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Ultrasound Diagnostics of Hipdysplasia in Infants

Nozima I. Salieva

Research assistant, Department of radiology, Republican Specialized Scientific and Practical Medical Center of Traumatology and Orthopedics, Tashkent, Uzbekistan

Abstract: ***Early detection of hip joint pathology in children is an important task of modern orthopedics. We conducted an ultrasound study in 59 children from 2 months to 1 year of age. The study was carried out according to the method of R. Graf. The received data of ultrasonic researches are analyzed. Depending on changes in the elements of the hip investigated children divided into groups: children with mature hip joints, children with changes acetabular and femoral component (congenital dislocation of the hips), children with changes acetabular and femoral components (congenital dislocation of the hips and rachitic changes), children with changes in the femoral component (rickety changes). Ultrasonic changes are relatively studied. The role of ultrasound in the differential diagnosis of hip joint pathology in children has been proved.***

Keywords: hip joint, ultrasound, dysplasia, rickets, children

1. Introduction

Dysplasia is the common name for impaired development and growth of organs and tissues, regardless of the time and cause of their occurrence. The most frequent dysplasia in young children are bone ones, for example hip joint dysplasia makes up to 15% in the structure of orthopedic pathology leading to static-dynamic disorders and early disability [2]. In recent years there has been a tendency to increase the absolute number of patients with hip joint dysplasia. According to a number of authors, hip joint dysplasia occurs in 5–16 children in each 1,000 newborns, dysplastic dislocation of the hip in 3–4 children per 1000 normal deliveries [2,4,5]. Suspected, but not confirmed, dislocation of the hip indicates only the care of the doctor and the child does not harm. An undiagnosed disease can make a child a lifelong disabled [2, 5]. Dysplasia is often found on the background of rickets. The delay of ossification of the hip joints with rickets is often combined with a delay in the physiological development of the hip joints, thus complicating not only the diagnosis, but also the treatment of hip joint dysplasia and congenital hip dislocation.

Ultrasound examination (ultrasound) allows visualizing the cartilaginous and soft tissue structures, which mainly represent the hip joint in children during the first months of life. The method is non-invasive, perhaps its repeated use and the use of functional samples in real time [8,9]. This type of hip joint research can be a marker of ossification of its structures as reliably as x-rays[10,11]. First of all, we have the opportunity to assess the dynamics of ossification of the hip joints by the timing of the appearance of the ossification nucleus [7].

The purpose of the study is to improve the diagnosis under development elements of the hip joint in children by analyzing x-ray / sonographic changes.

2. Materials and Methods

Ultrasonography was performed in the area of both hip joints in 59 children of the first year of life (118 hip joints). The studies were conducted in the X-ray diagnostic department of the Republican Specialized Scientific and Practical Medical Center for Traumatology and Orthopedics using SonoScape ultrasound scanner using a multi-frequency linear scan sensor from 5-7.5 MHz.

For proper ultrasound of hip joints in children in younger age group, it was necessary to observe the following conditions: 1) the child should be placed correctly to provide reliable data; 2) the position of the sensor relative to the axis of the body should be only vertical, that is, the plane of joint scan should pass exactly in the middle part of the greater trochanter; 3) knowledge of the ultrasound anatomy of the hip joints in children during the first months of life; 4) correct determination of the coordinate points of the joint for further adequate angular measurements.

Hip joints formation evaluation was carried out on the basis of the ultrasound technique of Professor R. Graf (Austria, 1984), which assesses the formation of the bone acetabulum, bone and cartilage bay window. The undoubted advantage of the R.Graf technique, which distinguishes it from all alternative methods, is the performing elaborate standardization an ultrasound of hip joint in a morphologically unambiguous standard plane, differentiated classification according to the degree of maturity of the formation, taking into account the age of the child, including the concept of instability and decent ration (4). The Graf lines (along the surface of the ilium), the roof of the acetabulum (its bony part) and the acetabulum (cartilaginous lip) constitute two measured angles: α-angle of the acetabulum roof, β-angle of the acetabulum.

3. Results and Discussion

Within the framework of this project, clinical and diagnostic studies were conducted, a prospective analysis of clinical, digital radiological, ultrasonographic and laboratory data was conducted (Table 1).

Research methods	Amount of children
Clinical examination	59
Digital radiography	31
Ultrasonographic	59
Laboratory blood test (calcium, phosphorus, alkaline phosphatase, vitamin D)	7

Clinical research method.

- Limitation of legs abduction bent at a right angle in the hip and knee joints;
- Asymmetric arrangement of skin folds on the hips;
- Asymmetric arrangement of the gluteal folds on the hips;
- Shortening of the lower limbs;
- Excessive rotation of the thigh;
- Symptoms of "slipping" or "clicking" in the hip joint;
- External stop rotation.

