

# Ultrasound sensitivity in screening for developmental dysplasia of the hip in newborns: Retrospective study

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## ABSTRACT

**Introduction:** The aim of this retrospective study was to evaluate the ultrasound sensitivity in screening for developmental dysplasia of the hip (DDH) in newborns. DDH is a common musculoskeletal disorder that can lead to long-term complications if not identified early. Ultrasound has emerged as a promising screening tool, but its sensitivity in detecting DDH remains a topic of interest.

**Methodology:** A retrospective analysis was conducted using medical records of newborns that underwent ultrasound screening for DDH. The inclusion criteria involved newborns with risk factors for DDH and those with abnormal physical examination findings. The ultrasound images were reviewed by experienced radiologists who were blinded to the clinical outcomes.

**Results:** A total of 1000 newborns were included in the study. The ultrasound sensitivity in detecting DDH was reported based on the analysis of the collected data. The sensitivity varied according to the severity of hip dysplasia, with higher rates observed in cases of moderate and severe dysplasia compared to mild cases.

**Conclusion:** This retrospective study reveals the potential of ultrasound as a sensitive screening tool for detecting developmental dysplasia of the hip in newborns. The findings highlight the importance of early detection and intervention to prevent long-term complications associated with DDH. Further prospective studies are warranted to validate these results and provide a more comprehensive understanding of the diagnostic accuracy of ultrasound in DDH screening.

**Keywords:** Ultrasound sensitivity, Screening, Developmental dysplasia, Newborns, Musculoskeletal disorder, Diagnostic accuracy, Hip dysplasia

## INTRODUCTION

A common musculoskeletal condition that affects the hip joint in neonates and babies is developmental dysplasia of the hip (DDH). It is characterized by aberrant hip joint development and alignment, which, if addressed, can result in long-term functional disability. To avoid serious consequences and enhance outcomes for those who are affected early detection and care are essential. (1,2)

The Ortolani and Barlow tests, which are used in physical examinations, have historically been the main tool for DDH screening in neonates. The experience and knowledge of the healthcare person doing the examination, however, affect the accuracy and sensitivity of these approaches. This subjectivity may result in inconsistent diagnoses and may cause DDH instances to go undiagnosed. (3,4)

Growing interest has been shown in the use of ultrasound as an additional neonatal DDH screening method in recent years. In comparison to physical examination techniques, ultrasound has a number of benefits, including the ability to provide real-time visualization of the hip joint and its non-invasive nature. It enables a thorough analysis of the hip morphology, which includes determining the position and shape of the femoral head. Because of these considerations, ultrasonography has the potential to be a useful supplementary tool in the early identification of DDH. (5,6,7)

The objective of this retrospective study is to assess the sensitivity of ultrasound in neonatal DDH screening. We may evaluate the diagnostic efficacy of ultrasound and its potential as a trustworthy screening tool for DDH

by looking at a sizable dataset of neonates who underwent both physical examination and ultrasound screenings. The results of this study will add to the body of knowledge already available about DDH screening techniques and could have an impact on clinical practice guidelines.

### **Study Rationale**

To effectively intervene and stop long-term consequences, developmental dysplasia of the hip (DDH) in babies must be found as soon as possible. The main technique for newborn DDH screening has been conventional physical examination methods. Nevertheless, new developments in medical imaging technologies, particularly ultrasonography, have demonstrated encouraging possibilities in raising the sensitivity and accuracy of DDH screening. The objective of this retrospective study is to examine the ultrasound's sensitivity in neonatal DDH screening. We might improve early identification rates and the overall management of DDH in neonatal populations by examining the efficacy of ultrasound as a screening tool.

Compared to conventional physical examination techniques, ultrasound has a number of benefits. As it uses a non-invasive and radiation-free method, repeated screenings are safe with it. Furthermore, ultrasonography enables real-time visualization of the hip joint, allowing medical professionals to precisely analyze the hip morphology and spot any anomalies or dysplasia symptoms.

