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RESULTS OF ULTRASOUND SCREENING OF THE HIPS IN NEWBORNS AND INFANTS

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Summary: The aim of this study is to analyze the results of ultrasound screening of the hips in newborns and infants and to establish the importance of ultrasonography in early diagnosis and treatment of developmental dysplasia of the hips (DDH).

Material and Methods: In 2010, at the Clinic for orthopedic surgery in Skopje, 6333 newborns and infants were examined. They were classified in 2 groups: first group consisted of patients with normal ultrasound findings and second group consisted of patients with DDH on ultrasound finding. Patients underwent clinical examination and ultrasonography of the hips.

Results: We examined 6333 newborns and infants up to 6 months of age. 3213 were female and 3120 were male. In the first group there were 5932 (93.67%) patients with normal ultrasound of the hip-Graf Type 1. In the second group there were 401 (6.33%) patients with DDH on ultrasound. The patients of the second group were divided in 3 types according to Graf method. Graf Type 2 — Patients with dysplasia 378 (5.97%) subdivided in 2a- 260 (4.11%) patients, 2b 85 (1.34%) patients and 2c 33 (0.52%) patients. Graf Type 3 — Patients with subluxation of the hip 9 (0.1%), subdivided in 3a 3 (0.05%) patients and 3b 3 (0.5%) patients. Graf Type 4 — Patients with luxation of the hip 17 (0.27%) patients. 124 patients (30.5%) with DDH had an associated risk factors (65 patients with positive family history, 48 patients with breech delivery and 11 patients with clubfoot deformity). 387 patients with dysplasia and subluxation of the hips were treated with abduction brace and Pavlik harness. 17 patients with luxation of the hips were treated with exercises and overhead traction of the muscles, close reduction of the hip placed in spica cast or open reduction.

Conclusion: Ultrasound screening of hips in newborns and infants is important for early diagnosis of

DDH. This is necessary for adequate treatments. If this disease is not treated properly it gives long term morbidity such as gait abnormalities, chronic pain and degenerative arthritis.

Analysis of the results of ultrasound screening of the hips in our population showed that there is a significant number of dysplastic hips.

Key words: Developmental dysplasia of the hip (DDH), Ultrasound.

INTRODUCTION

The term Developmental Dysplasia of the Hip (DDH) is combination of congenital dysplastic hips and hips who became dysplastic or malformed after birth (1, 2).

Hip dysplasia is considered a “multifactorial trait”. Risks factors for DDH are: family history, position of the baby in the uterus (especially with breech presentations), other orthopaedic problems that include metatarsus adductus, clubfoot deformity, congenital conditions, and other syndromes. Hip dysplasia is more common in females than males (3, 4, 5).

Early detection of hip dysplasia is very important for diagnosis and treatment of this disorder. With clinical examination doctors can detect the stability or instability of the hip using the Ortolani and Palmen-Barlow tests (1, 6, 7).

Plain x-rays do not give a lot of information about the hip until the infant is approximately three months old, because of the cartilage structure of the hip. Radiography is usually used for diagnosis DDH in older infants and children (8).

Ultrasound can image the cartilage of the hip and it is used most frequently in the first 3 months of the infant. Visualization of the cartilage structure of the hip is very important before appearing of the osseous nucleus in the femoral head. Ultrasonography is dynamic

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method which requires experience and training of the examiner for getting relevant data of the examined hip. It has ability to detect abnormal position, instability and dysplasia not evident on clinical examination and it can be used for monitoring DDH while treated (7, 8).

This technique was introduced for the first time by Reinhard Graf in 1980 (5).

The treatment for hip dysplasia depends on the age of the patient and on the type of the hip disorder according to the Graf method. Abduction brace, Pavlik harness, Hilgenrainer apparatus, close reduction and open reduction if necessary are used in treatment of DDH (1, 8, 9, 10, 11).

