Screening of Developmental Dysplasia of Hip in Neonates and Infants at Hospital & Rehabilitation Centre for Disabled Children (HRDC)

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DDH includes hips that are unstable, malformed, subluxated, or dislocated. The disorder is not always present at birth (congenital) and an infant may have a normal neonatal hip screening examination and subsequently develop a dysplastic or dislocated hip. Ultrasound is a sensitive tool in confirming the diagnosis in newborns and infants, because it is a less expensive, easily available, radiation free imaging modality to screen hips for dysplasias. It affords direct visualization of the cartilaginous components of the hip joint.

A prospective study was started from March, 2018 till May, 2019. Around 75 neonates and infants were screened for developmental dysplasia of hip. Screening was conducted in bilateral hips using Harcke's dynamic ultrasound technique. There were 23 girls and 52 boys; the age of the infants ranged from 2 weeks to 10 months. The classification of dysplasia of hip was done based on A/B ratio obtained from D1 (diameter of femoral head covered by the acetabulum) and D2 (diameter of the entire femoral head). Morphology of the hip joint was noted and stress test was done to evaluate stability. Follow up scans of the neonates and infants

diagnosed with DDH was also done after application of Pavlik harness. This is an ongoing study and our aim is to study the incidence of DDH in Nepalese neonates and infants.

Based on A/B ratio and stress test, out of 75 neonates and infants, 4 had mild, 1 had moderate and 1 had severe dysplasia of right hip, 6 had mild, 1 had moderate and 1 had severe dysplasia of left hip, 1 had severe dysplasia of right hip and mild dysplasia of left hip, 1 had severe dysplasia of right hip and dislocated of left hip, 2 had subluxable right and 2 had subluxable left hip.

Ultrasound is a valuable tool for both screening and monitoring progress in neonates and infants for DDH. Further large scale studies need to be conducted in Nepal. All the neonates and infants visiting clinicians should be advised for ultrasound screening of hips.

Keywords: developmental dysplasia of hip, infant, screening, ultrasound.

Developmental dysplasia of the hip (DDH) is a disease that involves abnormal development of the femoral head and acetabulum. Although the precise mechanism of disease pathogenesis has yet to be elucidated, a normal acetabulum stimulates the femoral head to develop adequately and, conversely, an appropriately positioned femoral head enables normal acetabular development.[1] DDH includes hips that are unstable, malformed, subluxated, or dislocated. Instability is the inability of the hip to resist an externally applied force without developing a subluxation or dislocation. A malformation includes any abnormality in the development of the femur and/or acetabulum. A subluxation is an incomplete dislocation with some residual contact between the femoral head and acetabulum, and a dislocation indicates complete displacement of the femoral head from the acetabulum.[2]

The incidence in the UK before ultrasound (US) screening became available was quoted as 1–2 per 1000. Since the advent of selective US screening, which selectively ultrasounds the hips of babies who are thought to be at high risk of DDH, estimates of the UK incidence have increased and ranged from 5−30 per 1000.[3] There is consensus that a family history of DDH, breech presentation, female sex, primiparity and oligohydramnios increases the risk of a baby having DDH, although only babies in the first two categories are generally selected for US screening.[4]

The first use of hip sonography was as a morphologic examination. Graf, an Austrian orthopedic surgeon, began work with an articulated-arm scanner; because of the restricted movement of this equipment, his technique of evaluation was based on a coronal image of the hip obtained from the lateral approach with the femur in anatomic position. His method emphasized angular measurements of acetabular landmarks, in addition to assessment of hip position.[5] As real-time equipment became available, Graf switched to a linear-array transducer, but continued his basic approach of classifying hip disease according to