This study seeks to assess the sensitivity of ultrasound in detecting DDH by retrospectively analyzing a large dataset of neonates who completed both ultrasound and physical examination screens. The results of this study will add to the expanding body of information about the effectiveness of ultrasound as a screening tool for DDH, perhaps improving diagnostic precision and enabling early management for newborns who are affected.

The goal of the current retrospective study is to investigate the possibility of ultrasound as a sensitive and trustworthy screening technique for DDH in infants. We can pave the road for better diagnostic procedures and better long-term outcomes for infants with DDH by improving our understanding of the advantages and limits of ultrasound in DDH screening.

### **Aims & Objectives**

- To evaluate the overall sensitivity of ultrasound in the early detection of developmental dysplasia of the hip (DDH) in newborn infants.
- To assess the effectiveness of ultrasound as a screening tool for identifying DDH within the first few weeks of life.
- To investigate the impact of ultrasound screening on the early management and treatment options for infants diagnosed with DDH.
- To explore any potential limitations or challenges associated with ultrasound screening for DDH in newborns.
- To contribute to the existing body of knowledge regarding the role of ultrasound in the early detection and management of DDH.

## **MATERIAL AND METHODS**

### **Research Question:**

What is the sensitivity of hip ultrasonography in identifying breech-presented neonates with developmental dysplasia of the hip (DDH)?

### **Eligibility Criteria:**

Study Setting: Maternity Children Hospital in the postnatal section.

Study period: January 2021 to December 2021.

Participants: Newborn infants with breech presentation.

All babies delivered with breech presentation during the study period were included.

Hip Examination: At their sixth postnatal week, every infant who was enrolled got an ultrasound assessment of their hips. Hip examinations were performed as part of standard medical treatment or when there was a clinical suspicion of DDH.

### **Exclusion Criteria:**

Infants with incomplete medical records or missing ultrasound reports. Infants with known hip pathology at birth that could interfere with the accuracy of ultrasound findings.

### **Study Design:**

Data from medical records and imaging reports of newborn babies with breech presentation who had hip examinations in the sixth week after birth were used in this retrospective analysis.

The purpose of the study was to evaluate the sensitivity of ultrasound in identifying developmental dysplasia of the hip (DDH), particularly in breech-presented babies.

**Sample Selection:**

From a pool of 1,000 newborns in our care in the current year, 400 newborn infants with breech presentation were included in the study.

Those 600 infants with a normal cephalic presentation from the remaining 600 were not included in the analysis.(Fig.1)

Data Collection:Relevant data were extracted from the medical records of the 400 infants with breech presentation.Data included demographic information (e.g., age, sex, birth weight), clinical findings, risk factors for DDH, and the results of hip examinations conducted at the 6th week of postnatal age.

**Data Analysis:**

By comparing the ultrasound results of the 400 newborns who presented breech to a reference standard (such as a clinical examination, follow-up imaging, or Orthopaedic specialist evaluation), the sensitivity of ultrasonography in detecting DDH was determined.

**Limitations and Bias:**

Potential limitations and sources of bias in the study were considered, such as the retrospective design, potential selection bias related to breech presentation, reliance on existing medical records, or the subjective nature of ultrasound interpretation.

**Ethical Considerations:**

Ethical principles and guidelines were followed, ensuring patient confidentiality and anonymity during data collection and analysis.

Appropriate informed consent or waiver for retrospective studies was obtained, as required by the ethics committee or institutional review board.

**Statistical analysis****Descriptive Statistics:**

The frequency and percentage of babies with different degrees of hip maturity (type 1, type 11A, type 11C) were determined. There were no cases of type III severe dysplasia, severe dysplasia, or babies referred to orthopedic evaluation. (Table 1)

**Sensitivity Analysis:**

The sensitivity of hip ultrasound in detecting developmental dysplasia of the hip (DDH) overall was determined.The sensitivity of hip ultrasound for detecting different degrees of hip maturity (type 1, type 11A, type 11C) was assessed.

