

To Study the Cost-Effectiveness of Clinical Screening with Ultrasonography (USG) of Hip for Diagnosing Developmental Dysplasia of the Hip (DDH) In New Borns – Prospective Study

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Abstract:

Aim: To study the cost-effectiveness of clinical screen with ultrasonography (USG) of hip for diagnosing developmental dysplasia of the hip (DDH) in new borns. **Methodology:** Prospective study was conducted in DVVPF's Medical College and Hospital, Ahmednagar over a period of two years. Term new borns had (i) target scan at 6 weeks—family history of DDH or breech presentation—and (ii) early scan—abnormal clinical screen. **Results:** In all, 58 babies had USG scan. Five early scans (Graf's classification; three Type IIA, one Type IIC and one Type IIIB] and 15 target scans (Type IIA) were reported abnormal. All Type IIA DDH had subsequent 12 weeks' scans normal. Babies with Type IIIB and IIC had hip reduction surgery at 6 and 16 months of age, respectively. At cost Rs. 200 INR/- scan, total Rs. 1,47,200/- INR was incurred against two possible hip replacements prevented. **Conclusion:** Universal clinical screen with USG of hip can aid in early diagnosis of DDH in newborns. Large population-based studies from developing countries need to look in its cost-effectiveness.

Keywords: Dysplasia of the hip (DDH), Graf's classification, Premature arthritis

Introduction:

Developmental dysplasia of the hip (DDH) affects 1–2% of newborns^{1,2} and is a leading cause of premature arthritis requiring total hip replacement.³ According to Norwegian arthroplasty register, 8.6% of all primary hip replacements with a third of the people aged ≤60 years had DDH as etiology.⁴ DDH being a dynamic and progressive disease⁵, if uncorrected, can cause long-term morbidities including gait abnormalities, chronic pain and degenerative arthritis.^{4,6,7} Of the various factors implicated⁸, family history for DDH and breech presentation are the two major risk factors associated with pathogenesis of DDH.⁹

The management of DDH involves early diagnosis and referral to paediatric orthopaedic surgeon.¹⁰ Early

diagnosis will help in preventing the morbid complications and avert hip replacement surgery. Early diagnosis of DDH involves clinical screen of all newborns with Ortolani's¹¹ and Barlow's¹² method, aiming to elicit dislocatable hip.

Lately, ultrasonography (USG) of hip is increasingly used in early diagnosis of DDH, especially in at-risk neonates, and confirm results of clinical screen.^{13–15} American Academy of Paediatrics (AAP) recommends a universal clinical screen for DDH at birth followed by USG (target scan) at 6 weeks in all at-risk newborns.¹⁶ Similarly, in United Kingdom, all babies have clinical screen before hospital discharge at birth, at 6 weeks, between 6 and 9 months and at walking age.^{17,18}

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All abnormal results of clinical screens are then confirmed with USG of hip before discharge (early scan). Indian health system lacks a national policy on diagnosing DDH. Given the cost and financial burden any screening programme can incur, we aimed to verify whether clinical screen with USG hips was a cost-effective practice.

Methodology:

It was a Prospective cohort study, conducted between 2018–20. Study subjects were term new-borns (gestation age ≥ 37 –42 weeks) born at DVVPF's Medical College & Hospital, Ahmednagar, Maharashtra, India.

All neonates had an initial clinical screen of hips in first 36–48 hrs of life, before discharge. Any baby (i) at risk for developing DDH, viz. family history or breech presentation, had USG scan of hip (target scan) at 6 weeks of age (ii) with click or clunk. 11, 12 On initial clinical screen had USG of hip before discharge (early scan), with additional studies at 6 and 12 weeks of age. All USG scans were done and reported by a radiologist in accordance to Graf's classification¹³

(Fig 1) on ultra-sonographic diagnosis of DDH. All abnormal clinical screen or USG of hips were managed in consultation with a paediatric orthopaedic surgeon. The cumulative cost incurred on screen was calculated based on the hospital tariff levied to patient. For calculation, maximum charges ever over the study period was used, i.e. Rs. 200/- INR for each initial USG hip scan; no additional charges were paid for clinical screen.

Fig 1: Graf Classification of hip dysplasia (1987)

Type	Alpha angle	Beta angle	Comment
I	> 60	-	Normal
IIA	50–59	-	Physiological immaturity (< 3 months old)
IIB	50–59	-	Delayed ossification (> 3 months old)
IIC	43–49	< 77	Critical zone; labrum not everted
IID	43–49	> 77	Subluxed; labrum everted
III	< 43	> 77	Dislocated
IV	< 43 or not measurable	> 77	Dislocated with labrum interposed between femoral head and acetabulum

Results:

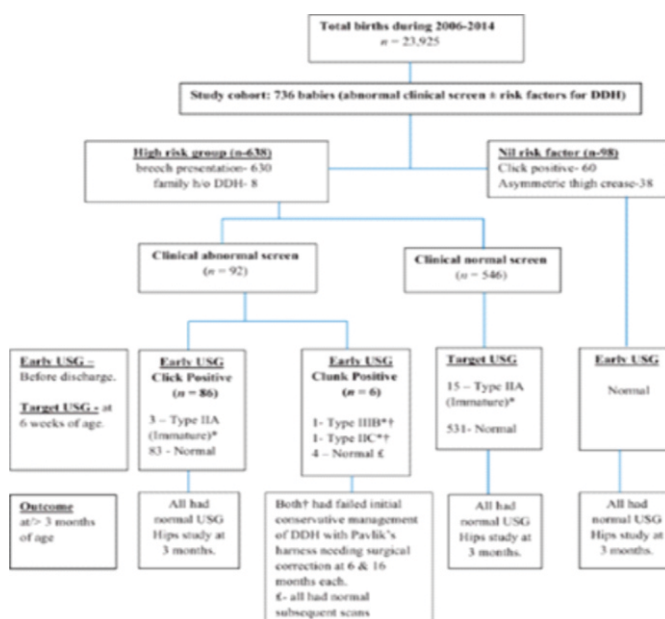
The study period had a total of 23, 925 births. In all, 736 babies had USG scans of hips (abnormal clinical examination \pm target scan) and formed the study cohort. The median gestation and birth weight of the

cohort are 38.3 weeks and 2.8 kg, respectively.

A total of 190 babies had early scans before discharge for abnormal clinical screen with click or clunk on hip assessment. Of 190 babies scanned, 185 had normal USG results, with subsequent examinations of hip as normal. Five babies with abnormal results in clinical screen had abnormal scans reported (three Type IIA, one Type IIC, one Type IIIB; Graf's classification). (Fig. 1) Remaining 546 of 736 babies had target scan for being at risk for developing DDH. Fifteen of 546 had immature hip (Type IIA, Graf's classification). (Fig. 1)

A total of 20 initial scans were reported abnormal. Eighteen babies with immature hip (Type IIA) were managed conservatively using double nappy aiming abduction at hips. All had subsequent follow-up scans at 3 months of age reported as normal.

Two of 20 babies had Type IIIB and Type IIC reported on initial scans. Both had positive clunk on examination suggestive of a possible dislocatable hip and had initial conservation with Pavlik's harness. On follow-up, baby with Type IIIB had clinical deterioration and developed limb length discrepancy, requiring closed reduction of hip joint at 6 months of age. The baby with Type IIC developed painful hip by 16 months and required open reduction with femoral osteotomy. Both these babies on follow-up show normal gait and limb lengths at 4 years of age.



Follow-up data for at least 2 years were available in 662 of 736 (91%) babies of the cohort. They were examined clinically at various intervals as scheduled for immunization. They were all deemed to have normal examination and motor development of lower limbs by the attending paediatrician.

A total cost of Rs.1,47,200/- INR was incurred on initial screening scans at Rs. 200/- INR scan

Discussion:

Our results show universal clinical examination with target screen for at-risk newborns can aid in early detection and referral for management of DDH. A total of 20 of 746 scans showed abnormal results, of which two babies needed timely intervention. A total cost of Rs. 1,47,200/- INR was incurred on screening, and two possible hip replacements were prevented. Also, with conservative management among remaining 18 babies (Type IIA), probable progressive degeneration of hips was prevented. This was possible only for the ongoing surveillance used post-detection on clinical and USG screen. Also, the early involvement of paediatric orthopaedic surgeons experienced in managing DDH made timely surgical intervention possible.

In India, we do not have a standard screening programme for DDH. AAP recommends all babies to have a clinical screen for DDH at birth followed by ultrasound scan at 6 weeks for at-risk newborns.¹⁸ This is despite the fact that systematic review shows insufficient evidence for effectiveness of screening with clinical examination or ultrasound.¹⁹

Most countries emphasize on universal clinical screen with early and target USG hip scans. But certain researchers, on the contrary, consider USG hips for all births (generalized USG) a better screening tool for diagnosing DDH.^{20,21} In India, for the logistics and finances needed, generalized USG may not be possible. On the contrary, universal clinical screen followed by confirmatory early and target USG scans in at-risk newborns should be made as part of routine newborn screening. Similarly, equal emphasis on regular follow-up with paediatrician and paediatric orthopaedic surgeon till the child starts walking in later life needs to be made to the parents.

The main strength of our study is all newborns had a protocol-based care for diagnosing DDH and

management of every case in conjunction of paediatric orthopaedic surgeons. The major limitation is an observational study with small cohort. Of the 58 babies, only 2 had pathological hip, and both were at risk for developing DDH. Of the remaining births during study period, DDH missed despite normal clinical screen at birth, if any, is not known. And so, absolute cost-effectiveness of the above practice could not be commented on. Information from large population-based data from developing countries is needed in defining the cost and benefit of the above intervention

Conclusion:

Universal clinical screen for DDH (at birth and regular intervals till 18 months), with USG target screen of hips for all at-risk newborns can aid in early diagnosis and management of DDH. Information involving large population-based data from this study is benefited and same is continued in our institute.

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