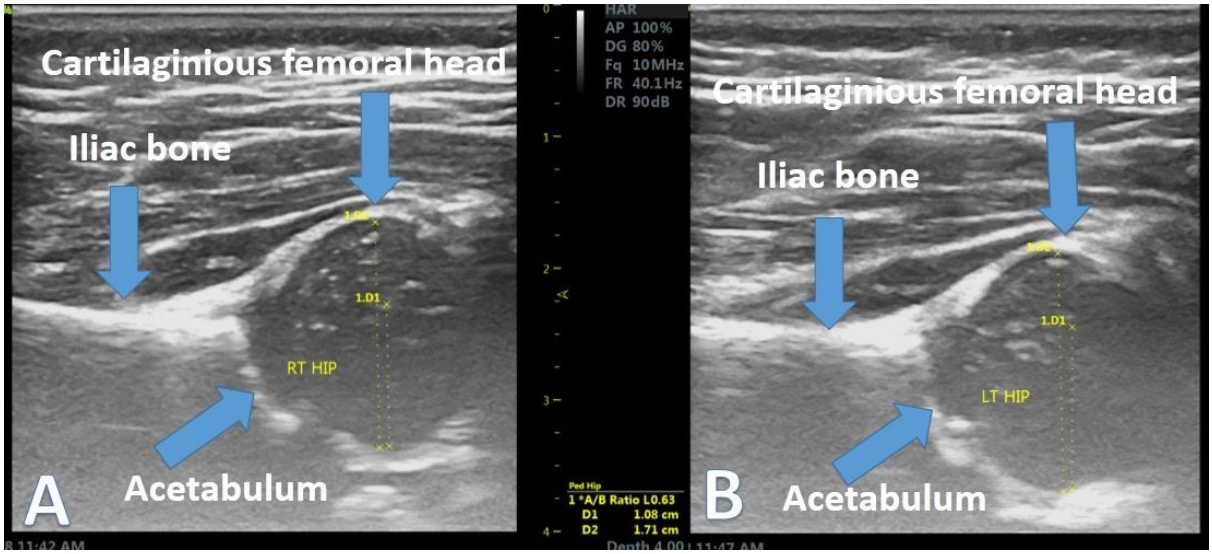

Figure 1: 3 months old boy with the diagnosis of B/L fibular hemimelia. Fig. 1A shows normal right hip with A/B ratio 0.63 and Fig. 1B shows normal left hip, A/B ratio was 0.68.

acetabular measurements.[6]

Sonographers such as Novick et al. and Harcke et al., who began their assessment of infant hips with real-time transducers, were willing to experiment with different approaches.[7,8] As experience developed, a dynamic approach was emphasized that assessed the hip in several positions. The evolution of this technique paralleled the following clinical maneuvers used in the physical examination of the hip. The Barlow test determines if a hip can be dislocated. The hip is flexed and the thigh brought into an adducted position. A gentle push posteriorly can demonstrate instability by causing the femoral head to move out of the acetabulum.[9] The Ortolani test is the reverse. As the flexed hip is abducted, the examiner "feels" a dislocated hip returning to the acetabulum.[10] **Figure 1**, shows ultrasound image of a normal hip joint.

Materials and Methods

Between March, 2018 and May, 2019, we carried out a prospective ultrasound screening programme for DDH at Hospital & Rehabilitation Centre for Disabled Children (HRDC). All the babies below 10 months who came to HRDC hospital for treatment were screened for DDH, regardless of the diagnosis. However, majority of the babies had CTEV. Total 75 neonates and infants were screened, out of which 23 were girls and 52 boys; the age ranged from 2 weeks to 10 months. Screening was conducted in bilateral hips using Harcke's dynamic ultrasound technique. The classification of dysplasia of hip into mild, moderate and severe was done based on A/B ratio obtained from D1 (diameter of femoral head covered by the acetabulum) and D2 (diameter of the entire femoral head). We classified hip as mild dysplasia if A/B ratio is $\geq 0.50 < 0.55$, moderate if $\geq 0.45 < 0.50$ and severe if < 0.45 (Table 1). Morphology of the hip joint was also assessed. All hips referred for ultrasound screening were examined using the Barlow and Ortolani maneveurs to evaluate stability of the hips. We have also

Normal	Mild	Moderate	Severe
A/B ≥ 0.55	A/B < 0.55	A/B < 0.50	A/B < 0.45
round acetabulum	round acetabulum	more or less round acetabulum	steep acetabulum

Table 1: Classification of dysplasias of hips based on A/B ratio and morphology.

done follow up scans of the neonates and infants diagnosed with DDH after application of Pavlik harness to monitor their progress.

Aim and objective

Our aim is to screen neonates and infants as early as possible and start their treatment at an early age and to monitor their progress. To avoid the use of X-rays that are not very useful at this age and harmful for the babies. This is still an ongoing study and our aim is to study the incidence of DDH in Nepalese neonates and infants.