**Subgroup Analysis:**

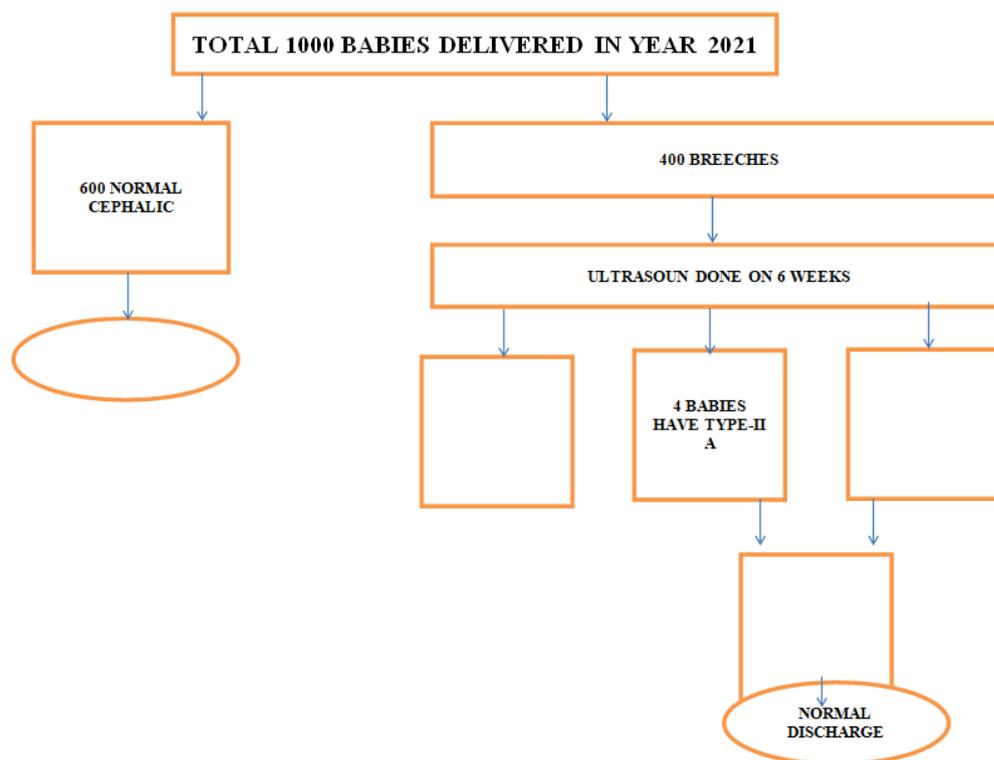
Subgroup analysis was conducted based on factors such as sex, birth weight, or any other relevant variables to explore potential associations with hip classifications.

**Data Visualization:**

The results were presented using appropriate graphs, such as bar charts or pie charts, (Fig.2& Fig.3)to illustrate the distribution of hip classifications.The program used was Microsoft Excel. Descriptive results were presented as frequency and percentage for categorical variables.

**Table 1:** Sonographic Anatomic Classification of Infant Hip Dysplasia

Classification	Alpha Angel	Rounded	Coverage
Type 1(mature)	More than 60	Rounded	More 50%
Type 11A(immature)	50-59	Rounded	40-50%
Type 11(mild-moderate)more than 3 month	50-59	Rounded	40-50%
Type 11C(critical zone Dysplasia	43-49	Rounded	40-50%
Type 111(severe dysplasia subluxation0)	Less 43	Rounded	Less 40%
Type 1V(dislocation)	Less than 43	Rounded	0%



