements on AP radiographs of the pelvis. 3 points are assessed: 1) pelvic height 2) inferior border of the hip socket 3) medial junction of the femoral head and neck. (8) Based on the measurements obtained, the degree of hip subluxation is calculated, given as a percentage, and dysplastic hips are classified into 4 groups: 1) Less than 50% - Crowe I 2) 50-75% - Crowe II 3) 75-100% - Crowe III 4) More than 100% - Crowe IV. Dysplasia in patients from groups 1 and 2 is usually mild, while dysplasia in those from groups 3 and 4 is severe. The classification of the patient on this scale is extremely important in deciding on the appropriate surgical procedure.

3. HAGOS (The Copenhagen Hip and Groin Outcome Score)

HAGOS is a questionnaire used to assess the intensity of symptoms associated with hip or groin problems. The scale consists of 6 subscales and includes, among others, pain, functioning in daily life, symptoms during physical activity and quality of life. (9). The patient rates each subscale on points from 0 to 4, where 0 means no problems and 4 serious dysfunction. The collected points are then converted into percentages, with 100% meaning full health and no complaints. The use of the scale is recommended during treatment when the patient's quality of life is of primary importance.

TREATMENT METHODS

Timely implementation of treatment for patients with hip dysplasia is extremely important, as it reduces the risk of developing degenerative joint changes and significantly improves the patient's quality of life.

Depending on the severity of the hip dysplasia, as well as the patient's age and overall condition, both surgical and non-surgical treatment methods can be considered.

SURGICAL TREATMENT

The most common surgical treatment methods include periacetabular osteotomy (PAO), arthroscopy, arthroplasty, and total hip replacement.

1. PERIACETABULAR OSTEOTOMY (PAO)

Periacetabular osteotomy is a globally recognized method for treating residual hip dysplasia. It is used to reduce hip joint dysfunction and alleviate pain. The procedure involves surgically cutting the pelvic bone around the acetabulum of the hip joint to improve the positioning of the femoral head in the acetabulum and increase its coverage by the acetabulum.

This method is highly effective in treating adolescents and young adults. Positive results have also been observed in individuals over 40, though these cases typically involve patients without arthritis of the hip joint and in generally good health. (10)

The advantages of PAO include significantly reduced pain levels and improved hip joint function. Although the treatment outcomes are generally more noticeable in younger patients, improvement is observed in all age groups. Importantly, joint mobility and patient-reported pain levels 5 years after surgery are typically better than preoperative levels. (11) Additionally, one year after surgery, patients report improvements in all six domains of the HAGOS (Hip and Groin Outcome Score). According to research, around two-thirds of patients also experience reduced pain in the muscles and tendons near the hip joint. (12)

The risk of postoperative complications is 14%, though these mostly involve minor adverse events. The risk of serious complications is 4%. (11) The most common complications include peroneal nerve dysfunction, acetabular necrosis, and delayed or nonunion of the bone.

2. HIP ARTHROSCOPY

Although hip arthroscopy was controversial until recently, advancements in tools and surgical techniques have made it an increasingly common method in orthopedics. This procedure allows for detailed visualization of the cartilage surfaces of the femur and acetabular labrum, and provides a view of the ligamentum teres, synovial membrane, and peri-trochanteric spaces. (13)The list of indications for hip arthroscopy continues to grow. In adolescents and adults with hip dysplasia, this procedure is important for assessing the extent of cartilage damage in the joint. It plays a key role in deciding on reconstructive surgeries and further treatment stages. The procedure can also be used to debride cartilage in affected patients.

For patients with femoroacetabular impingement (FAI), those with borderline hip dysplasia achieve satisfactory outcomes similar to patients without dysplasia. However, it should be noted that treatment outcomes for patients with severe

dysplasia (lateral center-edge angle [LCEA] <18°) are often negative, as the condition may worsen after surgery. (14) Additionally, if the impingement symptom outweighs the instability symptom, it is advised to select this method with caution. (15)

Studies show that the risk of complications after this procedure is low. Among 1,054 patients studied, adverse side effects occurred in only 1.6% of cases, with only one instance of a serious complication. (16)Potential complications include septic arthritis or bursitis, hemorrhage, neuropraxia, cartilage and labral damage, and fluid leakage. (17)

In conclusion, hip arthroscopy is an extremely useful method for joint assessment, with the additional advantages of being minimally invasive and having a low rate of complications. Studies suggest that this procedure can yield positive results in the treatment of borderline hip dysplasia. However, when choosing a treatment, it is essential to consider the patient's predominant symptoms, and for patients with severe dysplasia, alternative methods should be considered.

3. HIP ARTHROPLASTY

The hip joint consists of the head of the femur and the acetabulum, which is formed by the pelvic bones. Hip arthroplasty is a procedure in which one or both of these parts are replaced. In cases where both parts are replaced, it is referred to as a total hip replacement.