During the examination of the hip joints in 59 children (118 hip joints) were distributed by gender (Table 1).

Table 1: Distribution of children by gender

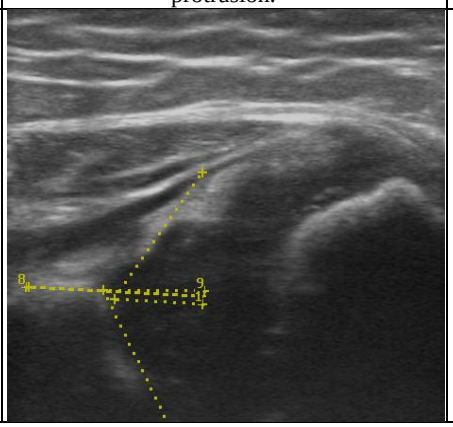
Total: n=54	Boys		Girls	
	one-sided	double sided	one-sided	double sided
№	5	18	4	27
%	9,2	33,3	7,4	50,1

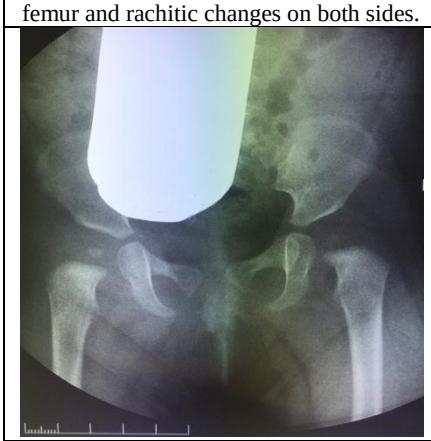
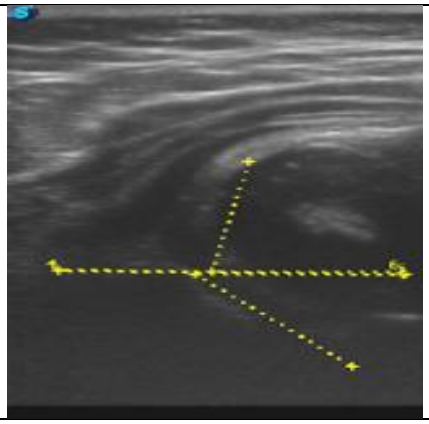
According to the table, only 59 children were examined, 5 of them did not show abnormalities in the hip joints, 5 boys (9.2%) and 4 girls (7.4%) were diagnosed with unilateral changes, 18 boys (33, 3%) and in 27 girls (50.1%) bilateral.

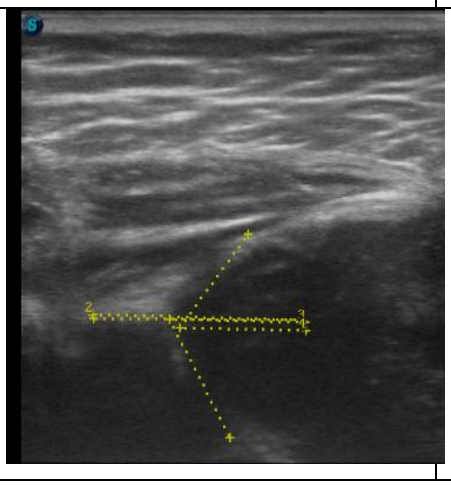
Table 2: Forms of hip joint dysplasia in children of the first year of life (according to R. Graf)

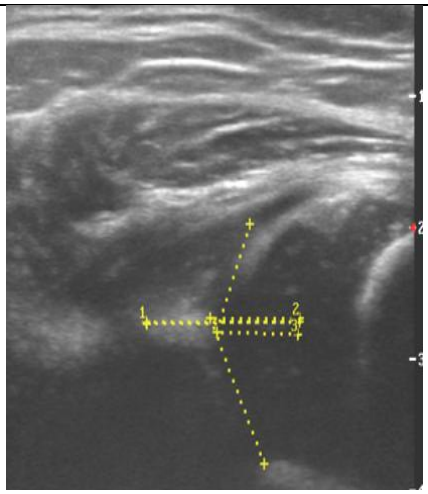
Total (n=59)	1st group		2nd group			3rd group		4th group
	A	B	A	B	C	A	в	
up to 3 months.	1(1,7%)	3(5,0%)	5(8,4)	2(3,3%)	4(6,7%)	0	0	0
3-6 month	2(3,3%)	1(1,7%)	2(3,3%)	9(15,2%)	6(%)	2(3,3%)	0	1(1,7%)
6-9month.	3(5,0)	2(3,3%)	2(3,3%)	4(6,7%)	1(1,7%)	1(1,7%)	0	0
9-12 month	1(1,7%)	1(1,7%)	1(1,7%)	1(1,7%)	1(1,7%)	1(1,7%)	1(1,7%)	1(1,7%)
Total	7(3,3%)	7(11,8%)	10 (16,9%)	16 (27,1%)	12 (37,2%)	4 (6,7%)	1 (1,7%)	2 (3,3%)

According to the table, it can be noted that among the children studied there were more often changes corresponding to group 2 - with a physiological delay in the development of components of the hip joint, while taking into account the data of the most modified side.

