Risk Factors for Development of Hip Disorder Among Newborn Babies in Tesanj Region

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Introduction: Development disorder of the hip is a congenital, dynamic and progressive disease where there is disorder in the development of all elements of hip that is clinically shows as functional disorders. Aim: To determine clinical and statistical arthrosonographic representation of developmental disorders of the hip at newborn babies in Tesanj region, with or without risk factors. Material and methods: The subjects are 300 newborns born in Tesanj region, which are examined in the orthopedic clinics in the period from October 1st 2008 to May 1st 2009. Results: The youngest child in the studied sample had an examination in the first nine and the oldest 42 days, an average of 33 days. In the studied sample representation of the firstborn children was 179, and second born children 97, third born 23. Only one child was born from the fourth pregnancy. Positive family history had 26 children and negative 274. Natural way was born four children, by Caesarean section 51 children. One child was born early but naturally. On time 244 children were born by normal natural way. Of firstborn children, the representation of female children was 80, and the male 99. 6 children were born as twins. Associated anomalies were found in two of the examined children; agenesis of fibula and pes equinovarus. One risk factor had 113 children, two 27 and three risk factors at one child. The remaining 159 children had no risk factor for a developmental disorder of the hip. Discussion: Developmental disorder of the hip is the most common developmental anomaly, which occurs in all races and ethnic groups, ranging from 0.4% to 6%. It is more common in female than male children in the ratio of 1:4 to 1:10. Mutual disorder appears more than one-sided reports. Sided phenomenon affecting more left than right hip. Developmental disorder of the hip is often associated with other developmental abnormalities. Early detection of initial disturbances in newborn is crucial, because of using of early traumatic therapy, which reduces the incidence of operative treatment and secondary complications. Conclusion: Developmental hip disorders in children in Tesanj region, defined by hip sonography Graf, were found in 4.33% cases. If the borderline cases of type I by Graf included in the category of children with possible spontaneous evolution from type I to type II (no prevention measures), the incidence of RCC would be 10.66%. Almost half of children (141) of the investigated sample have a risk factor in the anamnesis. Remarkably high percentage of children born caesarean. The greatest correlation of risk factors, was determined in children with a positive family history, were born with abnormalities of the loco motor apparatus and natural way of born. Key words: Developmental disorders of the hip, sonography

1. INTRODUCTION
Developmental hip dysplasia is a congenital, dynamic and progressive disease in which there is disorder in the development of all elements of the hip joint, resulting in complete dislocation of the joint parts with all the functional disorders (1). The term “developmental disorder of the hip (DDH) encompasses all levels in the development of these anomalies: dysplastic, subluxated, and dislocated hip (2).

The first descriptions of RPK gave Hippocrates. A significant contribution to the knowledge of the diagnosis is given by Ortolan and Palmen, Lorenz, in the treatment of plaster, Hilgenreiner and Pavlik with their apparatus, and in prevention Roser (3). The significance of surgical treatment of DDH has given in his works Chiari 1955 introducing a pelvic osteotomy, Pemberton in 1959 by etabulum covering and Salter in 1961 with innominate bone osteotomy and later with triradiat osteotomy (4). It is known for
certain that the DDH occurs in utero, and happens more frequent in children with positive family history, among the firstborn female children, twins, breech birth or Caesarean section, children who have other congenital anomalies, particularly of the locomotor apparatus (5,6). Identified are also other risk factors such as pelvic disproportion of mother and fetus, the lack of amniotic fluid (oligohydramnios), heavy and extended labor ... (5).

Radiographic hip examination is valid when the child reaches 3 months of life. This is because part of hip cartilage is replaced by bone mass and ossification core of the femoral head forms (7).

Sonography provides an absolutely safe intrauterine visualization of the hip or in the first days of life of a child. In this age most of the hip joints are made of cartilage, which provides a broad “ultrasonic window and display a large portion of the hip joint. In Europe, hip ultrasonography is used according to Graph (3). For completely correct interpretation of the sonogram has to be shown seven anatomical structures: cartilage-bone border, head of the femur, the transitional groove, joint capsule, labrum acetabula, cartilage acetabula roof, bone acetabulum.