The goal of the surgery is to remove degenerated or non-functional parts of the joint and replace them with suitable components or implants. The primary reason for replacing the joint or its parts is degenerative joint disease. Other reasons include hip deformities, tumors, or bone necrosis.

3.1 TOTAL HIP REPLACEMENT (THR)

Total hip replacement is a procedure mostly used in older patients with degenerative changes in the joint. However, it is becoming increasingly popular in younger patients whose quality of life has significantly declined due to limited joint mobility and difficulty performing physically demanding tasks. Since young patients often prioritize full recovery of mobility and seek minimal risk of life-threatening complications, total hip replacement is becoming a more frequently recommended procedure for these patients. (18)

Total hip replacement can also be used to treat hip dysplasia. It is especially worth considering in cases of severe dysplasia, when less invasive methods, such as osteotomy or physiotherapy, have not yielded the desired results.

Studies show that both radiological and clinical outcomes after THR in patients with DDH are positive and satisfactory. In patients with Crowe III and IV hips, the frequency of complications and revisions is higher, and when leg lengthening is also performed, the risk of damage to the sciatic nerve or the peroneal portion of this nerve increases. Despite this, THR is often considered the best treatment option for patients with DDH. (19)

3.2 TYPES OF PROSTHESIS

The selection of the appropriate prosthesis is extremely important for obtaining the optimal result of the operation. The decision on the prosthesis used should be made based on the Crowe scale. In the case of mild dysplasia, standard prostheses can be used, and in the case of severe dysplasia, specialist prostheses (e.g. modular) can be used.

The most frequently distinguished prostheses are cemented and non-cemented. Although according to Norwegian data (20) as much as 85% of all

endoprostheses made are cemented, in the case of younger people there has been a tendency to increasingly decide on non-cemented prostheses. Although the non-cemented prosthesis, unlike the cemented one, does not fully integrate with the bone and the healing time after the operation is longer, it offers significant advantages for younger patients. It is long-term stable, in people whose bone is healthy and able to grow over the implant. Making this prosthesis completely eliminates the risk associated with loosening of the cement.

In the case of Crowe III-IV (more severe dysplasia), specialized prostheses with the possibility of additional osteotomy and bone reconstruction are required, e.g. modular prostheses or prostheses with reinforcing rings.

3.3. CHALLENGES ASSOCIATED WITH HIP REPLACEMENT

It is important to remember that the anatomy of the hip in patients with dysplasia can be significantly altered, making surgery more challenging and increasing the risk of complications. Patients with DDH not only often have different bone morphology and positioning (the femoral head is usually too high) but also changes in the soft tissues surrounding the joint. All of these factors make hip arthroplasty more risky for this group of patients compared to the same procedure in individuals with typical osteoarthritis. (21)

The aforementioned anomalies may require additional surgical procedures, such as acetabular reconstruction or femoral shortening. Another risk is the potential for prosthesis overload after surgery, which may occur due to the joint's anatomical pathology. (22)

Although these potential challenges and complications might suggest that performing arthroplasty in patients with DDH would result in worse surgical outcomes, studies show that the procedure remains effective even up to 15 years

post-operation for this group of patients. (20) Among 41 patients with developmental dysplasia of the hip, arthroplasty was performed using an autograft from the femoral head (the femoral head autograft covered an average of 26% (16 to 35) of the acetabular component). In all patients, the graft was successful, and no revisions were made within 11 years. Importantly, only a few patients reported mild discomfort after the procedure, and around 95% of patients did not experience any pain. (20)

These data show that arthroplasty can be an effective treatment method for patients with DDH. However, it is crucial that the surgery is performed by a surgeon aware of the anomalies and the challenges they present, and that the prosthesis is well-fitted to the individual needs of the patient.

CONSERVATIVE TREATMENT

In the case of advanced age of the patient or other contraindications that prevent surgery, we can offer patients alternative therapies aimed at relieving symptoms.

1. PROGRESSIVE RESISTANCE TRAINING (PRT)

Resistance training in patients with dysplasia is based on strengthening the muscles surrounding the hip joint. Although in the described anatomical condition the extensors and abductors of the hip joint are the most weakened, during training we strengthen not only these muscles, but also the flexors of the hip joint.(23) Maintaining even loads on all muscle groups prevents muscle imbalance. The described training would consist of exercises such as: loaded squats, hip extension, hip flexion and hip abduction performed with a barbell or dumbbells. When designing an appropriate training for patients, the number of exercises should be limited so that the training does not exceed 60 minutes. In

the case of training that is too long or too hard, patients may be reluctant to do it, and skipping training sessions would significantly reduce the effectiveness of this method. Progressive exercises (adding weight) should be performed when the patient is able to perform 2 more repetitions than required with a given weight.

