## Abstract of the PhD thesis:

# MORPHOLOGICAL AND ULTRASOUND STUDY OF THE DEVELOPMENT OF THE HIP JOINT IN PRE- AND POSTNATAL PERIOD

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# SUMMARY

Developmental dysplasia of the hip (DDS) is a frequent anomaly and it is the main indication for the ultrasound examination of the hip joint of new-borns and infants. The late detection of dysplasia's signs can cause the early occurrence of degenerative changes at grown-ups and therefore the need for hip prosthesis.

The cardinal objective of this research is to explore the changes of the main morphological, geometrical and ultrasound parameters, during the development of the hip joint in the pre- and postnatal period through 3 studies:

**Study no. 1**. Geometrical and morphological study of the hip joint in the prenatal period
By the post-mortem dissection of 33 foetuses of gestational ages between 3 and 9 months and by measuring the main morphological and geometrical parameters, I was following the development of joint components reported to the gestational age. The intrauterine development of the hip joint leads to the decrease of the joint stability. The increase of the femoral head surface is more intense than the increase of the acetabulum surface, therefore decreases the percentage of femoral head coverage. Geometrical changes of the proximal end of femur are: increase of inclination (CD) and of femoral anteversion (AT). These changes also have an influence on the development of the acetabulum, so the acetabulum's anteversion (AT) will gradually increase. The results of this study are similar to those described in the medical literature, but there are unique concerning the evaluation of forms and sizes of the joint surfaces and cavity.

**Study no. 2**. Ultrasound study of hip joint in the prenatal period
Before the morphological study, the post-mortem foetuses were subjected to an ultrasound examination to determine the main ultrasound parameters used for the screening and diagnoses developmental dysplasia of the hip in the postnatal period (α angle, L value). Our purpose was to follow the changes of these parameters related to the gestational age.
Changes of angle α and the L value determined on ultrasound images, present a decrease of acetabulum's inclination.The α angle is negatively and the L value positively correlated with the gestational age.
The α1 angle determined through mathematical way and using morphological parameters, offers a better, more accurate and more real description than the acetabulum's inclination. This method used by us offers a comparison basis with the α angle.The difference between the two angles (α1, α) is sharpen before the age of 18 gestational weeks. The ultrasound examination of the hip at this age is difficult to interpret, because on the ultrasound image, anatomical landmark elements are difficult to detect. I didn't find information in the medical literature about the assessment of changes of L value and its comparison with the α angle in the foetal period.

**Study no. 3.**Ultrasound study of hip joint in the postnatal period

Studying the hip joint by ultrasound examination at 106 new-borns and infants, having the age between 1-9 months, I was following the postnatal changes of the main ultrasound parameters, defining their role in the screening of hip dysplasia.
The optimal age to perform the ultrasound examination of the hip is the most discussed topic in the medical literature, since there is no international consensus on this issue. Most discussions are related to the ultrasound screening in the first 8 weeks of life.
The most commonly used and accepted static method in Europe, also used in our study, is the Graf method. According to this method hips are classified in four types. Rakovac and Colab. (2011) have described the most recent technique of interpretation of the ultrasound examination of the hip by studying the coverage of the femoral head, determining the "L value" – the method also used in our study.
Values of α angle correlate positively and the L value negatively with the age. The sensitivity of L value to the values of α angle and to the type of the hip is reduced, and the specificity of L value to the α angle and to the type of the hip is increased. In our casuistry, in terms of ultrasound, the majority of the studied hips were normal, similar to the information from the medical literature. The incidence of developmental dysplasia of the hip, according to the Graf method was of 4.24%, value which is within the range of 3-5%, incidence described in the Central Europe. On the basis of L value, the DDS incidence was of 9.9%, so approximately double to the reported incidence of the Graf method.
During the study performed in the prenatal period, I have found that there is no difference in case of morphological and ultrasound parameters followed by gender and location, but after birth the situation changes for still unclear reasons, and developmental dysplasia of the hip develops mostly at the left hip and at females, observation supported also by the medical literature.
Unlike the most recent studies from the medical literature which recommend the earliest screening as possible, and the adequate treatment in the presence of ultrasound changes of developmental dysplasia of the hip, generally before the age of 8 weeks, in our casuistry the majority of DDS cases were diagnosed after the age of 3 months. These observations underline the need and importance of a more effective collaboration between medical specialities (orthopaedics, paediatric surgery, neonatology and radiology) which are involved in the DDS screening and diagnosis, to avoid the late diagnosis and to reduce the number of DDS cases requiring surgical treatment.

**Keywords**: development of the hip joint, developmental dysplasia of the hip, ultrasound examination of the hip, α angle, "L" value.