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*Biomechanical prenatal factors for the development
of congenital hip dysplasia*

Biomechaniczne czynniki prenatalne wpływające na powstawanie wrodzonej
dysplazji stawu biodrowego

The aetiology of congenital dysplasia of the hip joint (CDH) which can also be called “developmental dysplasia of the hip” (DDH) is multifactorial. There are various known influences including: genetic factors, hormones influence and biomechanical factors. Biomechanical factors can influence the hip growth during both the prenatal and postnatal periods. These biomechanical factors are not only on the child’s side, but also on the mother’s side, which is presented in this article. The “syndrome of contractures”, which we very often observe in children, is a very decisive influence for the development of congenital hip dysplasia and it is described by many authors (2, 3, 5, 11, 12, 13, 14).

THE “SYNDROME OF CONTRACTURES”

The clinical picture of the “syndrome of contractures” was especially extensively described by *Ma u* who called it in German “*Siebener-Kontrakturen-Syndrom*” because the number of contractures we can most often observe is seven (11). Other authors also describe the “syndrome of contractures”; *Lübbe* and *Beckmann* called this syndrome “*Schräglagedeformitäten*” (10). The growth of the child takes place in the limited space of the uterus which causes the oblique position of the child and is the cause of the “syndrome of contractures”. Others, such as *Lloyd-Roberts* and *Pilcher* describe the syndrome of contracture as “*modulary syndrome of children*” (9). *Karski* called it in Polish “*zespół przykurczów*” – which means exactly “a set of contractures” (5, 6). An-



Fig. 1, 1a. Child - Karolina S., 6 weeks old. Syndrome of contractures of the left side

other doctor from the Paediatric Orthopaedic Department in Lublin who also researches into the field of paediatric orthopaedics and also describes the "syndrome of contractures" is Tarczyńska (12, 13).

The "syndrome of contractures" consists of: 1) plagiocephaly, 2) torticollis, 3) asymmetry (deformity) of the chest, 4) infantile scoliosis (very early disappears after simple treatment or without treatment), 5) the contracture of adductor muscles (mostly the left hip) which often leads to dysplasia of the left hip; 6) the contracture of abductor muscles (mostly right hip) which is later very often the etiological factor of the so-called idiopathic scoliosis (6), 7) foot deformities (Fig. 1, 1a).

MATERIAL AND DATA ON THE MOTHER'S AND CHILD'S SIDE INCLUDED IN THE EXAMINATION

The material includes 123 women aged 18–39, who have been observed during the whole gravidity, especially during the last three months of the pregnancy, and their 123 babies. Various factors leading to congenital dysplasia of the hip have been observed and analysed during the research.

On the mother's side the following data have been taken into account: 1) mother's age and height, 2) weight before the conception and just before the labour, 3) anthropometric features of the pelvis, 4) kind of pregnancy, 5) kind of the labour, 6) the number and course of pregnancy, 7) the presence or absence of some malformations in the family, 8) the style of living and working, before and during pregnancy, 9) the sonographic examination providing the information about the position of the fetus, 10) the quantity of the amniotic fluid and possible pathology in the fetus.

On the baby's side the following data have been taken into account: 1) clinical examination within 1-5 days after the birth, 2) kind of labour, 3) baby's sex, 4) the weight of the newborn, 5) the length of the newborn, 6) symptoms of the syndrome of contractures (full or partial symptoms), 7) sonographic examination of the hip joints during the first week after the birth, 8) after 2-3-4 weeks after birth the next sonographic examination of the hip joints was performed.

The observations (research) were conducted at Gynaecology and Delivery Department of Medical University in Lublin¹ in the years 1998-1999. The measurement of mother's body, abdomen and pelvis was done and much information about the course of pregnancy was noted on the basis of the above list. Each pregnant woman underwent clinical and sonographic examination three or four times during gravidity. The last examination was conducted just before the delivery and special attention was given to the child's legs.

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After birth every child was examined minimum two times by an orthopaedic surgeon. In case any abnormalities were discovered in the hips the child was examined more times during the following months and of course was treated. We have observed the new-borns and noted every clinical symptom described and mentioned above on the list.

RESULTS

We noticed that the hip dysplasia on the child's side depends on:

The sex - CDH (DDH) is more common among girls, the ratio girls to boys is 2.1:1 and this observation concerns the 5-6 days old children; within the first 1-5 days after the birth the occurrence in girls and boys is similar and there is very small difference between them. Later, in the second month of life of the child the ratio of girls to boys is bigger. It is 5.25 : 1 and is presented in most orthopaedic books.

Size of the fetus: the weight and the length - our research describes close dependence of big weight and length in girls and boys with coming-in of CDH. The children whose bodies are longer and weight bigger during the prenatal period are more likely to develop hip dysplasia. [(Heikillä writes that there is no dependence between the weight of the fetus and the hip dysplasia (2); Zwiierzchowski and others postulate that low birth weight is a risk factor (15); Walsh and Morrissy see close dependence between the big birth weight and dysplasia of the hip (14)]. We did not find any information in the literature about the birth length.

