

Orthopedic and ultrasound assessment of hip stability of newborns referred by pediatricians with suspected Developmental Dysplasia.

Avaliação ortopédica e ultrassonográfica da estabilidade dos quadris de recém-nascidos encaminhados por pediatras, com suspeita de Displasia Típica do Desenvolvimento.

MÁRIO AUGUSTO FERREIRA CRUZ¹; JOSÉ BATISTA VOLPON¹

ABSTRACT

Objective: to evaluate newborns with suspected hip instability, referred by pediatricians to a tertiary orthopedic service. **Methods:** newborns from a public university maternity hospital, with suspected instability or risk factors for hip dysplasia, were referred to the Department of Orthopedics and Anesthesiology, Ribeirão Preto/SP, where we evaluated them clinically and through ultrasound examinations of the hips. Once we found dysplasia, we initiated treatment, and in cases in which there was only hip immaturity and normal clinical examination, we performed clinical and ultrasound observation and review at two or three months of age. **Results:** we examined 448 newborns, with female predominance and average age at first evaluation of 27 days. The main cause of referral was pelvic presentation at delivery. In 8% there was a positive Ortolani sign and in 12.5%,. At orthopedic examination, 405 (90.5%) patients were normal, 8.5% had hip click and 1.1% had positive Ortolani test. At ultrasound, 368 (89.5%) had immaturity, 26 (6.3%) had moderate dysplasia and in 17 (4.1%) patients the hips were frankly dysplastic. All cases with positive Ortolani sign showed dysplasia at ultrasound. **Conclusion:** there was an excess diagnosis of hip instability in the pediatrician evaluation, which, however, allowed the patient a second assessment, in a more specialized environment and with more technological resources.

Keywords: Infant, Newborn. Hip. Hip Dislocation, Congenital. Joint Dislocations. Joint Instability.

INTRODUCTION

The Developmental Dysplasia of the Hip (DDH) involves an evolutionary spectrum of childhood disorders that begins with instability and acetabular dysplasia, and may lead to sub-dislocation and even complete dislocation of the hip during growth. It presents a typical form, in which the child is otherwise normal, and a teratogenic form, in which the hip is usually dislocated at birth due to syndromic systemic conditions or neuromuscular disorders such as myelomyelinguoceles, arthrogryposis and others¹.

Typical dysplasia may regress spontaneously in mild cases, but without treatment may result in painful conditions associated with joint degeneration and gait disorders¹. The incidence of typical DDH

depends on the geographic region and the literature analyzed, ranging from 1/1000 to 20/1000 live births²⁻⁵. Although there are no official statistics in our country, it displays a higher incidence in the Southern region.

In the past, the condition was known as congenital hip dislocation, because the diagnosis was made late. Consequently, treatment started when the hip was already dislocated had poor results and many sequelae. From the beginning of the XX Century, great contribution was made by Ortolani, disclosing the possibility of early diagnosis and treatment of the condition. By involving non-orthopedic doctors in the diagnosis, especially pediatricians, Ortolani greatly contributed to the prevention of sequelae, which were very common in the orthopedic environment.

1 - University of São Paulo, Ribeirão Preto Medical School, Department of Orthopedics and Anesthesiology, Ribeirão Preto, SP, Brasil.

Another important historical step occurred when the possibility of cases of typical dysplasias with different severity profiles was recognized, as well as the evolutionary aspect of the condition and the possibility of not always being congenital, which led to the change of its name from "congenital hip dislocation" to "developmental dysplasia of the hip"^{6,7}. Currently, the term "congenital dislocation" was reserved for late diagnosis or teratogenic cases, where the dislocation occurs intra-uterus and is usually accompanied by severe malformations of the various anatomical elements of the hip, with complete dislocation and irreducibility by conservative means.

Another great benefit to the understanding of DDH came up with the use of ultrasound, which highlights the contribution Graf⁸⁻¹¹, which made it possible to determine different degrees of the condition and select treatment. Currently, it is well established that pediatricians are important professionals in the diagnosis of DDH, as they are responsible for screening the newborn with suspected affection for referral to the orthopedist. In our institution, the partnership between pediatrician and orthopedist has been a long one in order to ascertain early diagnosis and treatment of DDH cases. Ortolani and Barlow tests^{12,13}, as well as the presence of risk signs, constitute routine in newborn semiology.