Drawing the base line which is tangential to the iliac bone wing and passing through the intersection and perichondria periosteal or through a place where the periosteal becomes perichondria (11). The second line is a line of the bony roof. It starts from the lower edge of the os ilium, the bottom of the acetabulum and passes tangentially through the bony acetabula roof angle creating alpha. The other line is drawn from the cartilage roof start with bony bay windows and passes through the center of labrum acetabula making the angle beta. The angle beta indicates the center of labrum acetabula making the bay windows and passes through the bony acetabula roof angle, bone acetabulum and passes tangentially through the bony acetabula roof angle creating alpha. The other line is drawn from the cartilage roof start with bony bay windows and passes through the center of labrum acetabula making the angle beta. The angle beta indicates the center of labrum acetabula making the bay windows and passes through the bony acetabula roof angle.

2. GOAL

The goals of research are: to determine the clinical and arthrosonographic finding the hip in newborns in the hospital Tesanj, determine the prevalence and clinical and statistical significance of sonography findings in infants with risk factors and no risk factors, to propose recommendations for early detection of persons with increased risk for DDH.

3. MATERIAL AND METHODS

Subjects are 300 newborn infants in Tesanj region, which were examined in an orthopedic clinic in the period from October 1st 2008 to May 1st 2009. The first ultrasound examination was performed in infants who were not older than 45 days.

After taking the anamnesis data from the parent started clinical examination of the newborn. Formed is a questionnaire in which they entered the data used for statistical analysis. In addition to basic data such as general data, sex and age entered the data on the order of pregnancy, type of pregnancy (normal, twins). In the section on birth, entered the data on the type of delivery (normal, premature, by Caesarean section), followed by details on the fetus (head first, breech birth) and birth weight.

Entered are the data on the associated anomalies such as congenital pes equinovarus, pes valgus and other anomalies and the occurrence of developmental anomalies of the hip in first degree relatives, and information on family history. In a special section were possible remarks.

Separate questionnaire was used for statistical analysis of the data about the DDH risk factors: positive family history, the firstborn female child, breech birth, birth by Caesarean section, twin pregnancy, premature birth, congenital anomalies of the musculoskeletal system, pes equinovarus, pes equinovalgus, various forms of dysplasia, and agenesis. The part of the questionnaire was designed for clinical examination of the hips collected are the data on asymmetry of gluteal, inguinal and femoral groove (Bade sign), the result of abduction test separately for each hip: Ortolani luxation and Palmen reposition sign. Clinical examination was performed by hip sonography. Used is ultrasound machine “Toshiba” with linear probe of 7.5 MHz. Method used is by Reinhardt Graf.

With tests of statistical significance determined is inferential statistics—tests of implicit (additional) and explicit (main) research hypotheses by nonparametric method,—χ² test (Chi-square test).

4. RESULTS

The youngest child in the sample had 9 and the oldest 42 days, an average of 33 days. In the baseline there was 179 (59.67%) first born, and the second born in 97 (32.33%), third-born 23 (7.66%)
cases. Only one child (0.33%) was born from the fourth pregnancy. Positive family history in the sample had 26 (8.67%) children, while with negative family history was 274 (91.33%). Breech birth was in case of 4 children (1.33%), born by Caesarean section were 51 (17%). (Figure 1). Premature, but naturally born is 1 (0.33%) child. Normal and natural way in the term was born 244 (81.33%) children. From the first-born children, in the sample were 80 (26.67%) female children and 99 (33.00%) male.

As the twins were born 6 (2%) children. Associated anomalies as a risk factor for DDH were found in two children. In one it was an agenesis of the fibula and lateral side of the foot, while in the second the congenital pes equinovarus. With only one risk factor for DDH was 113 (37.67%) children, with two risk factors for DDH 27 (9%) and three risk factors for DDH is born only 1 (0.33%) child. The remaining 159 (53%) children had no risk factor.

Testing of hypotheses about the significance of differences of research parameters (characteristics) in relation to individual risk factors in the sample is presented in Table 1

In the Table (1) NCFT is short: there are no conditions for the testing of hypotheses. NCFT label indicate the fact that at least one cell in the corresponding contingency table have frequencies of 5 or lower.

Based on the tables and rules of reasoning we conclude that for the studied sample:

- There is no correlation between individual risk factor and gender (p = 0.4675);
- There is no correlation between individual risk factors and the order of birth (p = 0.1599);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and pregnancy;
- There are no conditions for testing hypotheses about the relationship of individual risk factors and types of birth;
- There are no conditions for testing hypotheses about the relationship of individual risk factors and family history;
- There is no correlation between individual risk factors and positive Bade sign (p = 0.2228);
- There is no correlation between individual risk factors and positive Abduction test (p = 0.7939);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and positive Ortolani sign;
- There are no conditions for testing hypotheses about the relationship of individual risk factors and positive Palmen sign;
- There are no conditions for testing hypotheses about the relationship of individual risk factors and the angle alpha (right);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and the angle alpha (left);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and types of hip according to angle alpha (right);
- There is no correlation between individual risk factors and types of hip according to angle beta (right) (p = 0.4897);
- There is no correlation between individual risk factors and types of hip according to angle beta (left) (p = 0.1888);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and types of hip according to Graf (right);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and types of hip according to Graf (left);
- There are no conditions for testing hypotheses about the relationship of individual risk factors and types of hip according to angle alpha (left);
- There is no correlation between individual risk factors and types of hip according to angle beta (left).