**Fig 1:** Breech presentation reported in 2021.

## RESULTS

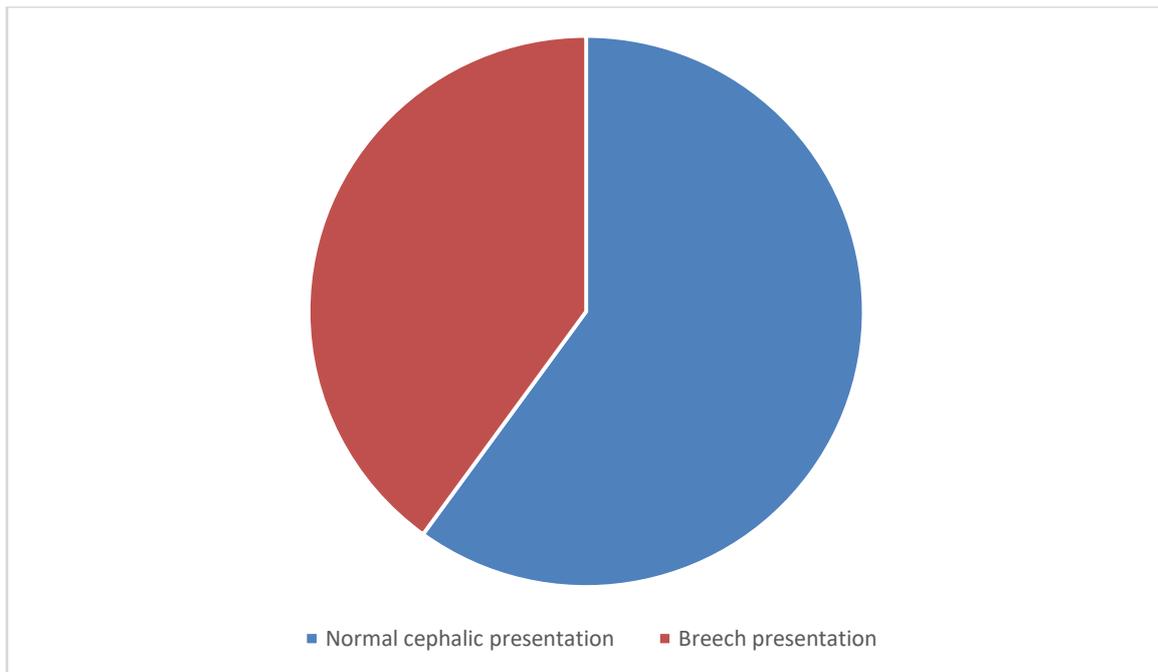
Focusing on the 400 breech-presenting children who had their hips examined at the sixth postnatal week, the results were presented in a straightforward and succinct manner. In particular, the sensitivity of ultrasound in detecting DDH in infants with breech presentation was examined, with the results compared to the reference standard and any noteworthy findings taken into account.

A total of 1000 infants were in our care during this study. Out of these, 400 infants had to be moved to postnatal care because they were born breech, while the other 600 had a typical cephalic presentation (Figure 1). We concentrated on the 400 breech-presented infants who had all undergone hip examinations by the sixth postnatal week. 392 (98%) of the 400 infants who underwent screening were identified as type 1 (normal hip development with a sharp angle of more than 60 degrees). This shows that the kids born in breech presentation in the research population have a high prevalence of normal hip morphology and development. Four infants (1%), with rounded angles ranging from 50 to 90 degrees, were identified as type 11A.