Thus, the objective of the present investigation is to evaluate the population of newborns in a public maternity hospital, referred to the pediatric orthopedics because of suspected DDH or the presence of risk factors. The hypothesis is that many suspicious cases occur, but without diagnostic confirmation with the objective exams.

METHODS

This is a cross-sectional, descriptive, retrospective study, with a qualitative and quantitative approach, of hips newborns (NB) referred from a public maternity hospital. When the pediatrician suspected or diagnosed a condition of the locomotor system, the newborn was sent to the pediatric orthopedics department of the same institution for complete orthopedic evaluation. In the presence of positive Ortolani or Barlow signs, the child was immediately referred. However, if there was no instability, but presence of risk signs for DDH, such as familial occurrence, pelvic presentation, nonspecific signs such as clicking, or there was doubt about hip stability, the child was referred at four weeks of age for examination of the hip expert. This delay was intentional to allow eventual cases of immaturity of the hip, which could simulate dysplasia, to have regressed upon orthopedic examination.

Third-year orthopedic residents carried out the specialized Orthopedic examination, overseen by a pediatric orthopedist. In addition to general orthopedic evaluation, the hip was examined for pelvic asymmetry, presence of asymmetrical gluteal folds (Peter-Bade sign), shortening, Galeazzi sign, abduction limitation (Hart sign), and stability tests (Ortolani/Barlow). Positive family history of DDH, pelvic presentation and twin pregnancy were considered signs of risk. In hip instability, ultrasonography (US) was requested by the Graf method, quantifying the degree of dysplasia, and treatment was initiated. However, with normal physical examination but presence of risk factors, the ultrasound of the hips was requested around one month of life.

Radiology residents specializing in the locomotor system performed the US exams under the supervision of an attending physician. We determined the alpha and beta angles, which delimit three zones once cast on the Graf ruler (Figure 1). In zone I there is only hip immaturity and there is no need for specific treatment, only follow-up. Zone II is subdivided into two areas: transition subzone, where patients may or may not be treated depending on their history and physical examination, and danger

subzone, where cases are usually treated. Zone III hips are considered broadly dysplastic and require treatment⁹. We excluded cases of teratogenic dislocation (association with syndromes, multiple malformations or neuromuscular diseases).

For the present evaluation, we collected data from medical records of newborns treated during the period between June 2015 and October 2017 (29 months). We followed the flowchart of figure 2.

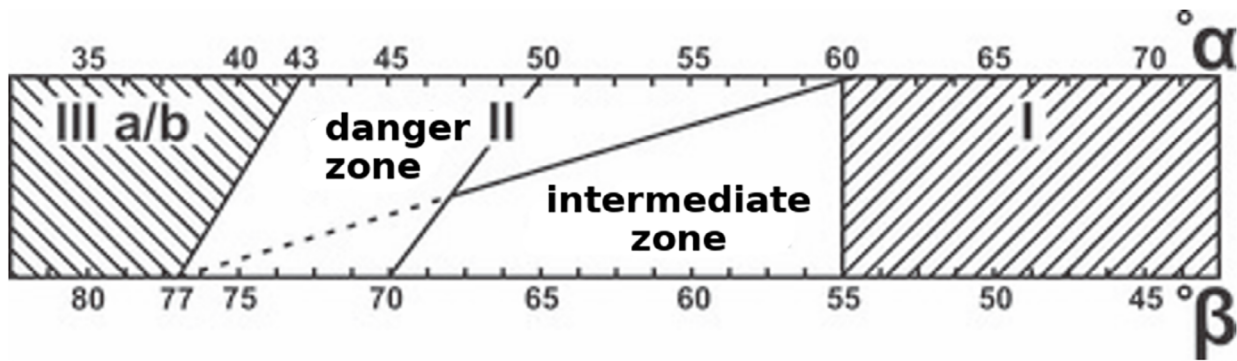


Figure 1. Graf ruler used to facilitate the interpretation of the degree of dysplasia and decide the approach. The alpha angle (α) values are in the upper limit and the beta (β) angle values, in the lower limit (GRAF, 1984). Three regions are delimited.

