

**Sonographic evolution in screening for developmental dysplasia of the hip in newborns**

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**Abstract**

The term developmental dysplasia of the hip (DDH) refers to an abnormal relation between the femoral head and the acetabulum. At birth the femoral head and the acetabulum are mainly cartilaginous, and a normal adult hip joint depends on their correct development. During the newborn period unstable hips are common, but most of these develop normally.1 If subluxation or dislocation persists, anatomic changes develop, and eventually the correct positioning of the femoral head within the acetabulum (reduction) can be achieved only with surgery. Early detection of DDH can enable less invasive and potentially more effective corrective procedures.

Some believe that DDH detected on ultrasonography should be treated very early or should be followed up intensively. The assumption of proponents of ultrasound screening is that untreated cases will have an adverse outcome,7 whereas others believe that the risk of overtreatment is considerable and that the cost-benefit equation for ultrasound screening is not favourable enough.10,12 Consequently, the screening of all newborn infants at birth for DDH using ultrasound imaging is standard practice in some European countries, such as Germany and Switzerland, but has not been accepted in the United Kingdom, the United States, or Scandinavia.13,14 Therefore, we conducted a systematic review to determine the diagnostic accuracy of ultrasonography for detecting DDH in a unselected population of newborns and to assess the impact of ultrasound screening of newborn infants.

**Introduction**

Ultrasound is a rapid, noninvasive, and cost-effective tool for the assessment of the infant hip. With ultrasound, sonographer can directly evaluate the femoral head, composed of hyaline cartilage, and its relationship to the acetabulum. As with any sonographic study, the accuracy of the results will depend greatly on attention to normal and pathological anatomy.

Imaging methods are currently the main clinical auxiliary methods for infants and young children with congenital hip dysplasia, including X-ray, ultrasound, and others. However, X-rays are limited in infant disease screening due to insufficient resolution and radiation .

Ultrasonography has been widely used and popularized in the early screening of infant diseases due to its advantages including easy operation, repeatability, and no radiation damage . Based on this, this study analyzed the value of ultrasound Graf method witch describes [alpha](https://radiopaedia.org/articles/alpha-angle-developmental-dysplasia-of-the-hip-2?lang=us) and [beta](https://radiopaedia.org/articles/beta-angle-developmental-dysplasia-of-the-hip-2?lang=us) angles, in the screening and follow-up of treatment effects in infants and young children with congenital hip dysplasia, so as to provide a reliable basis for clinical diagnosis and treatment.

**Purpose**

Developmental dysplasia of the hip (DDH) is the most frequent inborn deformity of the locomotor apparatus. With ultrasound, sonographer can directly evaluate the femoral head, composed of hyaline cartilage, and its relationship to the acetabulum.

Ultrasound screening is frequently used to identify DDH in view of the brevity of the preclinical period during which diagnosis is possible. Appropriate therapeutic intervention during this period can positively affects the evolution of the disorder.

**Materials and methods**

All examinations were performed in the pediatric department of the Hospital International Medpark from the Republic of Moldova on a number of 385 newborns and underwent ultrasound examinations of both hips, and the findings were classified according to the method described by Graf. Ultrasound investigations of the coxofemoral joints of newborns were performed with the Philips Affiniti 30 ultrasound.

Based on this, this study analyzed the value of ultrasound Graf method witch describes [alpha](https://radiopaedia.org/articles/alpha-angle-developmental-dysplasia-of-the-hip-2?lang=us) and [beta](https://radiopaedia.org/articles/beta-angle-developmental-dysplasia-of-the-hip-2?lang=us) angles, in the screening and follow-up of treatment effects in infants and young children with congenital hip dysplasia, so as to provide a reliable basis for clinical diagnosis and treatment.

For the purposes of the present study, the Graf method [[20–22]](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3553277/#bib5) was used to classify the forms of hip dysplasia on the basis of their ultrasound features, as shown in [Table 1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3553277/table/tbl1/).

