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THE CONTRIBUTION OF IMAGING IN THE  
DIAGNOSTICS AND TREATMENT OF  
DEVELOPMENTAL DYSPLASIA OF THE HIP  

Ph.D. Thesis  

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2011
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KEYWORDS: dysplasia, planning, preoperative, arthroplasty, recovering
INTRODUCTION

THE IMPORTANCE OF THE ISSUE

The developmental dysplasia of the hip remains an important challenge for the orthopedist surgeon, although the newborn’s medical assistance, the post-partum clinical and echographic examination of the infant increasingly has better.

This is a complex condition that may vary as gravity from an insufficient coverage of the femoral head up to high luxation without support these being considered severe lesions.

The important aspect of this pathology is the one that, in the most of the cases, the symptoms are visible even before the arthrosis signs to be identified on the X-Ray images, requiring prompt decisions for arthroplasty. This would avoid the severe further damage of the hip joint that would require a more difficult procedure and with poorer postoperative results.

The developmental dysplasia of the hip is a complex condition with major implications considering the patients’ young age and the disability caused.

Despite the improved medical assistance the incidence is still high, on one hand because of the poor screening and diagnostic in the developing countries and on the other hand
because of the evolving character of the disease with the possibility to affect the joint at an adult age.

Therefore is required a good knowledge of all factors involved in the pathogenesis and of all the diagnostic and treatment options in each stage of the evolution. Everyone of those will be extensively exposed in the following chapters.

THE ISSUE OF THE THESIS

Among DDH in newborn, two entities are included: the teratological hip dislocation and the typical hip dislocation.

*The teratological hip dislocation* – occurs at some patients with severe congenital malformations, such as chromosomal abnormalities, lumbo-sacral agenesis, or neuromuscular diseases – myelomeningocele or arthrogryposis. The characteristics of the teratological dislocation: One occurs early during intrauterine development. At birth an important shift of the femoral head from the acetabulum can be observed and the hip joint is stiff and irreducible by the Ortolani manoeuvre.

*The typical hip dislocation* – also known as “Congenital Dislocation of the Hip”, occurs more frequently, and is not
accompanied by other abnormalities of the organs or systems
the child being apparently normal on psycho-somatic
evaluation.

Into this entity several types of the disease are included
that separates a variety of grades of gravity of the lesion, as per
below:

– The insufficient coverage of the femoral head by
  the acetabular rim,
– Instable hip,
– The hip sub-luxation
– The full dislocation, when the femoral head is
totally outside the acetabular cavity (the most
severe form)

Due to the newborn’s hip plasticity, coxo-femoral joint
normal development involves a congruency and a constant
pressure along the entire surface of the two joint components –
the femoral head and the acetabulum. The both components are
in a continuous process of mutual shaping having as final result
a normal development of the hip.

The morpho-functional characteristics that offers
plasticity to the newborn’s bones and joints, determines the
changes that occur in the dysplastic hip – either the femoral head loses the sphericity, the acetabulum flattens (in the absence of a normal head apposition) losing the continence capabilities, or in more complex forms changes of the both joint components.

Although present at the birth, if early diagnosed and concentrically reduced, the DDH’s outcome can be a normal bone modelling and normal development of the hip. On the other hand, if is undiagnosed and not proper reduced the condition evolves causing a vicious development of the both hip joint components, due to the lack of the pressures and mutual interactions described above.

For a while the condition was known and named in different ways, as:
- CDH – Congenital Disease of the Hip
- CDH – Congenital Dislocation of the Hip
- CDH – Congenital Dysplasia of the Hip

As short history of the condition – initially this was named and spread under the acronym CDH, meaning after some authors CDH – Congenital Disease of The Hip, CDH –
Congenital Dislocation of The Hip or CDH – Congenital Dysplasia of The Hip.

Lately Klisic[1] proposes the acronym DDH, accepted even today, although the sense has been modified afterwards. On first basis, the acronym stood for the Development Displacement of the Hip but afterwards the name Developmental Dislocation of the Hip was finally preferred.

Nowadays the condition is known as DDH – Developmental Dysplasia of the Hip, name accepted in 1991 on AAOS recommendation. [2]

This version presently used “Developmental Dysplasia of the Hip” was chosen and preferred to the previous one because expresses the dynamic character of the lesions that occur in hip depending of the severity of the condition and the consequently developing a normal or abnormal hip joint.

- On adolescent and adult within DDH we can meet:

- Dysplasia – the femoral head is localized in the acetabulum (Rx criteria – the cervical-obturatory arch is intact), but presents insufficient superior coverage, that can be seen on the AP Xray (by insufficient grow of the acetabular rim), anterior or deficit of version of the acetabulum or the femur.
- *Subluxation* – the two articular surfaces – the femoral head and the acetabular cavity keeps a partial contact (Rx criteria – the discontinuation of the cervical-obturatory arch).