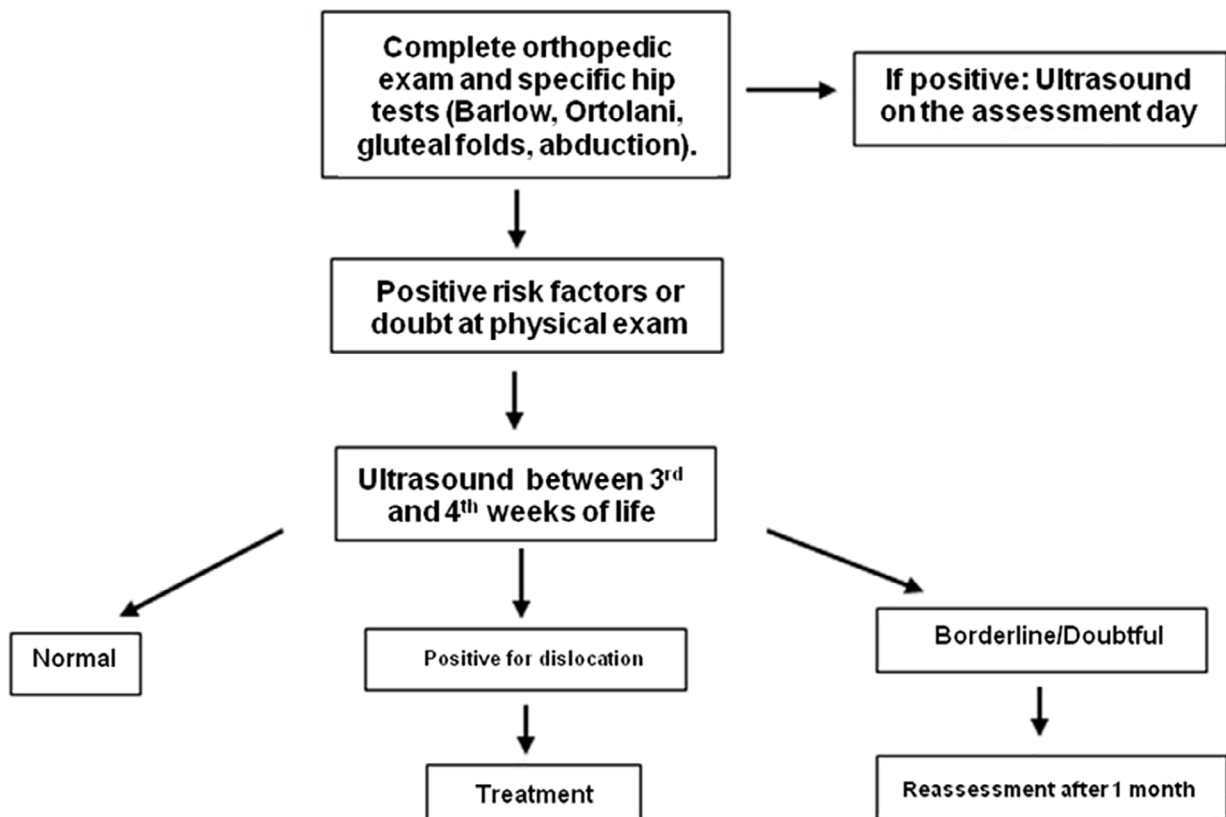


Figure 2. Flowchart used for selection and management in all cases.

We entered the variables analyzed into an Excel® spreadsheet and analyzed the data descriptively by mean and standard deviation (SD).

This study was approved by the Ethics Committee of the institution with Certificate of Presentation for Ethical Appreciation (CAAE) number 78086117.1.0000.5440.

RESULTS

A total of 448 newborns with suspicion of hip alterations were referred and evaluated by the orthopedist. Of these, 243 (54.3%) were female and 205 male. The average age at the first assessment with the Pediatric Orthopedics specialist was 27 days (SD±17).