Result

Out of total 75 hips screened, 4 had mild, 1 had moderate and 1 had severe dysplasia of right hip, 6 had mild, 1 had moderate and 1 had severe dysplasia of left hip, 1 had

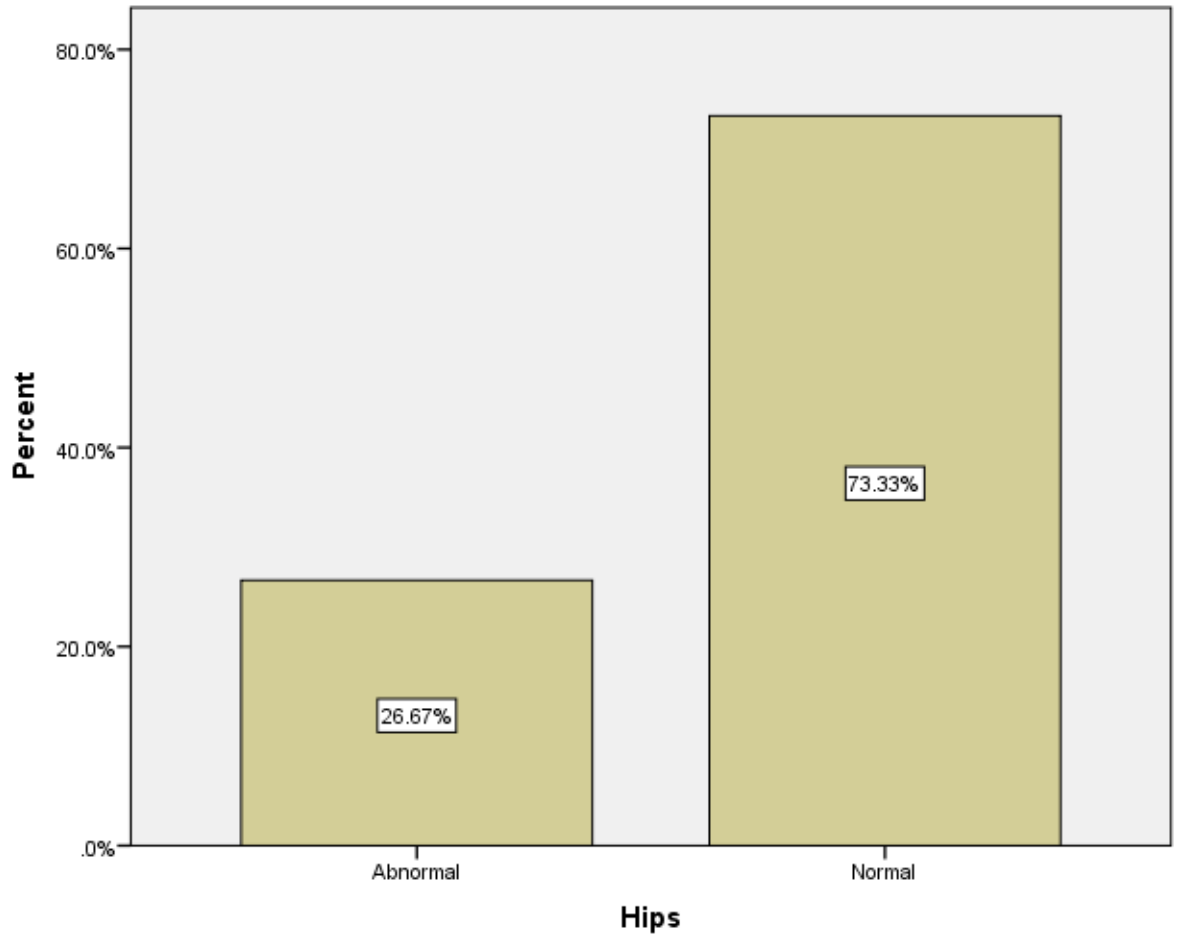

Figure 2: Percentage of abnormal hip pathology out of total 75 hips screened.