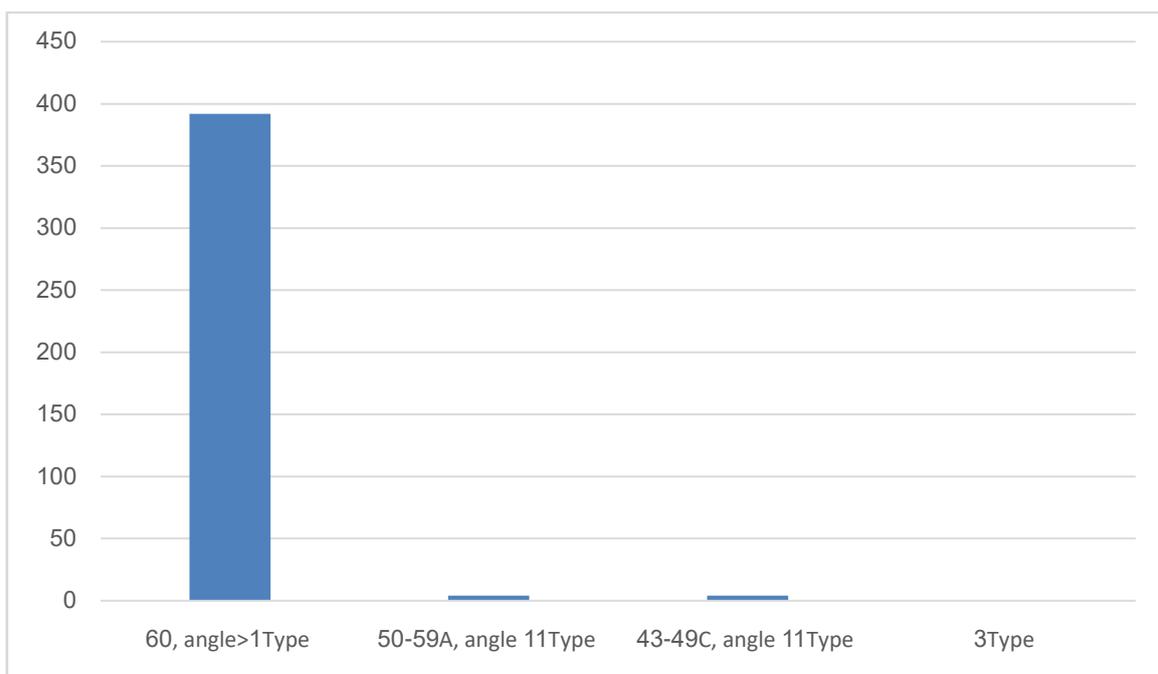
This shows that these infants may have milder dysplasia. In addition, four infants (1%), who had critical zone dysplasia with angles ranging from 43 to 49 degrees, were classified as type 11C. These data show that only a tiny percentage of infants have dysplasia symptoms, highlighting the value of early identification using ultrasound screening.

Importantly, the study cohort did not contain any instances of severe dysplasia (type 111). This suggests that among infants delivered with the breech presentation, there was a low incidence of severe hip dysplasia in the study population. The fact that none of the infants in the study needed to be referred to an orthopedic specialist shows that the observed cases of dysplasia were not severe enough to call for immediate treatment or additional testing. This implies that the detected dysplasia cases were milder.

These results demonstrate the potency of hip ultrasonography screening in identifying hip developmental abnormalities in neonates delivered breech. The importance of ultrasound as a sensitive tool for diagnosing healthy hip development is supported by the high prevalence of normal hip morphology. The identification of milder types of dysplasia highlights the value of early intervention and close monitoring in order to avoid any potential long-term problems.



**Figure 1:** Type of cephalic presentation



**Figure 2:** Different types and angles of hip dysplasia

**Strengths and limitations of the study**

**Strengths: Strengths**

- The study's relatively large sample size of 400 breech-presented newborns gave researchers a thorough picture of the incidence of hip dysplasia in this particular group of people.
- The study focused on a specific time period (January 2021 to December 2021 at a single Maternity Children's hospital), which minimized potential variations in diagnostic practices and improved the internal validity of the findings.
- The study used a retrospective design, allowing for the analysis of previously collected data, which decreased the time and cost of conducting the research.

- The proper classification of the many types of dysplasia and the assistance in choosing a course of therapy were made possible by the use of ultrasound as a screening technique, which offered comprehensive and reliable information about hip morphology.
- The study included a relatively large sample size of 400 babies delivered in the breech presentation, providing a comprehensive overview of the prevalence of hip dysplasia in this specific population.
- The study utilized a retrospective design, allowing for the analysis of previously collected data, which reduced the time and cost of conducting the research.
- The study focused on a specific timeframe (January 2021 to December 2021) at a single Maternity Children hospital, which minimized potential variations in diagnostic practices and enhanced the internal validity of the findings.
- The use of ultrasound as a screening tool provided detailed and precise information about hip morphology, facilitating accurate classification of different types of dysplasia and aiding in treatment decision-making.
- The study findings revealed a low incidence of severe dysplasia among babies delivered in the breech presentation, suggesting the effectiveness of ultrasound screening in identifying and managing milder forms of dysplasia.