The main reason for referral was pelvic presentation at birth, corresponding to 305 newborns (68%), of whom 29 had minor changes on physical examination, or other risk factors such as twin pregnancies, family history, calcaneus valgus foot or bent knee. Thirty-six newborns (8%) were referred with a positive Ortolani or Barlow sign at birth and 56 (12.5%) for hip click.

Most were born by cesarean section (78.6%) and the most frequent presentation at birth was the pelvic one (75.2%), followed by cephalic (21.6%) and transverse (0.2%) presentations, and in 3% of the subjects the type of birth information was not found. The reported skin color was distributed in: 76% white, 19% brown and 5% black.

During the orthopedic physical examination, the main findings were presence of hip clicking in 38 newborns (8.5%) and positive Ortolani/Barlow, in five (1.1%). Normal hip physical examination was found in 405 (90.5%). Of the 448 newborns referred,

411 underwent hip ultrasound examination. In the others, there was no indication of the exam, as there were no risk factors and the orthopedic physical examination was normal. Thus, 37 newborns were not submitted to imaging exams. The average age at the time of US was 33 days (SD±22.1). Of the 411 newborns evaluated by US, 368 (89.5%) had Graf I (immaturity), 26 (6.3%) had at least one hip in the intermediate zone, i.e., Graf II, and 17 (4.1%) showed signs of dysplasia (danger zone or downright dysplastic). All cases with positive Ortolani sign had dysplasia at ultrasound. In these 17 newborns (4.1%) the diagnosis of hip dysplasia was established, all being treated with Pavlik harness¹⁴ (Figure 3).

DISCUSSION

Although the concept of DDH has evolved, as well as its methods of diagnosis and treatment, early diagnosis is still compromised if there is no awareness of pediatricians. This recommendation is classic and originated with the work of Ortolani, in 1937¹⁵. Previously, other Orthopedic pioneers such as Pierre Le Damany, working in maternity hospitals, independently described a maneuver very similar to Ortolani's, which he named "Le signe du ressaut". This same author emphasized the importance of early diagnosis and established the principle of flexion position and abduction of the hips as a treatment method¹⁶. However, Ortolani's great merit was the dissemination of the diagnostic method among pediatricians.

Currently, there is much awareness of the need for early diagnosis and treatment of DDH and that the first step in this should be done in the delivery room and in the maternity ward.