AIM

The aim of this study is to analyze the results of ultrasound screening of the hips in newborns and infants

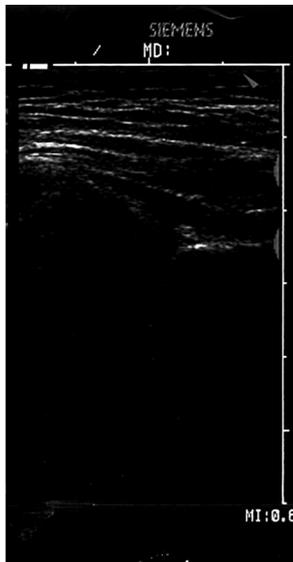


Fig. 1 Normal ultrasound of the hip



Fig. 2 Dysplastic hip, Graf type 2

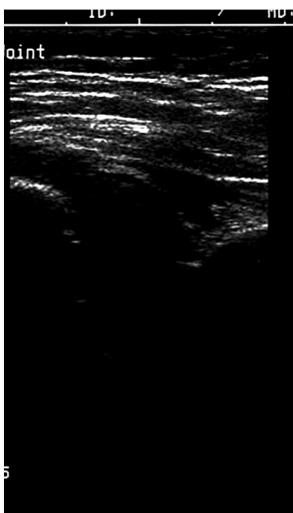


Fig. 3 Subluxated hip, Graf type 3

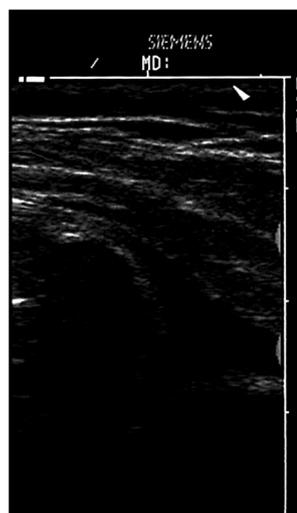


Fig. 4 Luxated hip, Graf type 4

and to establish the importance of ultrasonography in early diagnosis and treatment of developmental dysplasia of the hips (DDH).

MATERIAL AND METHODS

In 2010, at the Clinic for orthopedic surgery in Skopje, 6333 newborns and infants were examined. They were from 1 to 6 months of age. The patients were classified in 2 groups: first group consisted of patients with normal ultrasound findings (Fig. 1), and second group consisted of patients with DDH on ultrasound finding (Fig. 2, 3, 4).

All the patients underwent clinical examination and ultrasonography of the hips.

Method of clinical examinations was applied on all patients. We carried out clinical examinations to assess the stability of hip joints with help of Palmen-Barlow test and Ortolani test. Also, passive range of motion was checked for normal or reduced hip abduction, leg length discrepancy and asymmetry of the gluteal folds (2, 4, 12). Ultrasonographic method was done with ultrasonograph and linear transducer of 7.5 MHz frequency. We analyzed the centricity of the femoral head, bony coverage, alpha and beta angle for measurement the acetabular dysplasia. With all this parameters we defined the type of the hip dysplasia according to Graf method (12).

In the Graf method, the hip is evaluated by measuring two angles formed by three lines drawn from three landmarks, namely the lateral edge of the acetabulum, the bottom of the acetabulum and the acetabular labrum. These three lines are: the bony roof line, the baseline and the cartilage roof line measured at the acetabular labrum. After these lines have been drawn, the bony roof angle (known as alpha angle) and the cartilage roof angle (known as beta angle) are determined (Fig. 5) (13).

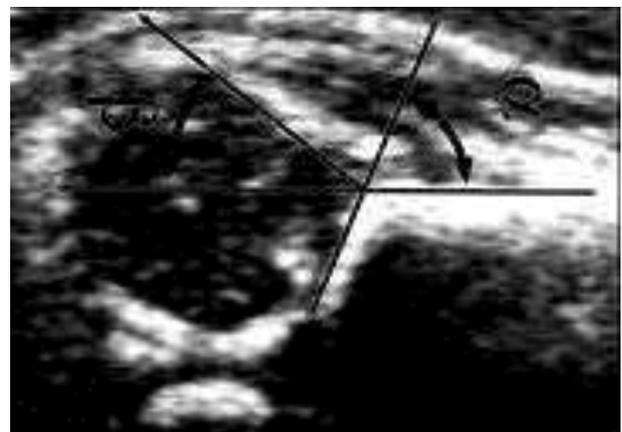


Fig. 5 Alpha angle-bony roof and beta angle-cartilage roof

Type	Alpha angle	Promontorium	Beta angle	Age
I	> 60	Angular	< 55	Any
IIa+	50–59	Rounded	Covers the fem. head	0–12 weeks
IIa–	50–59	Rounded	Covers the fem. head	6–12 weeks
IIb	50–59	Rounded	Covers the fem. head	> 12 weeks
IIc	43–49	Round. to flat	< 77, Covers the fem. head	Any
IId	43–49	Round. to flat	> 77, Dislocated	Any
IIIa	< 43	Flat	Shifted superiorly	Any
IIIb	< 43	Flat	Shifted superiorly	Any
IV	< 3	Flat	Shifted inferiorly	Any