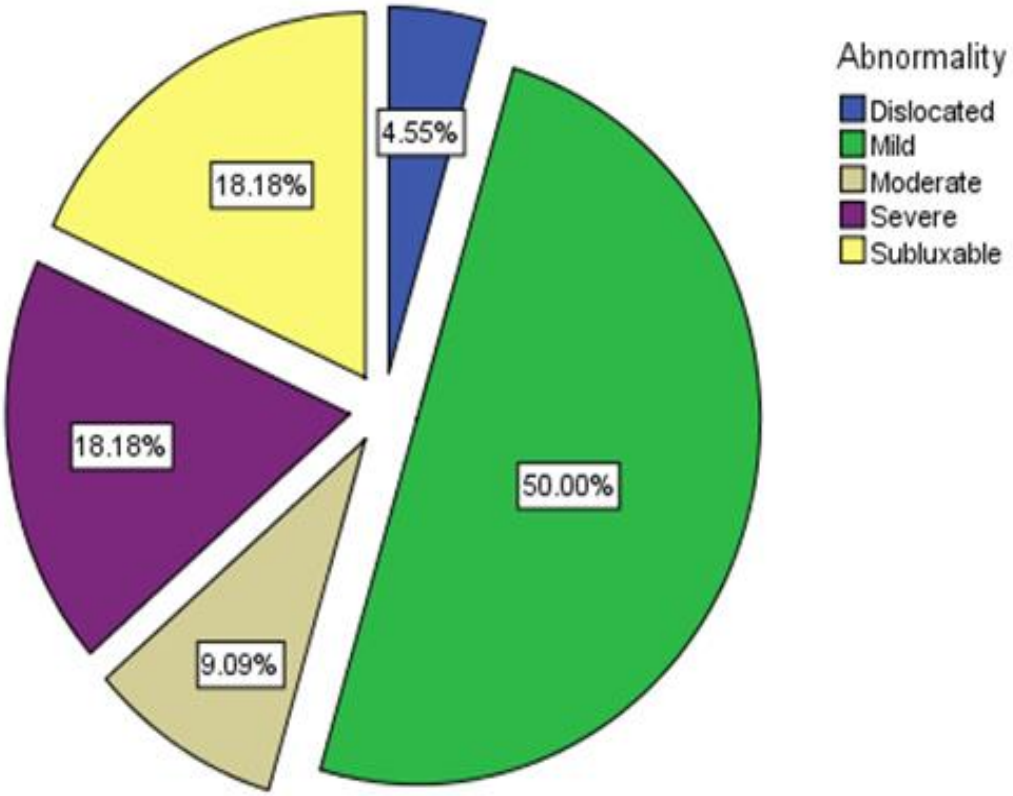

Figure 3: Percentage of mild, moderate, severe, dislocated and subluxable hips out of total 22 abnormal hips.