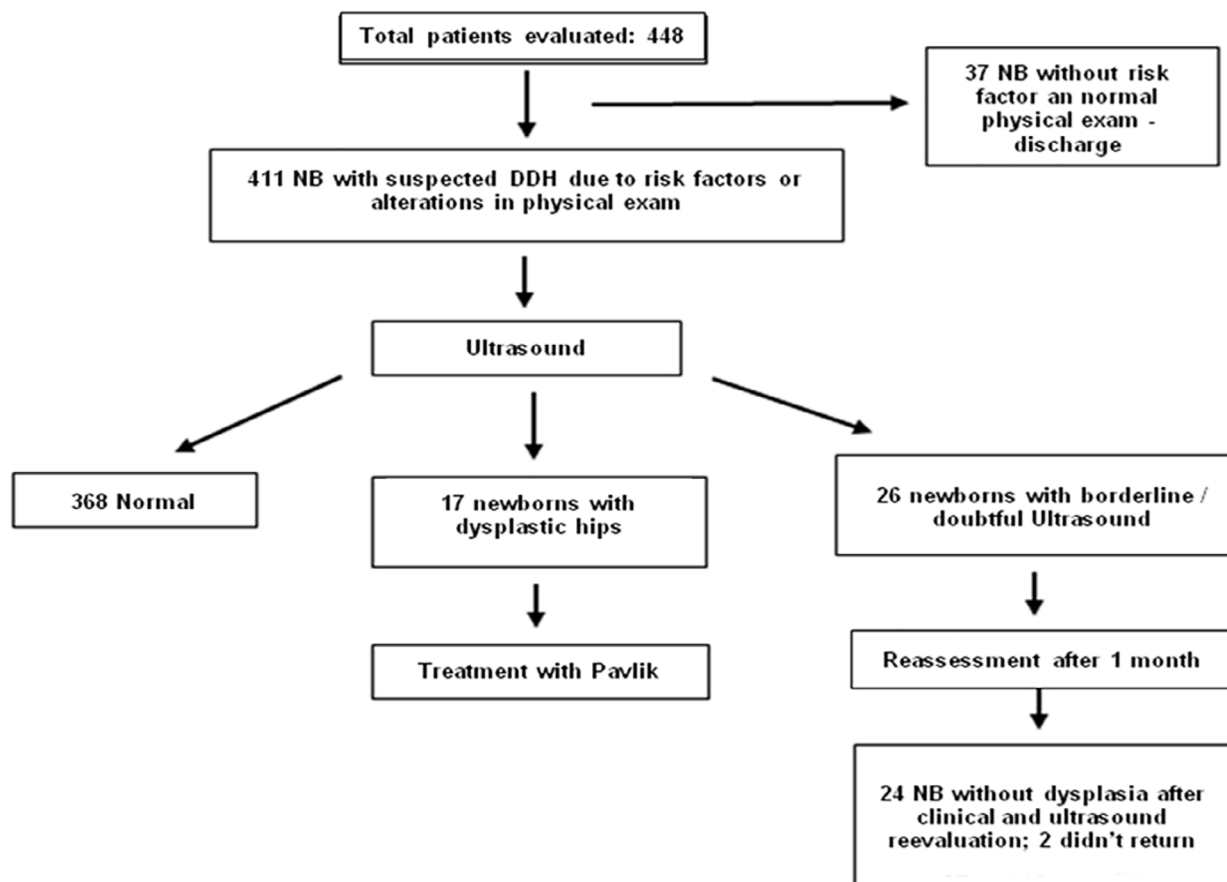


Figure 3. Sample characteristics and results.

However, less well known is the fact that the hip should continue to be examined following childcare, until six months of age, for the diagnosis of late cases, but with normal initial examination. The aim of the present investigation was to evaluate the first period of diagnosis, that is, the newborn phase. Our overall results show that the group of pediatricians in the maternity ward in question is well informed about the importance of diagnosis. Another important point is to provide the pediatrician with a channel for referral of cases so that the assessment by the orthopedist is easy. In this regard, our data also show that there is an adequacy of this system, since newborns were examined in the appropriate age group.

However, a methodological limitation is that we have no information about cases born in the maternity not suspected of hip instability, and therefore not referred, although the condition could exist (false negatives). Recent publications warn that no professional, not even the ultrasound exam, can diagnose all cases of instability¹⁷, even so because the condition may have many nuances and be so mild in the newborn that it is undetectable on clinical examination, but can progress with growth. For this reason, pediatricians should be aware that research on hip dysplasia does not end in the nursery, but should continue throughout child care. Thus, the possibility of diagnosing cases of late manifestation is increased.

Also, these same professionals should be aware that hip dysplasia manifests differently according to age. In fact, Ortolani's sign, researched in the first 48 hours of life to be more sensitive, disappears around two months, to be replaced by limitation of hip abduction (Hart's sign), gluteal fold asymmetry (Peter-Bade's sign) and shortening (Galeazzi's sign). However, in severe cases of teratogenic dislocation, these signs are already present in the newborn. When ambulation is initiated, gluteus insufficiency (Trendelenburg) gait may arise.

In Brazil, Souza *et al.*¹⁸ concluded that knowledge of DDH among health professionals who perform screening in the newborn is poor, as 81.1% of them (students, residents, pediatricians and orthopedists) have never made a diagnosis of DDH. In this sense, the use of mannequins can be very useful for training students and health personnel, since the condition is uncommon and even orthopedists may have no experience with any case.

In our protocol, risk signs and early clinical examination are valued to serve not only as diagnosis, but as criteria for indicating US. Our results show that there was excess suspicion or diagnosis of hip instability by the pediatrician. Although it overloads the health service, this behavior is preferable because it gives the child a second opportunity for assessment. A Cochrane review compared the costs and benefits of newborn hip screening by clinical evaluation and US. When this test was performed routinely in all newborns, there was no decrease in the incidence of late cases, but there was an increase in the number of unnecessary reviews and treatment rates, as well as health system overload¹⁹⁻²¹.