I control group		
X-ray diffractometry mature hip joints child M., 6 months.	Sonogram of the hip joint, mature joint (control group), with a rectangular bone protrusion.	Blood tests Average
		**Vitamin D 32 (n`30-100) ng / ml Osteocalcin 28 (n`11-43) ng / ml Alkaline phosphatase 495 (n` <= 644) u / L Phosphorus 1.6 (n`1,30-2,26) mmol / L Calcium 2.30 (n`2,02-2,60) mmol / L Ionis. calcium 1.5 (n`1,1-1,4) mmol / L**

Group II Congenital dislocation of the hip		
Dysplasia of both hip joints with the presence of pryvoshiha head of the left femur and rachitic changes on both sides.	Sonogram of the hip joint of group II - with the presence of congenital hip dislocation	Blood tests Average
		**Vitamin D 21 (n`30-100) ng / ml Osteocalcin 8 (n`11-43) ng / ml Alkaline phosphatase 729 (n` <= 644) u / L Phosphorus 0.8 (n`1,30-2,26) mmol / L Calcium 1.4 (n`2,02-2,60) mmol / L Ionis. calcium 0.8 (n`1,1-1,4) mmol / L**

Group III: dysplasia on the background of rickets		
Photo radiograph of the child K., 8 months. Hip dysplasia with congenital dislocation of the femoral bones.	Sonogram of hip joint of group III - dysplasia on the background of rickets	Blood tests Average
		**Vitamin D 11 (n`30-100) ng / ml Osteocalcin 8 (n`11-43) ng / ml Alkaline phosphatase 832 (n` <= 644) u / L Phosphorus 0.7 (n`1,30-2,26) mmol / L Calcium 1.40 (n`2,02-2,60) mmol / L Ionis. calcium 0.9 (n`1,1-1,4) mmol / L**

Group IV: congenital dislocation of the hip + Rachitis		
Photo radiograph of the child K., 8 months. Dysplasia of the hip joints, congenital dislocation of the femoral bones.	Sonogram of the hip joint of group IV, with the presence of congenital hip dislocation + rickets	Blood tests Average
		**Vitamin D 8 (n`30-100) ng / ml Osteocalcin 7 (n`11-43) ng / ml Alkaline phosphatase 843 (n` <= 644) u / L Phosphorus 0.8 (n`1,30-2,26) mmol / L Calcium 1.30 (n`2,02-2,60) mmol / L Ionis. calcium 0.9 (n`1,1-1,4) mmol / L**

On ultrasound examination in children of the control group, the angle α did not exceed 600, the angle β was not more than 550, with the presence of a pointed or smoothed bone protrusion, which corresponds to the first type according to the Graph.

In children of the second group, with congenital hip dislocation, angle α was within 50-430, angle β - less than 55-770, immature hip, bony roofs flattened, cartilaginous protrusion does not cover the head, which corresponds to the second third type according to the Graph.

In children of the third group, dysplasia on the background of rickets, the angle α does not exceed 600, the angle β is not more than 550, the bone roofs are flattened, the absence of a bone nucleus, the sharpening of the inner X-ray angles of the proximal femur metaphysis.

In children of the fourth group, with congenital hip dislocation and dysplasia on the background of rickets, angle α varies from 43 to 490, angle β less than 770 immature hip joints, bone roofs flattened, cartilaginous protrusion does not cover the head, lack of bone nucleus, sharpening internal x-ray proximal angles metaphysis of the femur.

4. Conclusions

An analysis of the sources of literature and our observations has shown that X-ray and ultrasonographic methods of research allow us to determine rachitic dysplasia and differentiate it from congenital hip joint pathology in children. The study should be carried out in children at risk, with clinical symptoms of dysplasia and congenital dislocation, diseases and malformations of the musculoskeletal system. The most optimal period for screening ultrasound: - 2-3.5 months to exclude acetabular dysplasia and proximal femur (congenital dislocation of the hip) - at this age, all elements of the joint develop very quickly, and the pathological changes detected during this period joints are most amenable to orthopedic correction; - 6-12 months to exclude rachitic changes. With the modern development of diagnostic equipment, ultrasound of the hip joints seems to be a viable alternative to the X-ray method, since it allows visualizing the cartilage structures of the hip

joint with a high degree of certainty in earlier periods, while avoiding undue radiation exposure.

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