### Table 1. The Graf classification of hip dysplasia (Graf et al. 2001).

| **Type** | **Superior bone rim** | **Cartilaginous rim** | **Alpha angle** | **Beta angle** |
| --- | --- | --- | --- | --- |
| 1A Mature hip  (all ages) | Sharp | Thin triangle covering the femoral head | >60° | <55° |
| 1B Mature hip  (all ages) | Blunted | Wide base, short, covering the femoral head | >60° | >55° |
| 2A (+/−)  (up to 1 month) | Rounded | Wide, covering the femoral head | 50°–59° | >55° |
| 2B (>12 weeks) | Rounded | Covering the femoral head | 50°–59° | >55° |
| 2C | Rounded/flattened | Borderline coverage | 43°–49° | <77° |
| D | Rounded/flattened | Compressed | 43°–49° | >77° |
| 3A | Flattened | Compressed cranially without structural alterations | <43° | >77° |
| 3B | Flattened | Compressed cranially with structural alterations | <43° | >77° |
| 4 | Flattened | Compressed caudally | Not measurable |  |
|  |  |  |  |  |

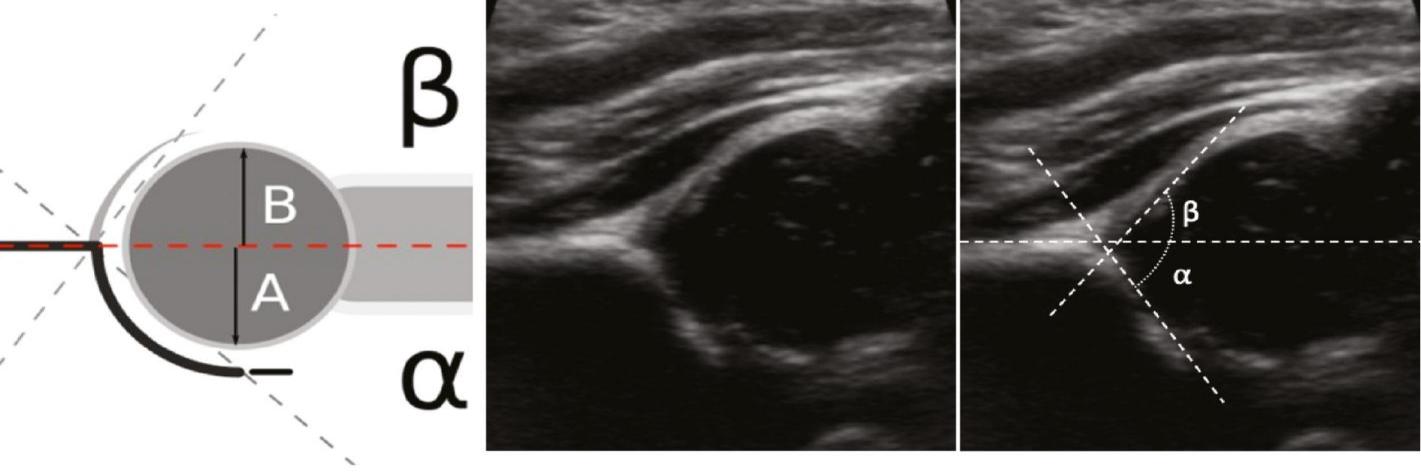
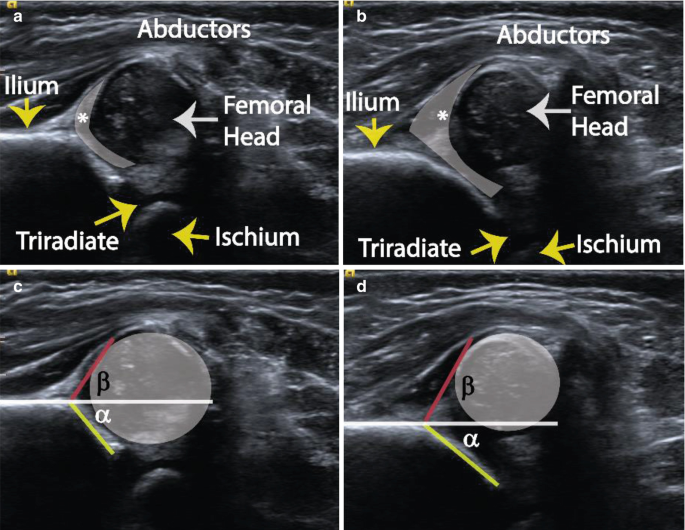
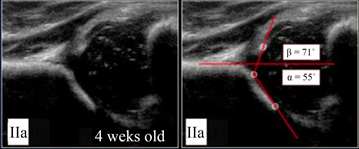
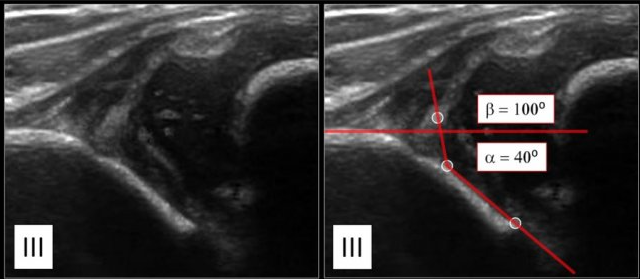