Oligohydramnion - all the authors talk about compatibility - the oligohydramnion is a risk factor for the development of hip dysplasia. Our research shows that oligohydramnion is a relative negative factor and the most important factor is the ratio of the size of the fetus to the amniotic fluid. A free zone for movement is needed for a normal development of the fetus. If the child is big and there is not enough amniotic fluid the danger of hip dysplasia is greater.

Changes in fetus position during the last month of pregnancy are also very important from the point of view of the development of hip dysplasia. Very frequently, the movement of the child's body and permanent changes of the position of the fetus during the last two months of the pregnancy is connected with hip dysplasia. In the literature, we found no information confirming our observations.

We noticed that hip dysplasia on mother's side depends on:

Mother's age. Generally speaking the children from older mothers are mostly with malformations. This information concerning the increased frequency of the congenital malformation occurrence was not confirmed in our material but is very often proclaimed by many doctors. Nevertheless, in our research we found close dependence between mother's age and the occurrence of congenital hip dysplasia. Kubacki and others also say about the dependence between mother's age and hip dysplasia in her child (7). The incidence of hip malformation increases with the older mother's age (because they have less amniotic fluid!) and this information is proved in our research.

Kind of pregnancy. We did not find any information in the literature, but in our research we found close dependence between the type of mother's body structure and hip dysplasia in babies. Slim and very tall women's children are endangered with hip dysplasia.

Woman's weight ratio. We have analysed the difference between the weight before the conception and just before the labour. Hip dysplasia was more likely to occur with a slight increase in mother's weight during pregnancy. In the literature we did not find any information concerning this subject.

Woman's circumference of the abdomen ratio. We found no information in the literature, but our research shows that a small increase is a risk factor. When the difference of the circumference of mother's abdomen at the beginning of the gravidity and just before the labour is small - the possibility of the hip malformation in the child is greater.

Types of abdomen during pregnancy. Our research shows that pointed abdomen is very bad for the fetus, transversal-oval abdomen is also bad for the fetus, longitudinal-oval abdomen is relatively bad for the fetus, but pendulous (sagging) abdomen is good for the fetus.

The external conjugate diameter of mother's pelvis. As proved in our material hip dysplasia was more likely to occur if the external conjugate diameter of the pelvis was smaller than average. We found no information in the literature concerning this information. The ratio connected with the external conjugate diameter and the inter-crest of mother's pelvis informs precisely about the possibility of CDH. The lower is the ratio of anatomy of the pelvis the greater is the possibility of the development of hip dysplasia. Androgenic pelvis and platypelloid (flat) pelvis (Coldwell and Moloy's classification) - more frequent dysplasia of the hip.

The length of the time of pregnancy. As Hinderaker and others claimed the premature babies are more exposed (4); Dunn, Kubacki and other authors noted that babies born "at term" are more exposed (1, 7). In our research we noticed that babies born in time are more exposed.

Multiple pregnancy. In the literature we have found no dependence between this kind of pregnancy and the incidence of CDH. Our research gave no answer (in the whole material we found only two cases of multiple pregnancy).

Kind of labour. As Kusz and others proved there is a dependence and the development of hip dysplasia after difficult, traumatic and breech labour is more likely to occur (8). In our research we found no information. In Lublin, all difficult pregnancies are treated by Caesarean section.

The number of pregnancy. Many authors write that the babies coming from the first pregnancy are more exposed. Our research provided no clear answer.

The dependence between kind of the fetus position "in utero" and the "syndrome of contractures". The fetus position on the left side of mother's abdomen (the first position - 81%) develops the "syndrome of contractures" of



Fig. 2, 2a. Pointed type of the mother's abdomen. Limited space for the development of the fetus and of its legs. 2a. Child – Grzegorz R., 8 weeks old. Syndrome of contractures of the right side. Dysplasia of the right hip



Fig. 3, 3a. Pointed/transversal-oval type of the mother's abdomen. Child – Wiktorja T., 6 weeks old. Syndrome of contractures of the left side. Dysplasia of the left hip

the left side. The fetus position of the right side of the mother's abdomen (the second fetus position - 15%) develops "syndrome of contractures" of the right side. Other fetus positions are - breech and other presentations - 4%.

Figures 2, 2a, 3, 3a show clinical examples.

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STRESZCZENIE

Wrodzona dysplazja, wrodzone podwichnięcie i wrodzone zwichnięcie stawu biodrowego to nadal aktualny problem dotyczący biodra dziecięcego. W pracy autorzy na podstawie materiału 123 kobiet ciężarnych i 123 urodzonych przez nie dzieci próbują określić, jakie czynniki biomechaniczne działające na rozwijające się biodro w trakcie życia płodowego mogą wpływać na powstawanie dysplazji.

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