In studies conducted to verify whether progressive resistance training is a suitable method for patients with hip dysplasia, an improvement in the results of patients performing the exercises was observed. (24) During the study, patients performed jump tests, completed the HAGOS and measured the peak torque of the hip joint using isokinetic dynamometry. During 8 weeks, patients were asked to perform 20 training sessions, with the average compliance of the patients being 90%. After completing all training sessions, an improvement in results was observed in all the fields tested. A particularly large change was noted in the isokinetic peak torque (16%). On the HAGOS scale, there was an improvement in at least 2 of the 6 subscales in everyone.(24)

Taking into account the above observations, we can conclude that resistance training not only reduces pain but also improves the performance of patients with hip dysplasia. TRP is undoubtedly a method worth considering in adult patients.

2. PAINKILLERS

Pain is one of the major problems for patients with hip dysplasia. It is particularly uncomfortable for those in the advanced stages of the disease, where hip joint degeneration has also occurred. Patients with osteoarthritis (OA) who report pain most often describe it as intermittent and worsening towards the end of the day and with physical activity. (25) Strong evidence at level A recommends the use of NSAIDs and well-chosen glucocorticoids for pain

associated with OA. These agents can reduce short-term pain related to the disease. (26) (27)In some cases, intra-articular injections of glucocorticoids may be indicated, for example, in patients who have contraindications to surgery or in younger patients where there are concerns about the proper acceptance of the prosthesis. However, it should be noted that steroid injections can lead to the progression of degenerative joint disease and, as a result, worsen pain-related issues. (25)

In patients with established osteoarthritis, etoricoxib 60 mg/day and diclofenac 150 mg/day seem to be among the more effective oral NSAIDs.(28) Oral and topical NSAID are recommended first-line treatments for osteoarthritis pain. However, it should be remembered that they are associated with an increased risk of adverse events in patients, especially those with certain comorbidities e.g. increased cardiovascular risk. (29) In the case of people at risk of side effects after taking NSAIDs (older age, comorbidities), it is worth remembering that there is research showing that properly selected exercises can be as effective in relieving pain as medications. Due to their high safety profile, exercises should be recommended more often in clinical practice for the treatment of hip OA.(30)

COMPARISON OF SURGICAL AND NON-SURGICAL METHODS

Conducting thorough comparative studies of these methods can be challenging for several reasons. Firstly, it is difficult to randomize trials considering the impossibility of blinding the patient to whether they are undergoing surgery or participating in progressive resistance training (PRT). An additional problem is the placebo effect—many doctors argue that patients are more likely to believe in the effectiveness of surgical methods, which may result in this group being more satisfied with the treatments. The muscle pain experienced after exercises in PRT may also contribute to inflated positive opinions about surgical

interventions. (23) While adult patients with DDH are most often qualified for surgical procedures, it's worth remembering the alternative that PRT offers.

Furthermore, the use of progressive resistance training as preparation for surgery or post-surgical strengthening should be considered.

For patients qualified for total hip replacement (THR) due to osteoarthritis (a common complication of hip dysplasia), resistance training was introduced twice a week for 10 weeks prior to surgery. After undergoing THR, these patients reported significantly greater improvement (as assessed by the HOOS scale) and had noticeably greater muscle strength than patients who did not exercise before THR. (31)

An important additional component of surgical treatment should also be appropriate pharmacological intervention. Particularly for patients reporting severe discomfort from pain, we should consider introducing medications such as NSAIDs to improve their quality of life until the planned surgery. Medications and appropriately tailored physiotherapy can also be alternatives for patients for whom surgery is not possible.

SUMMARY

Surgical methods are the basis for the treatment of hip dysplasia in adults. Depending on the stage of the disease and the general condition of the patient, the orthopedic surgeon decides on the most effective method for each patient. In young patients, in many cases, the final decision falls on periacetabular osteotomy (PAO), as this method is highly recommended for patients in good general condition and without joint degeneration. In the case of advanced DDH, PAO may be insufficient, and the only effective method is often a total hip

replacement. Regardless of the surgical method chosen, it is worth encouraging the patient to lead an active lifestyle and introduce resistance training, as this can additionally improve their quality of life and reduce discomfort associated with pain.

Author's contribution

AUTHOR'S CONTRIBUTION

Conceptualization: F. Czyżewski; methodology: I. Wiak; F.Jasiński; software: K.Wojtach; check: F. Banyś, F. Czyżewski; formal analysis: K.Bochen, K.Pasierb, J.Szałajska; investigation: F.Czyżewski, A.Łukawski, I. Wiak; resources: S. Dudek, K. Wojtach, F.Banyś; data curation: K.Bochen; F.Jasiński; writing-rough preparation: F.Czyżewski, K. Pasierb, J.Szałajska; writing – review and editing: A.Łukawski, I.Wiak, S.Dudek; visualization: F.Banyś, A.Łukawski, K. Wojtach; supervision: F.Czyżewski, J.Szałajska; project administration: F.Czyżewski

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