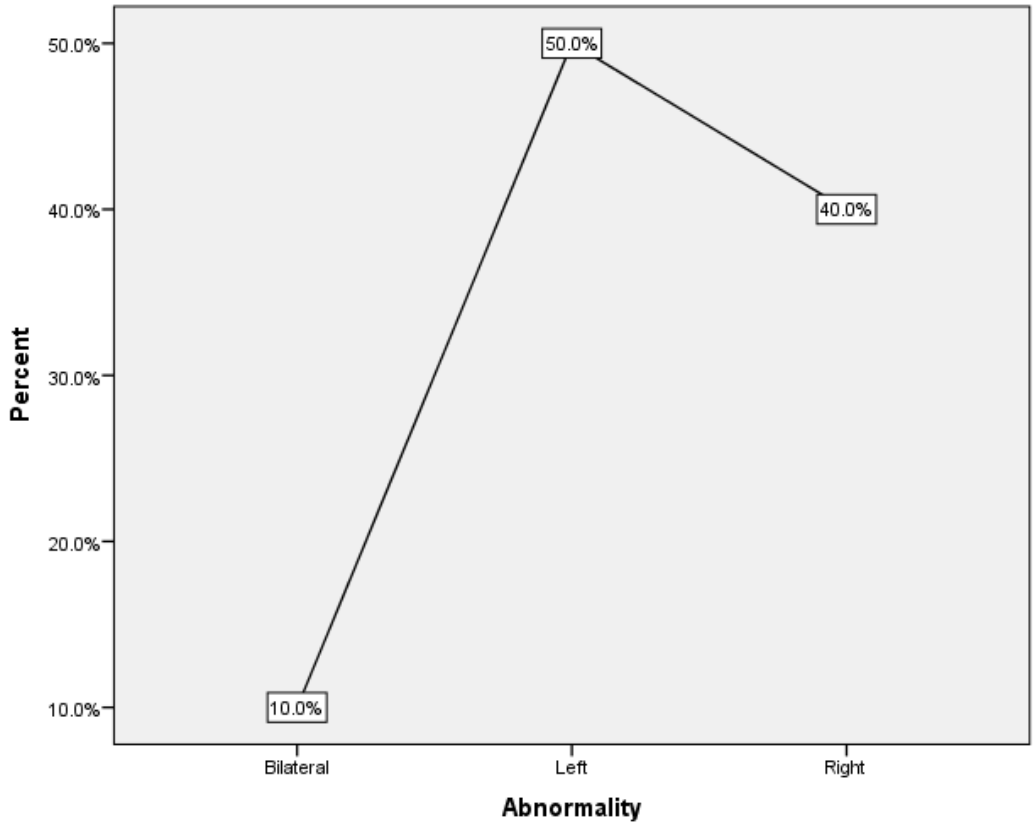

Figure 4: Percentage of right, left or bilateral hips involvement.

severe dysplasia of right hip and mild dysplasia of left hip, 1 had severe dysplasia of right hip and dislocated left hip and during stress test out of 4 normal hips, 2 had subluxable right and 2 had subluxable left hip. Therefore, 20 out of 75 hips showed some kind of hip abnormality which account for approximately 26.6 % **(Figure 2)**. Out of the abnormal hips, mild dysplasia was noted in 50 %, moderate in 9.09 %, severe in 18.18 %, dislocated in 4.55 % and subluxable in 18.18 % **(Figure 3)**. Right hip was abnormal in 40 %, left hip in 50 % and bilateral hips in 10 % **(Figure 4)**. All the babies with hip dysplasias were called for follow up scan but many patients lost follow up. Out of 7 babies that came for follow up, 1 with severe left hip dysplasia corrected to normal after 3 months, 1 moderate left hip dysplasia in 6 weeks, 1 severe right hip dysplasia to moderate in 1 week and mild in another 1 week.

Discussion

Developmental dysplasia of the hip (DDH) is a potentially disabling condition particularly when treated late; if detected early, operation may be avoided. Clinical screening programmes are important in reducing the incidence of surgery.[11] In the UK clinical examination for the screening of DDH was recommended in 1969. This advice was updated in 1986 when it was felt that ultrasound had a role in assessment. It was stated that 60% of dislocations of the hip arose in patients with 'at-risk' factors which included breech delivery, family history, and congenital postural deformities including those of the foot, caesarean section, oligohydramnios and retardation of fetal growth. Family history, breech delivery and foot deformity were thought to be the most important.[11] Universal ultrasound screening of the hip has, in many cases, resulted in an increase in the number of infants requiring splintage without a reduction in the number diagnosed 'late' who need surgery.[12] According to Catford JC et al, the natural rate of operation in DDH in which early splintage is not advocated is 1.6 per 1000 live births.[13] In our study, we could see that ultrasound screening of neonates and infants help to diagnose hip dysplasias at an early stage, thus, avoiding the need to do x-rays. In follow up scans, diagnosed cases of dysplasias showed correction within weeks after application of Pavlik harness, which would help us to avoid surgical procedures. Our study shows very high numbers of DDH patients in babies that come to HRDC for treatment. However, our study has limitations because we have been screening babies that already have associated other diseases and till now, we have screened very less number of babies. Therefore, we are planning to perform large scale screening programmes of normal babies in future. Few cases of DDH have been shown in **Figure 5-8**.