According to Paton²², conducting clinical neonatal screening of all newborns has a sensitivity of 66%, a specificity of 99.8%, a positive predictive value (PPV) of 28% and a negative predictive value (NPV) of 99.9%. Ultrasound examination in newborns with hips considered at risk for DDH increases sensitivity to 100% and specificity to 94.2%, and has PPV of 20.5%²². Kyung *et al.*²³ recommended that US be performed in the DDH screening to assess morphology and stability, in addition to the physical examination of the newborn, as about 7% of the normal hips on physical examination had dysplasia on ultrasound examination.

Another aspect that should be considered is the so-called hip click. This greatly confuses pediatricians and orthopedists, who may interpret it as an Ortolani's sign. Even in the literature, the significance of this finding is controversial²⁴. Kamath and Bramley²⁴ studied cases of hip clicking by ultrasound and found that, in a small percentage, they were associated with mild dysplasias, which did not require treatment. They recommended that persistent clicks for more than six weeks should be investigated by US. In any case, it is recommended that the ultrasound examination always be associated with the clinical examination^{25,26}. In conclusion, there are several nuances to clicks. Those most typical and persistent up to three months after the first examination should undergo US. In our cases, 8.5% of the newborns had clicks in the first visit. However, none of them persisted and thus there was no need to prolong follow-up.

Given that the hip is such a stable joint in the adult, it is intriguing that it presents this degree of instability in the young child. Moreover, if we consider that the hip has an embryological origin in a single mesenchymal mass, which progressively differentiates into individualizing the acetabulum from the femur, with the creation of a gap between the mesenchymal nuclei, that is, the femoral head is originally formed within the acetabulum²⁷. This leads to search for some factor that could alter this relationship after the formation of the joint. It is believed that there are two important factors in cases of DDH: acetabulum dysplasia and capsular-ligament laxity²⁷.

Currently, diagnosis and treatment are based on morphological changes in the acetabulum, but this change is probably secondary to inadequate dynamic positioning of the femoral head before birth due to excessive capsule compliance in some individuals.

In summary, our results show that there was an overdiagnosis of hip instability in the pediatrician evaluation and, consequently, referral to the orthopedist. Although this may cause overload to the health service, this attitude is adequate, as it allows the patient a second assessment in a more specialized environment and with more technological resources.

R E S U M O

Objetivo: avaliar recém-nascidos com suspeita de instabilidade do quadril, encaminhados por pediatras a um serviço ortopédico terciário. **Métodos:** recém-nascidos de uma maternidade pública universitária, com suspeita de instabilidade ou fatores de risco para displasia do quadril, eram encaminhados ao Departamento de Ortopedia e Anestesiologia, Ribeirão Preto/SP, onde eram avaliados clinicamente e através de exames ultrassonográficos dos quadris. Constatada a displasia, iniciava-se o tratamento, e em casos em que havia apenas imaturidade do quadril e exame clínico normal, procedia-se à observação e re-exame clínico e ultrassonográfico com dois ou três meses de vida. **Resultados:** foram examinados 448 recém-nascidos, com predominância feminina e média de idade na primeira avaliação de 27 dias. A principal causa do encaminhamento foi apresentação pélvica. Em 8% havia sinal de Ortolani positivo e em 12,5% estalido no quadril. No exame ortopédico, 405 (90,5%) pacientes eram normais, 8,5% apresentavam estalido no quadril e 1,1% apresentavam teste de Ortolani positivo. À ultrassonografia, 368 (89,5%) apresentavam imaturidade, 26 (6,3%) tinham displasia moderada e em 17 (4,1%) pacientes os quadris eram francamente displásicos. Todos os casos com sinal de Ortolani positivo apresentavam quadro ultrassonográfico de displasia. **Conclusão:** houve excesso de diagnóstico de instabilidade do quadril na avaliação do pediatra, o que, no entanto, permitiu ao paciente uma segunda avaliação, em ambiente mais especializado e com mais recursos tecnológicos.

Descritores: Recém-Nascido. Quadril. Luxação Congênita de Quadril. Luxações Articulares. Instabilidade Articular.

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Mailing address:

José Batista Volpon

E-mail: hc.ortopedia@gmail.com

m.gutocruz@gmail.com