Sonographic examination revealed DDH in 13 (4.33%) children from which 9 female and 4 male children. In case of 3 children it was a bilateral, and in 10 the unilateral DDH, which makes a total of 16 from which was 8 right and 8 left DDH. In our sample, 287 children had type I by Graf, 12 type II according to Graf, one child type III according to Graf. From a total of 16 altered hips 15 were type II and only one type III according to Graf. We did not found any hip of type IV according to Graf.

Clinical examination of 141 children in whom is determined the presence of risk factors, medical history, clinical signs were found DDH in 33 (23.40%), and of 159 children who have not any anamnestic risk factor was 26 (16.34%) children with clinical signs of DDH.

In 26 children who had a positive family history 16 had no other risk factors for DDH. In the remaining 5 (31.25%) children were found clinical signs of DDH and it was found in 4 cases Bade positive sign, and one child with a positive Ortolani Palmen sign.
Out of 80 first-born female children 59 had no other risk factors for DDH. From which 18 (30.50%) had clinical signs of DDH: 13 positive Bade sign, 4 abduction positive test and 1 positive for both these characters.

From 4 children who were breech born none had clinical signs of DDH.

From 51 children that were born by caesarean section 32 had no other risk factors for DDH. Clinical signs of DDH at birth by caesarean section had 2 (6.25%) children. In one was found positive Bade sign, and the abduction positive test in other.

For children from twin pregnancies, there were no clinical signs of DDH and with one child who is born prematurely. With congenital anomalies of the locomotor apparatus, there were two children. Neither of them have clinical signs of DDH.

Two risk factors for DDH had 27 children. In 19 there were no clinical signs of DDH and were found in 8. Clinical signs of DDH in 8 children are manifested: a positive Bade sign had a 4, a positive abduction test 2 and a positive sign for both of these 2 children.

Three risk factors had only 1 child in without clinical signs of DDH.

Without risk factors were 159 children. Clinical signs of DDH were found in 26 (16.35%) and a positive Bade sign in 19, abduction positive test in 2 and a positive sign of both in 5 children.

Analysis of 141 children with confirmed anamnestic, clinical risk factors, sonographic DDH was found in 4 (6.38%), and from 159 children without medical history or clinical risk factors for sonographic DDH was found in 4 (2.51%).

In relation to individual risk factors was found sonography of hips following conditions:

From 16 children with positive family history, and without other risk factors, by sonography DDH was found in 2 (12.50%).

Out of 59 first born girl child, and without other risk factors was found by sonography DDH in 4 (6.77%).

From 32 children born by Caesarean section, and without other risk factors, only 1 (3.12%) had sonographic signs of DDH. One child from a twin pregnancy and one that is born premature, and without other risk factors had sonographic healthy hips (type I by Graf).

With congenital anomalies of the locomotor system in the sample were 2 children, both male. In one it was a congenital bilateral pes equinovarus, while in another the fibula and lateral agenesis of the right foot. In one was found sonographic DDH of the right hip.

From the 27 children with two clinical risk factors for DDH by sonography was diagnosed in 3 children (11.11%). In one child with three clinical risk factors there was no sonographic diagnosis of DDH. Out of 159 children from the tested sample at which it is not established in a single clinical risk factor, at 4 (2.51%) there was sonographic diagnosis of DDH.

In relation to individual risk factors by sonography of the hips was found the following conditions:

From 7 children with positive family history, and without other risk factors, DDH was verified by sonography in one case.

Out of 13 firstborn female children, and without other risk factors did not nor by a sonographic diagnosis of DDH, Of 21 children who were born by caesarean section DDH was diagnosed by sonography in 2 children. Only one child was born from a twin pregnancy with sonography diagnosed DDH.

The maximum value of the angle alpha that was found on the right hip is 78°, minimum 48°, and the mean value of 70.44°. The maximum value of angle alpha on left hip is 78°, minimum 43°, and the mean value of 70.40° degrees (Figure 3).