- *Hip luxation* – this case, according to the definition, is the most extreme one, when the femoral head and the acetabulum completely loses the contact.

In regards to the position of the femoral head against the acetabulum, the luxation can be:

- *supported* – the femoral head is in contact with the iliac wing, where during the growth creates itself a spot (new/false acetabulum) or

- *unsupported* – the femoral head is placed at a distance above the acetabulum, surrounded by a chord of fibrous tissue.

*The hip instability* – it is not a well defined situation, such in newborn and infant where at the clinical examination the femoral head may be (under)-dislocated from the acetabulum. The evolution is towards the symptoms and secondary arthrosis after a variable time.
THE SPECIAL PART

This analysis is an observational study, a single centre experiment on 36 cases of Secondary Coxarthrosis due to DDH treated with THR from 2005 to 2010 in the Orthopedics – Traumatology Clinic of the Bucharest Emergency University Hospital.

The left hip was affected in 28 out of the 36 cases. In 8 cases both hips have been involved. The patients were aged between 18 and 45 years, with an average of 36 years and a sex ratio of 13:23 M:F.

The preoperative planning included complete clinical assessment with functional score. Preoperative radiological exam, A-P, lateral, special incidences, templating based on the X-ray images, CT scans with 3D reconstruction of the hip, and measuring the femoral canal diameter, measuring the limb length inequality as well as the analysis of the secondary alterations (genu valgum, hyperlordosis, scoliosis). The planning was complete in 12 cases. For the rest of the cases only the clinical and radiological assessment was done.

The approach was posterior-lateral with the patient in lateral decubitus. After the total capsulotomy, was identified
the transvers ligament and the basis of the quadrant blade at the level of the obturator foramen. The acetabular preparation was performed by horizontal reaming with small reamers up to the quadrant blade in order to obtain the maximum of medialization, followed by superior-medial reaming under intraoperative X-ray control, within the limits of the two acetabular columns. There have been used trial cups in order to determine the position against the iliac bone (the tilt angle, the cup’s anteversion and the coverage).

In regards of the cup positioning, 20 cups have been implanted in the true acetabulum and 16 of them were implanted in an intermediary position. In 4 cases was performed the greater trochanter osteotomy and in 8 case the femur shortening osteotomy. The hip arthroplasty was realised in 30 cases using uncemented cups and in 6 cases were used the cemented ones. The acetabular plasty with solid bone graft was performed in 14 cases.

The dysplasia’s severity was evaluated using the Crowe classification, precisely coding the subluxation degree or dislocation as of this depend the further evaluation of the bone capital abnormalities soft tissues pathology, the knee alterations, the lumbar spine and the limb inequality. In the
studied group were 20 cases of Crowe I, 10 cases of Crowe II, 4 cases of Crowe III and 2 cases of Crowe IV dysplasia.

III. CONCLUSIONS

To realize the THR as treatment for the DDH an important criteria is the correct patients’ selection. Many patients with those deformities have a favourable evolution up to the middle age and the surgery should be considered only if the pain becomes invalidating.

The reconstruction through THR on the patients with DDH faces few particular problems, as: shortening of the limb, the dysplasia of the acetabular cavity, femoral hypoplasia, muscular atrophy, and the inability to move the pelvis on walking.

At the patients with one side luxation, the equal length of the limbs should be done partially or completely during surgery. At the patients with bilateral DDH, a postoperative unilateral limb lengthening would cause serious discrepancies.

Often the lengthening of a limb must be compensated be the shortening the femur in order to be able to place the head in the true cavity.
In subluxations, the presence of the bone deformities or of the surrounding soft tissues, are of a great surgical importance: the femoral head is small and deformed, the femoral neck is short and narrowed, and most of the times antevered, the great trochanter is small and often localized posteriorly, the femoral canal are narrowed. Because the femur is narrowed and anteriorly curved makes its preparation very difficult.

Preoperatively must be done X-rays A-P and lateral of the pelvis and the proximal femur in order to accurately determine:
- The quality and quantity of the bone where the cup will be placed
- The level where the fixation is planned
- The narrowing and the bending of the femur
- The opportunity for femoral osteotomy
- Sizing and type of the implants that will be implanted

If the femoral head is dislocated proximal, the acetabular cavity is deformed and its roof is eroded. In the high-level luxations and in the intermediary ones the femoral head creates a false acetabulum, which usually is neither large enough nor deep enough for the cup. The most dense bone
structure is at the level of the true acetabulum, and that is the ideal spot to place the implant.

The abductors, adductors, psoas and quadriceps muscles are usually shortened. The capsule is elongated and thickened in the inferior side, preventing the return of the head in the true cavity. Dissection at this level will need the ligature of the branches of the medial circumflex and obturator arteries. The extensive capsulectomy, the psoas, right femoral, and adductors’ tenotomy might be needed in order to correct the deformity.

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