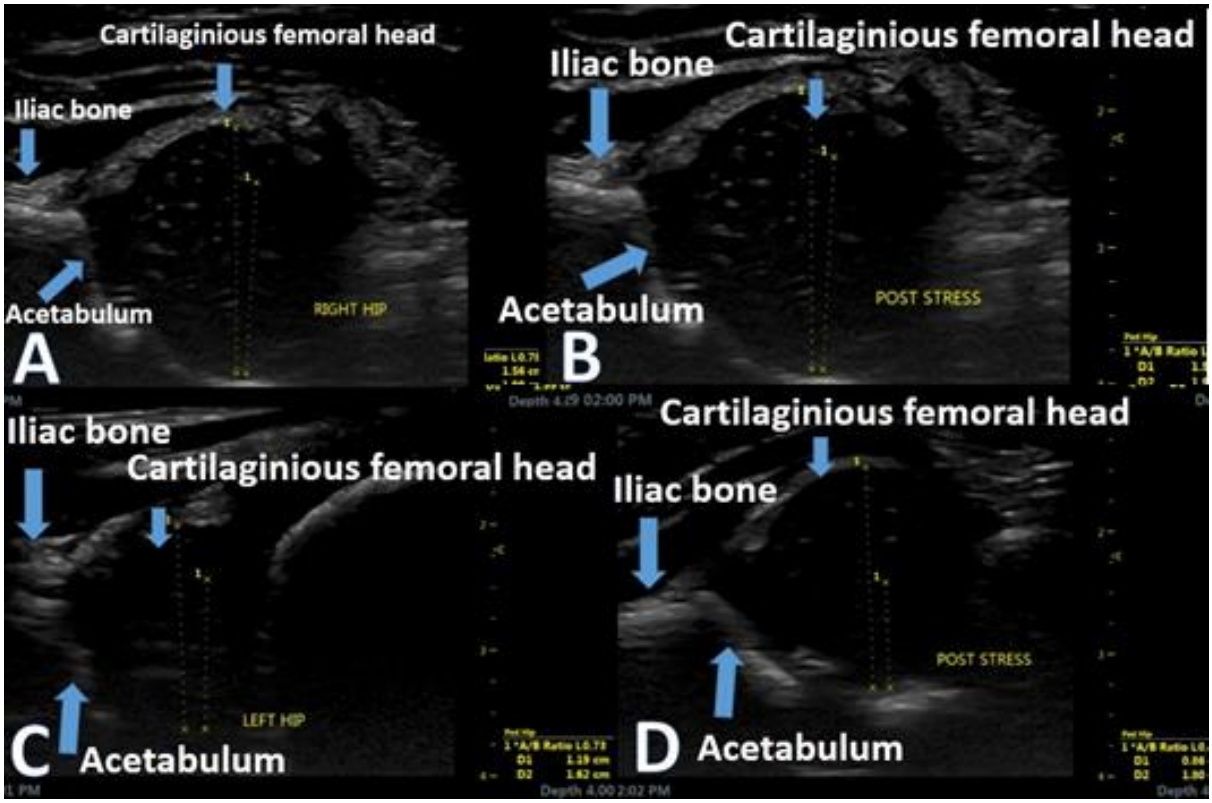

Figure 5: 2 months old boy with the diagnosis of right CTEV. Fig. 5A shows normal right hip with A/B ratio 0.78 and during post stress there was no change in A/B ratio which is shown in Fig. 5B. However, in left hip A/B ratio was 0.78 (Fig. 5C) but during post stress A/B ratio changed to 0.48 (Fig. 5D) indicating the left hip was subluxable.

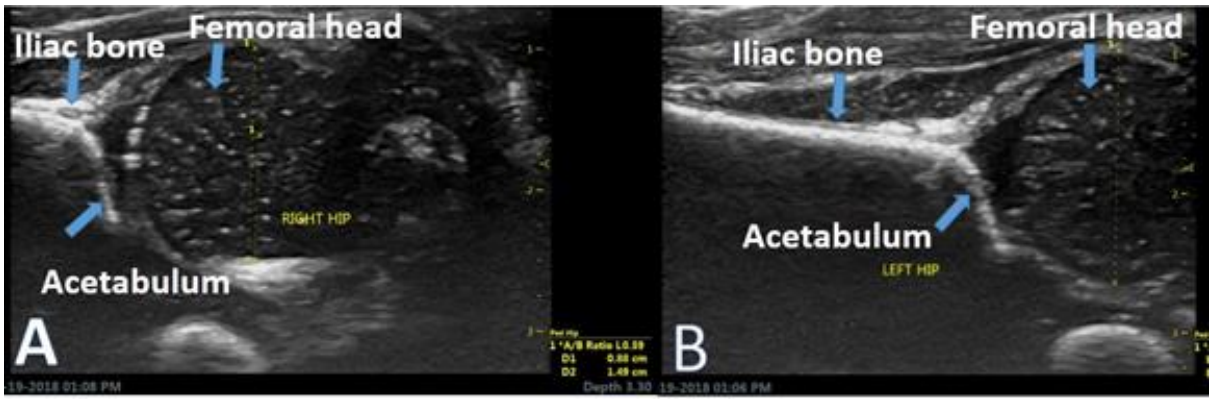

Figure 6: 2 weeks old boy who came to our hospital with the diagnosis of B/L DDH from other Centre. Fig. 6A shows normal right hip with A/B ratio 0.59 and Fig. 6B shows mild dysplasia of left hip with A/B ratio was 0.53.