The maximum value of the beta angle on the right hip was 82°, minimum 39°, and the mean value of 46.85° degrees. The maximum value of the angle beta on the left hip was 83°, minimum 39°, and the mean value of 47°.

Most often value of angle alpha at the first examination of children in the sample was on the right hip 75° (41 times), 72° and 70° (37 times). The left hip angle commonly found value of alpha is 75° (43 times) 72° (35 times) and 70° (35 times).

Most frequent value of the angle beta in the right hip in the sample was 45° (30 times), 44° (29 times) and 48° (25 times). The most common value of left hip angle beta was 44° and 45° (29 times), and 46° (25 times).

Prevention, broadly folded, abduction exercises, treatment with Pavlik stripes and Hilgenrner tracks were involved from the first examination, diagnosis (Figure 4). Four weeks after the first clinical and sonographic examinations all children were reviewed for the second time. Clinical examination in neither one child from each sample was reported positive abduction test, and Palmen-Ortolani sign. All had asymmetric inguinal and femoral grooves, Bade positive sign, as at baseline. Any child who at the first examination had sonographic type I by Graf, had sonographic type I also at the second examination. From the 13 children who at baseline had sonographic type II and type III by Graf, 10 patients (76.92%) were diagnosed with type I. Three children still had type II according to Graf.

At the third examination in the sample, by sonography were established DDH in two children, one male and one
female. All children who at baseline had sonographic findings of DDH at the fourth review were healthy.

Measuring the angles alpha and beta in the second, third and fourth review is followed by maturation of acetabulum. The average value of angle alpha at baseline in healthy children in the sample was 71°, second 73°, third 73.5° and fourth 74°, while the average value of the angle beta at baseline was 46.5°, second 44°, on third 43.2° and fourth 42.8°. (Figure 3)

5. DISCUSSION

Developmental hip dysplasia is the most common developmental anomaly of the locomotor apparatus. It occurs in all races and ethnic groups, ranging from 0.4% to 6% (1,2). It is more common among the Slavic people, Navaho Native Americans... There are so called luxogenic zones such as the Valley of Zeta in Montenegro and Eastern Herzegovina, where the incidence of 9% is found (2). It is much more common in female than in male children and occurs at a ratio of 1:4 to 1:10 in favor of female children (12). More frequent is bilateral than unilateral. In cases of unilateral occurrence affected is more often the left hip than right. It is not rare that DDH is combined with other developmental anomalies (2).

Developmental hip dysplasia (DDH) is the most common disease of the joint. It is manifested as a dislocation in children and in adults as coxartrosis (9). Early detection of initial disorder in newborns and early atraumatic application of the therapy reduces the incidence of surgical treatment and secondary complications (10).

In our prospective study that was conducted in Tesanj from October 1st 2008 to May 1st 2009 we examined 300 children. The sample consisted of only those children who at the time of initial examination were not older than 45 days. The sample includes approximately one-half of children born in this region in time when the research was done. This data indicates that the method of early detection of DDH by sonography is not accepted method by the doctors who deal with this problem on Tesanj region. The incidence of DDH is different and varies in a range from 2-50 or even more per 1000 deliveries (2). For the big difference in the frequency the result is uneven terminology, the size of the study population, ethnic characteristics, and the child age during the examination, the experience of doctors, examination techniques and interpretation of results (5). The lowest incidence is in Hon Kong 0.01%, followed by Northern Ireland 0.14%, Sweden 0.17%, USA by 0.2% to 0.4%, in the UK about 1.5% (2.6,8,12).

In Croatia, according to reports from several places DDH screening results show that the incidence is around 2%, although there are regions where it was 0.2% and even higher than 4% (13). The incidence of DDH in Serbia in recent years is around 2%. During 2002 and 2003 at the Department of Gynecology and Obstetrics in Novi Sad and the Institute of Orthopedic-Surgery “Banjica” clinically is examined 4016 newborns by ultrasound and found the incidence of DDH was 1.95% (14). Results of the first screening in Bosnia and Herzegovina, which was carried out in the Tuzla region at the sixties of last century, say that the incidence of DDH us 4.9%, followed by 6.3% (1,7). According to recent findings, the United Kingdom has the highest incidence of DDH in the whole Europe (7).

Data obtained by analysis of the sample indicate that the incidence of DDH in the Tesanj region is high (4.33%) and it is higher than in developed countries of Europe and neighboring countries in the region.