Table 1. Classification of DDH according to Graf method

RESULTS

We examined 6333 newborns and infants up to 6 months of age, 3213 were female and 3120 were male. In the first group there were 5932 (93.67%) patients with normal ultrasound of the hip-Graf Type 1. In the second group there were 401 (6.33%) patients with DDH on ultrasound. The patients of the second group were divided in 3 types according to Graf method (Table 1). Graf Type 2 — Patients with dysplasia 378 (5.97%) subdivided in 2a- 260(4.11%) patients, 2b 85(1.34%) and 2c 33(0.52%) patients. Graf Type 3 — Patients with subluxation of the hip 9 (0.1%), subdivided in 3a 3 (0.05%) patients and 3b 3 (0.5%) patients. Graf Type 4 — Patients with luxation of the hip 17 (0.27%).

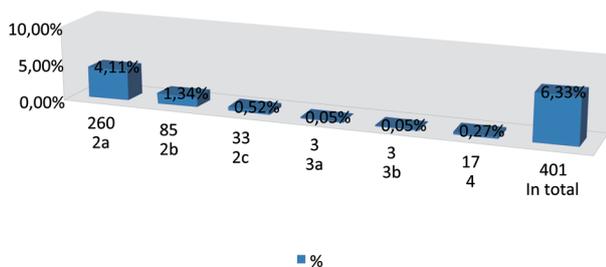


Table 2. Distribution of the patients with DDH according to Graf method

124 patients (30.5%) with DDH had associated risk factors (65 patients with positive family history, 48 patients with breech delivery and 11 patients with club-foot deformity).

Treatment of dysplastic hips depends on age of the patients.

We had 387 patients up to 6 months of age who had dysplasia or subluxation of the hips. They were treated with abduction brace or Pavlik harness and exercises of the adductor muscle. Duration of the treatment was between 2 to 6 months. After one year follow up only 8 patients had a residual dysplasia.

17 patients up to 6 months of age with luxated hips were treated with exercises, overhead traction of the

muscles and close reduction of the hip placed in spica cast. Patients were placed in spica cast for 6 weeks, and after that Pavlik harness for another 6 weeks or more, depends of the case.

We performed an open reduction in 3 patients with luxated hips, because it was necessary (7, 8, 10, 14).

In one patient with luxation of the hip, after treatment with closed reduction and spica cast, we had a complication- an avascular osteonecrosis of the femoral head. The follow up period was 1.5 year (Fig. 6, Fig. 7).



Fig. 6 MRI of osteonecrosis of the femoral head



Fig. 7 Radiography of osteonecrosis of the femoral head

DISCUSSION

Ultrasonography is a method of choice for early diagnosis of developmental dysplasia of the hip (DDH) in newborns and infants. It is simple and non-invasive method for visualisation of bony and cartilage structures of the hip. While treating the DDH, it gives possibility for multiple performances and for monitoring (14, 15).

It is a sensitive method for visualisation of the hip in infants up to 6 months of age, especially before appearing the osseous nucleus in the femoral head. It can detect minimal abnormalities of the hip which are not diagnosed with clinical examinations (1, 6, 7).

Many authors reported their results in diagnosis of DDH with ultrasonography.

Rosendahl et al. report that in the Norwegian newborn population approximately 85% of the infants have morphologically normal hips (based on the alpha-angle) while 12% have immature and 3% dysplastic hips (15).

Finnbogason et al. report that the dynamic ultrasound outcome was with 88% stable hips, 10% unstable and 2% dislocatable (12).

Holen et al. reported a 6.1% incidence of neonatal hip instability in breech patients determined by clinical examination and confirmed by dynamic ultrasonography (16).