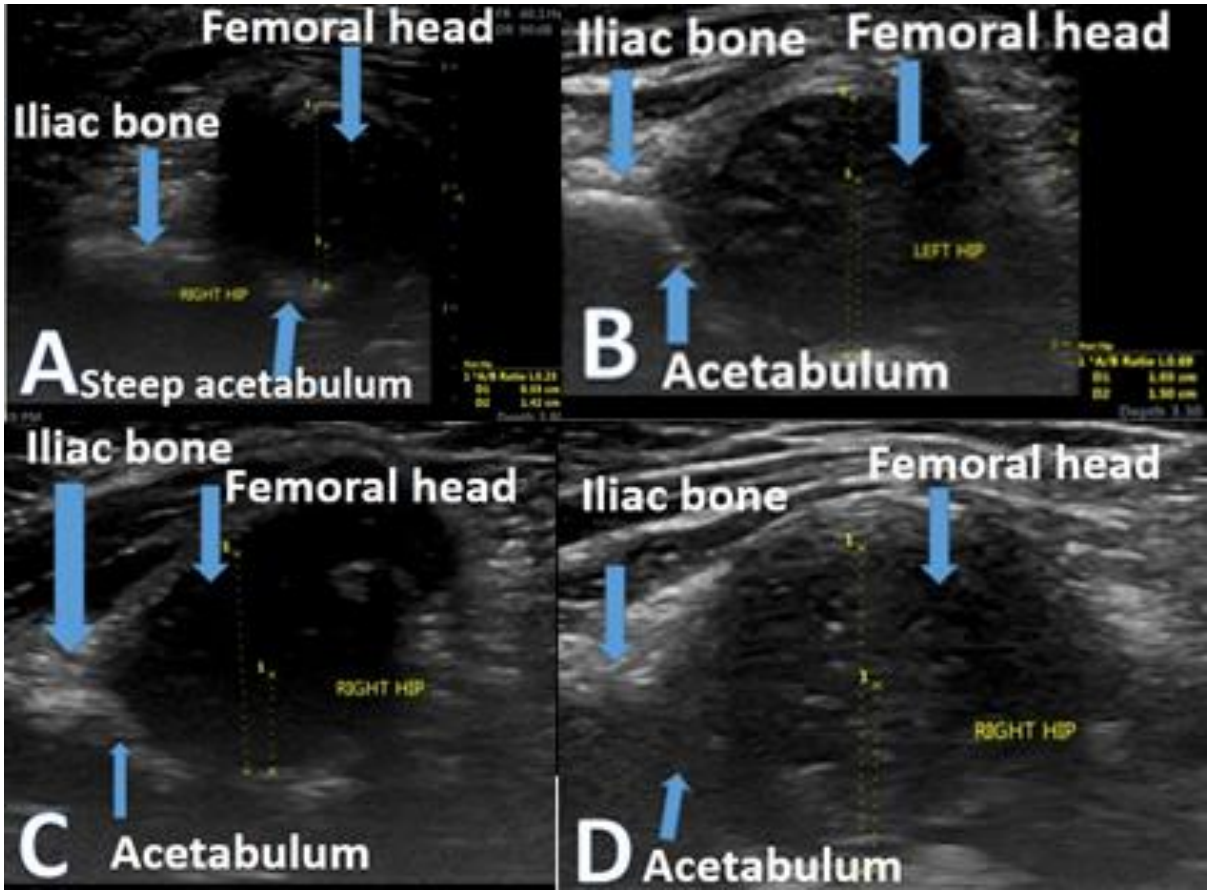

Figure 7: 3 months old girl who came to our hospital with the diagnosis of B/L DDH from other Centre. Fig. 7A shows severe dysplasia of right hip, the right femoral head is almost out of the acetabulum and Fig. 7B shows normal left hip with A/B ratio was 0.69. Fig. 7C shows follow up scan 1 week after the application of Pavlik harness where A/B ratio of the right hip is 0.45, indicating moderate dysplasia and Fig. 7D shows follow up scan after another 1 week where A/B ratio of the right hip is 0.57, indicating almost normal right hip.