Breech birth was in 4 (1.33%) cases in the sample. The reports from Zagreb, Rijeka, Slavonski Brod in neighboring Croatia is that the breech birth is present in 2-3% of children (5). Born by caesarean section in the sample are 51 (17%) children. The incidence of caesarean deliveries in the sample is as in developed European countries but lower than in the USA and Canada. According to WHO reports from 2002 and 2004 the incidence of caesarean birth in most developed countries is 10% to 15%, while it is slightly higher in the United States 20% and Canada 22.5%. These data, and data regarding the incidence of breech birth vary from region to region, and considering that a large number of deliveries by Caesarean started as breech birth and the birth by caesarean section has become a kind of trend, these data must be taken with a grain of salt.

The incidence of developmental dysplasia of the hip detected by clinical examination in the literature varies from 1.66% (4), to 40% (15). These data do not depend only on the assessors, but also by region and time in which the research was done, and the age of children at the time of the hips examination. During sixties Soc and Brecelj SOC performed DDH research in Donja Zeta and found that the incidence of DDH is more than 40% (1,15). At the same time the data is completely contrary to Barlow and sets a very low incidence rate of DDH. He surveyed children at birth and then followed up to age 4 months and came to the conclusion that 60% of hips that are unstable at birth, stabilize in the first week and 88% in the next 2 months. The remaining 12% had residual instability. These data indicate that only a clinical examination is insufficient and unreliable method of screening of DDH but that it should be done within the inspection of children's hips.

Most investigators agree that hereditary plays a significant role in the development of DDH, and that about 20% of children with DDH have a positive family history (6,8). In our sample 4 (30.76%) children with DDH have a positive family history, which is more than the specified data from the literature.

Of 59 first-born female children from the tested sample, only 2 (3.38%) has a developmental disorder of the hips. The incidence of DDH in first-born female children is even lower than in the whole sample, but higher than in children without risk factors, where the incidence is 2.51%.

Some say that more than 30% of children with DDH are firstborn female children (3). A number of authors have not point out to female first-born children, because they believe all the first-born child, regardless of sex are at increased risk of DDH due to rigid walls of the uterus, and insufficient space for the development of the fetus. For female children the risk is increased because of greater amounts of estrogen that leads to looseness of the hip joint capsule (4).
and delivered prematurely within the tested sample has been no outbreak of DDH. In prematurely born children (one in each sample) was established DDH. Many authors believe that the lower risk of DDH is in these children because of better relations between the size of the fetus and the uterus. Data from this study speak in favor of it.

For breech born children in our sample, there was no occurrence of DDH, which is not consistent with data from the literature where it is stated that 20% of children with DDH had breech birth.

6. CONCLUSION

The incidence of DDH in children in the Tesanj region determined by sonography of the hips and using the Graf method was found in 4.33% of cases but is significantly higher than in developed European countries and USA. If the borderline cases of type I by Graf are included in the category of children with possible spontaneous evolution from type I to type II (without prevention), the incidence of DDH would be 10.66% which is almost 2.5 times more than established. Incidence of DDH in children with risk factors is 2.5 times more frequent than in children without risk factors. Prevalence of risk factors in the sample is high. Nearly half of the children (141 or 47%) from baseline have at least one risk factor for DDH in anamnesis. Notably, a higher percentage of children are born by caesarean section.

The highest correlation between risk factors and DDH in the sample was found in children born with anomalies of the locomotor apparatus (50%) with positive family history (12.50%), and children with two risk factors (11.11%).

There was no significant correlation between DDH in first-born female children and birth by caesarean section, although it is slightly higher than in children without risk factors. Twin pregnancy, breech birth and preterm birth have no significance for the occurrence of DDH in our sample. The curve of the value of angles alpha and beta indicates that the potential of acetabula bone maturation is very good in the first 6 weeks. From 6 until the late 12th week ossification potential of acetabulum is good, and after that period begins to weaken. Clinical examination is not a reliable screening method of DDH. Significant differences in clinical and sonographic findings point to the possibility of diagnostic errors. Healthy children can be declared to be ill or sick to be healthy, which can have serious consequences. Clinical examination must not be omitted, and the first clinical examination should be carried out already at the maternity ward. Sonography is a reliable method of detecting DDH in newborns. Method by Graf is practical and applicable. The possibility of error in estimating the type of hip by Graf is only in borderline cases. Therefore, the limiting case of type I and type II should be treated as type II, in order to avoid unwanted consequences.

Sonogram hip examination should be introduced as mandatory for all newborns and should be done in the first 6 weeks when ossification potential for maturation of acetabula is biggest, so the results of prevention and treatment of developmental dysplasia of the hip is the best.

REFERENCES