

Ultrasound Diagnosis of Hip Dysplasia in Infants

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Abstract: In the structure of all congenital malformations of the musculoskeletal system, hip dysplasia occurs most frequently. Until recently, the main method for diagnosing pathology of the hip joint was radiological, recording changes only in the bone structures, the number of which in children in the first months of life is relatively small. According to various authors, an x-ray examination of the hip joints becomes informative at the age of no earlier than 3–5 months of life. In our work, ultrasonographic diagnostics of hip joint dysplasia in infants is presented, which made it possible to identify this pathology at the earliest stages of development, accurately determining its forms and stages.

Keywords: hip dysplasia, ultrasound, children in infancy.

Relevance: Hip dysplasia (HD) is one of the most common pathologies. Currently the incidence of dysplasia of the hip is 6-20 cases per 1000 infants, unfortunately, the tendency to an increase in the frequency of the disease is noted in environmentally disadvantaged areas.

The most important task of modern pediatric orthopedics is the early detection of children with congenital hip dislocation (CHD) and congenital dysplasia. It has been found that the percentage of positive treatment outcomes, at an early age, is inversely proportional to age. In 97% of children, good to excellent results can be achieved if the condition is detected before 3 months of age and treatment is started as soon as possible. In 82% of cases, similar results can be achieved if treatment is started after 3 and up to 6 months of age in children, and only 30% of cases have only good results if treatment is started in the second half of life.

According to the literature, the early detection of congenital hip dislocation and congenital dysplasia remains at a low level of 30-40%, using the old system of organisational and therapeutic measures (radiological and clinical examination of children under 6 months of age). However, due to the lack of clinical symptoms, it is very difficult to diagnose this pathology at such an early age, but despite this, this examination should be performed in the first days of the child's life in order to detect hip dysplasia. Until recently, radiographs (RG) were the main method of diagnosing hip dysplasia. However, because of the radiation exposure and the inability to visualize the proximal end of the femur and the roof of the acetabulum and to detect abnormalities in their structure due to the predominance of cartilage, it is not advisable to use it before the age of 3 months.

Ultrasonography (USG) is a relatively new alternative diagnostic modality that offers a wider range of options for assessing the developmental status of the hip joints in newborns and children in the first months of life. The use of this diagnostic method makes it possible to visualise the soft tissue components of the hip joint. Non-invasiveness, no special training, no contraindications or

complications, the possibility of repeated and regular use, no radiation exposure, rapid performance, mass examination and most importantly, the optimal age range of those examined from 0 to 10 months, all these are the undeniable advantages of this method.

Objective of the study: To determine the value of early ultrasonography diagnosis of DTS in infants.

Material and Methods Between 2019 and 2021, 64 infants aged 3 weeks to 8 months of life who were referred for consultation to an orthopedist by district pediatricians with suspected hip dysplasia were examined. Traditionally, the clinical examination of the child has been of great importance. The examination included an examination during which special attention was paid to: breech and pelvic presentation, prolonged waterless period, multiple pregnancies, heredity, and most importantly clinical symptomatology. It includes: high muscle tone in the lower extremities, asymmetry of the gluteal folds and limitation of hip abduction. Ultrasound performed on a Vinno E35 with a 4-12 MHz line transducer was the main method of examination. The standard technique used was that proposed by Graf R. This Austrian physician and foreign researcher first developed an ultrasound classification of hip joint types and a classification of the various forms of dysplastic joint disorders in 1989, and is also the author of the hip joint examination technique. This topic was further developed significantly in the work of several German authors. Despite the availability of equipment, USG of joints is poorly developed in our country, but the analysis of works allows us to outline a number of promising directions for the use of this method. Then, the optimal slice for the study was displayed under the control of a monitor. In this way, a layer-by-layer image of the hip joint was obtained. After visual assessment of the slice, the ultrasound image was analyzed and angulation indexes were calculated to assess the degree of obliquity of bone and cartilage parts of the acetabular roof. R. Graf developed his classification in 1984 using qualitative and quantitative assessment of the hip joint, in which he divided the degree of development of all hip joints into four types. These types include subtypes depending on age, presence of structural changes and other indicators such as the cartilage coverage factor (CCF) of the femoral head, which determines the degree of limb coverage of the head. The normal value is $\frac{1}{2}$ - $\frac{2}{3}$, in other words, the limbus overlaps the ossification nucleus (middle third of the head) completely or up to half. Hip joint types: type 1a, b: mature joint. Angle α is 60-69 degrees, angle β is 55-77 degrees. type 2a: physiological immaturity of the hip joint before 3 months of age. Angle α is 50 - 59 degrees, angle β is 56 - 77 degrees, CCH is $\leq \frac{1}{2}$ degree. Type 2c: DTHS in children over 3 months of age. Angle α is 43 - 49 degrees, angle $\beta \geq 77$ degrees. Functional testing reveals a transient decentration of the femoral head within the acetabulum. Decentration can be detected with changes in angulation when the subject is placed on his back or side, with $\frac{1}{2}$ - $\frac{1}{3}$ to $\frac{1}{2}$ - $\frac{1}{3}$ of the COP. Type 3a: subluxation (eccentration). Angle α is less than 43 degrees, angle β is greater than 77 degrees, the bony part of the roof of the acetabulum is flattened, the head is eccentric, children over 3 months of age tend to have increased echogenicity of the cartilage part of the roof of the acetabulum (due to long-term pressure of the femoral head on the joint capsule), KHP is less than $\frac{1}{3}$. Type 3b: with degenerative changes in the cartilaginous part of the roof of the acetabulum, the BCC is less than $\frac{1}{3}$. Type 4: dislocation. The ultrasound symptom of an "empty" acetabular socket is observed. The bony part of the acetabular roof is flattened and the limbus is usually not visualised as it is wrapped in the joint cavity. Out of 64 children, 12 children (18.8%) were diagnosed with no ultrasonic joint pathology (joint type 1a, mature - 8 boys, 4 girls). In 13 children (20.3%) (at the age over 2.5 months) the formation of the ossification nuclei was diagnosed as delayed while the angulation was normal. In 32.8% of cases (21 examined children, including 14 girls and 7 boys) dysplasia type 2a-2b was detected. In 11 children (17.2%) (7 girls, 4 boys) dysplasia type 2b was diagnosed, in all cases accompanied by delayed formation of the ossification nuclei. In 7 cases (10.9%) dysplasia type 3-eccentration was detected. As noted, there is a gender imbalance for hip dysplasia, which is defined by some authors as a risk group and is explained by a greater sensitivity to maternal hormones during

pregnancy. It should be particularly noted that all the severe degrees of joint retardation were observed in girls. Thus, this pathology can be considered to be associated with gender. In view of this peculiarity of the pathology, it seems to us 100% to recommend screening ultrasound examinations of newborn girls.

Conclusions: Ultrasonography can clarify or completely rule out a suspected orthopedic pathology and can often save a child from unnecessary treatment. An advantageous alternative to X-ray diagnosis of hip pathology in newborns is ultrasound examination of the hip joints, with the current development of diagnostic equipment. This method makes it possible to assess the cartilage structures that predominantly represent the joints of the baby in the first months of life, as well as the connective tissue and muscle components, while avoiding unnecessary radiation exposure. The use of a new ultrasonography in infants makes it possible to detect hip dysplasia at the earliest stages of development and accurately determine its shape and stage. The smaller the age of the child, the shorter the period of orthopaedic treatment and the less distressing the forced limitation of movement for the child.

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