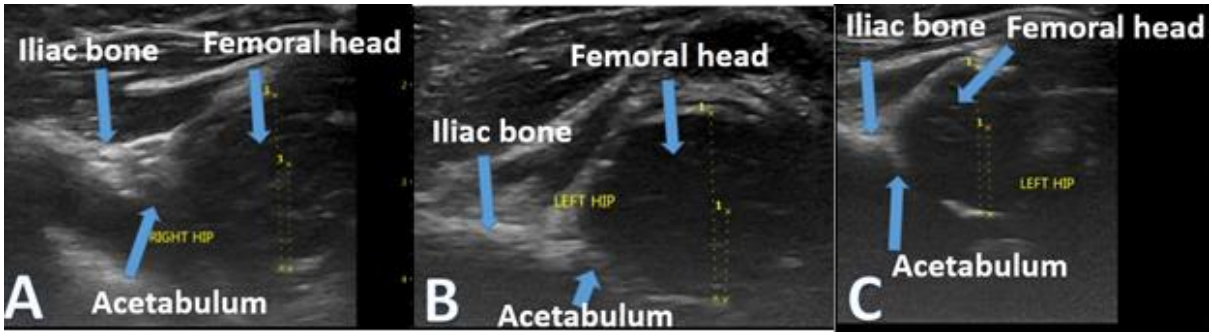

Figure 8: 2 months old boy who came to our hospital for screening of B/L hips. Fig. 8A shows normal right hip with A/B ratio 0.61 and Fig. 8B shows moderate dysplasia of left hip with A/B ratio 0.48. Fig. 8C shows follow up scan 6 weeks after the application of Pavlik harness where A/B ratio of the left hip is 0.59, indicating almost normal left hip.

Conclusion

An effective ultrasonographic method should include simple, precise, quantitative and consistent definitions for a proper examination and diagnosis. Both universal and selective ultrasonographic newborn hip screening programmes have significantly decreased the rate of late detected DDH and lessened the need for surgical treatment. Ultrasound screening of hips should be done in all the newborns regardless of their diagnosis, whether they fall into high risk or not. Further large-scale studies need to be conducted in order to study the incidence of DDH in Nepal.

References

1. Ponseti IV. Growth and development of the acetabulum in the normal child: anatomical, histological and roentgenographic studies. J Bone Joint Surg Am 1978; 60:575–85.
2. McKibbin B. Anatomical factors in the stability of the hip joint in the newborn. J Bone Joint Surg Br.1970;52:148-59.
3. Seweel MD, Rosendahl K, Eastwood DM. Development Dysplasia of the hip. BMJ. 2009;339:64454.
4. Committee on Quality Improvement, Clinical Practice guideline: early detection of DDH of the hip. Pediatics 2000;105:896-905.
5. Graf R. The diagnosis of congenital hip-joint dislocation by the ultrasonic Combound treatment. Arch Orthop Trauma Surg 1980;97:117-33.
6. Graf R. Ultrasonography of the infantile hip. In: Sanders AC, Hill MC, eds. Ultrasound annual 1985. New York: Raven, 1985:177-86.
7. Novick G, Ghelman B, Schneider M. Sonography of the neonatal and infant hip. AJR 1983;141:639-45.
8. Harcke HT, Clarke NMP, Lee MS. Boms PF, MacEwen GD. Examination of the infant hip with real-time ultrasonography. J Ultrasound Med 1984:3:131-37.
9. Barlow TG. Early diagnosis and treatment of congenital dislocation of the hip. J Bone Joint Surg [Br] 1962; 44-B: 292-301.
10. Hensinger RN. Congential dislocation of the hip: treatment in infancy to walking age. Orthop Ciln North Am 1987;18: 596-616.
11. Boeree NR, Clarke NMP. Ultrasound imaging and secondary screening for congenital dislocation of the hip. J Bone Joint Surg [Br] 1994;76-B: 525-33.
12. Robinson R. Effective screening in child health. Br Med J 1998;316:1-2.
13. Catford JC, Bennett GC, Wilkinson JA. Congenital hip dislocation: an increasing and still uncontrolled disability? Br Med J 1982;285:1527-30.