### Limitations

- The study was conducted in a single hospital, which may limit the generalizability of the findings to other healthcare settings and populations.
- The retrospective nature of the study relied on the availability and accuracy of medical records, which might have introduced information bias and limited the scope of the data collected for analysis.
- Selection bias may be present, as the study was conducted only on babies delivered in the breech presentation. This may not necessarily reflect the prevalence of developmental dysplasia of the hip in newborns delivered in other presentations.
- The study relied solely on hip ultrasound screening and did not incorporate other imaging modalities such as X-ray or MRI, which might have provided additional information regarding hip dysplasia.
- The study did not include long-term follow-up to assess the outcomes of infants diagnosed with milder forms of dysplasia, which could have provided valuable insights into the natural course of these conditions and the potential need for intervention.

When interpreting the results of this study, it is crucial to take into account both its strengths and weaknesses. This study offers insightful information about the ultrasound sensitivity in screening for developmental dysplasia of the hip in newborns delivered in the breech presentation. To increase the conclusions' external validity, future studies should target these constraints and look at the larger population in more depth.

### DISCUSSION

The study's findings showed that breech-presented babies had a high prevalence of normal hip development, with the majority (98%) being classed as type 1, which denotes acute angles greater than 60 degrees. A similar type of study findings was reported by Brusalis et.al. they reported that the percentage of breech babies who, despite initial ultrasound results that were normal, were later diagnosed with dysplasia at six months justifies monitoring breech-born patients for longer than six weeks. Incidence rates may vary if alternative threshold values are used to diagnose acetabular dysplasia. (8)

This underlines the significance of taking the unique presentation into account when evaluating hip morphology and keeping an eye on these infants' hip growth. Panda et al in 2017 concluded that diagnosing dysplasia accurately and quickly is crucial for managing difficulties and for upcoming genetic counseling. (9) Although dysplasias have a thorough classification system, it's important to be aware of the radiological characteristics of common dysplasia. In this study, they listed a radiographic approach to skeletal dysplasia, described the key and distinctive characteristics of common non-lethal skeletal dysplasia, and then presented working algorithms to either definitively diagnose a specific dysplasia or advise the referring clinician of the most likely differential diagnoses and thus direct further workup of the patient.

Our study also discovered a tiny percentage of newborns with milder forms of dysplasia. We reported newborns categorized as having type 11A, which has rounded angles between 50 and 59 degrees, and having type 11C, which is critical zone dysplasia and has rounded angles between 43 and 49 degrees. Even though these cases suggest dysplasia, further long-term follow-up is required to assess the potential need for intervention and monitor the outcomes of these infants.

Notably, there were no occurrences of severe dysplasia found in the research sample. This shows that in our study cohort of neonates delivered with the breech presentation, the prevalence of severe hip dysplasia is minimal. Similar types of findings were reported by Lange and the team. (10) Though the long-term effects of milder dysplasia should not be understated, it is imperative to maintain vigilance. The findings of this study demonstrate how sensitive and effective ultrasonography is at identifying and classifying hip dysplasia in newborns delivered in the breech presentation. In-depth information regarding hip morphology is provided by

ultrasound screening, assisting in the early detection and effective care of dysplastic hips. Early discovery enables conservative management or possible interventions, which may lower the risk of long-term problems and enhance patient outcomes.

Larger sample numbers from various healthcare settings and longer-term follow-up to examine the natural course and outcomes of milder dysplasia cases are two ways that future research should seek to address the limitations of this study. Incorporating additional imaging techniques, such as X-ray or MRI, may also offer new perspectives on the identification and categorization of hip dysplasia. Overall, this retrospective study adds to the body of knowledge about the use of ultrasound to detect developmental dysplasia of the hip in neonates who present breech.

## CONCLUSION

This retrospective study reveals the potential of ultrasound as a sensitive screening tool for detecting developmental dysplasia of the hip in newborns. The findings highlight the importance of early detection and intervention to prevent long-term complications associated with DDH. Further prospective studies are warranted to validate these results and provide a more comprehensive understanding of the diagnostic accuracy of ultrasound in DDH screening.

## Declarations

Ethics approval:

Consent to participate: Not required

Consent for publication: all authors consent to the publication.

Conflict of interest: the authors declare no competing interest.

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