Figure 1. Measuring normal angles by degrees

Figure 2. Graf method for ultrasound classification of developmental dysplasia of the hip.

Figure 3. Ultrasound dysplasia grade II newborns [[23]](Alexiev,%20V.A.,%20Harcke,%20H.T.%20and%20Kumar,%20S.J.%20(2006)%20Residual%20Dysplasia%20after%20Successful%20Pavlik%20Harness%20Treatment:%20Early%20Ultrasound%20Predictors.%20Journal%20of%20Pediatric%20Orthopaedics,%2026,%2016-23.%20https://doi.org/10.1097/01.bpo.0000187995.02140.c7)

Figure 4. Ultrasound dysplasia grade III newborns [[24]](https://radiologyassistant.nl/pediatrics/hip/developmental-dysplasia-of-the-hip-ultrasound#grafs-classification-type-iii)

**Results**

Congenital hip dysplasia is one of the major clinical congenital malformations, and it has a high disability rate for infants and young children. The risk factors include positive family history, breech presentation, and the presence of an unstable hip examination at birth. The left hip alone is affected in 60% of infants, the right hip in 20% of infants, and both hips in 20% of infants.

An explanation behind the left-hip predominance may be attributed to the typical left occiput anterior presentation during vaginal birth. This position causes the left hip to be adducted because it abuts the mother’s lumbosacral spine. Girls’ hips are more sensitive to the ligamentous laxity induced by the maternal hormone relaxin, which is thought to contribute to the higher incidence of DDH in female infants.

A total of 165 hips requiring treatment were observed in 152 children. Hip dysplasia and/or dislocation were diagnosed between the ages of 3 days and 3 months. One month after diagnosis ultrasound findings were normal in 94% of the infants with at least one hip classified as type 2a. The remaining 6% were classified as types 2b, and 3.

All were treated with abduction splints, and normal hip development was observed after one or two months of treatment. Type 3 hips were referred to an orthopedic surgeon for specialist treatment.

**Conclusion**

To conclude, in terms of incidence, evolution, and difficulty of treatment, dysplasia of the hip constitutes one of the major orthopedic disorders. Over the last 20 years, the advent of ultrasonographic techniques has radically changed the prognosis of CDH, and today it rarely requires surgical treatment. Ultrasound is a valuable tool in the evalution of the infant hip. It is cost-effective and accurate in the diagnosis of DDH. All newborns should be screened for DDH by physical and ultrasound examination for effective treatment and rational and modern management.Thus we can outline the necessity of using ultrasound as a sensitive diagnostic tool in the detection and management of DDH and its application as screening at the national level in order to have a healthy society.

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