Treiber M et al. give results of ultrasound screening of the population in Maribor region, where 84.9% of the hips were mature, 14.1% were immature and 1.1% were subluxated or luxated (17).

In the world literature the number of newborns with DDH is between 2 and 3%.

In our study 93.67% of the newborns had normal hips and 6.33% had DDH. In patients with dysplasia (5.9%) there were 0.1% patients with subluxation and 0.27% with luxation. This is a large percent of newborns which needed an adequate treatment.

Patients with dysplasia or subluxation of the hips are treated with braces and harnesses. Both, the braces and harnesses, are used for holding the hip in an abducted and flexed position, which allows best orientation between the femoral head and the acetabulum, allowing the hip joint to remodel and develop normally (1, 7, 11, 14). Patients with luxation of the hips are treated with close reduction of the hip placed in spica cast or open reduction if necessary (7, 8, 10, 14).

Osteonecrosis (ON) of the femoral head is one of the main complications associated with treatment of developmental dysplasia of the hips (DDH). The reported rates of ON vary widely between 6% and 48% (18, 19, 20).

CONCLUSION

Ultrasound screening of the hips in newborns and infants is important for early diagnosis of DDH. This is necessary for adequate treatments. If this disease is not treated properly it gives long term morbidity such as gait abnormalities, chronic pain and degenerative arthritis.

Analysis of the results of ultrasound screening of the hips in our population showed that there is a significant number of dysplastic hips.

Sažetak

REZULTATI ULTRAZVUČNOG SKRININGA KUKOVA KOD NOVOROĐENČADI I ODOJČADI

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Cilj ove studije je analiza rezultata ultrazvučnog skrininga kukova kod novorođenčadi i odojčadi i utvrđivanje značaja ultrasonografije u ranoj dijagnostici razvojne displazije kukova.

Materijal i Metode: studijom je obuhvaćeno 6333 odojčadi i novorođenčadi pregledanih 2010. godine na Klinici za ortopedsku hirurgiju u Skoplju. Ispitanici su podeljeni u dve grupe: grupu sa normalnim ultrazvučnim nalazom kukova i grupu sa pacijentima kod kojih je ultrazvučnim pregledom nađena razvojna displazija kukova.

Svi pacijenti su podvrgnuti kliničkom pregledu i ultrasonografiji kukova.

Rezultati: Pregledano je 6333 novorođenčadi i odojčadi starosti do 6 meseci. Ženskog pola je bilo 3213, a muškog 3120. U prvoj grupi je bilo 5932 odojčeta (93,67%) sa normalnim nalazom ultrazvučnog pregleda kukova — Graf Tip 1. U drugoj grupi je bilo 401 (6,33 %) odojče sa nalazom razvojne displazije kukova pri ultrazvučnom pregledu. Odojčad druge grupe su potom dalje klasifikovani prema Grafovom metodu. Graf Tip 2 — 378 (5,97%) slučajeva sa displazijom podeljenih 2a 260 (4,11%), 2b 85 (1,34%) i 2c 33 (0,52%) subtip. Graf Tip 3 — slučajevi sa subluksacijom kuka 9 (0,1%) dalje su klasifikovani na 3a 3 (0,05%) i 3b (0,5%) subtipove. Graf Tip 4 — slučajevi

sa luksacijom kuka 17 (0,27%). 124 (30,5%) slučajeva sa razvojnom displazijom kukova su imali i pridružene faktore rizika: 65 sa pozitivnom porodičnom anamnezom, 48 sa karličnom prezentacijom prilikom porođaja i 11 sa urođeno krivim stopalima. 378 pacijenata sa razvojnom displazijom kukova Graf Tip 2 i 9 sa subluksacijom kuka je lečenu pomoću abdukcionijskih rektivnih stega i Pavlikovih remenčića. 17 pacijenata

sa luksacijom kuka je lečeno odgovarajućim vežbama i gipsanom imobilizacijom.

Zaključak: Ultrazvučni skrining kukova kod odojčadi je neophodan za rano otkrivanje razvojne displazije kukova, kao i za adekvatan pravovremeni tretman.

Ključne reči: razvojna displazija kukova, ultrasonografija.

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