



Research Article

ROLE OF CRANIAL ULTRASONOGRAPHY IN EVALUATION OF PRETERM BRAIN INJURIES AND LONG TERM NEUROLOGICAL OUTCOMES: AN OBSERVATIONAL STUDY

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ABSTRACT

Background: Preterm babies are prone to develop various degrees of brain injury and adverse neuro-developmental outcomes. Hence, screening of these neonates should be done by cranial ultrasound to prognosticate the outcome.

Objective: The present study was conducted to find cranial ultrasound abnormalities in preterm babies and to help in screening at risk neonates for long term neuro-developmental disabilities.

Materials and Methods: This observational study was conducted in NICU (Neobless) Moulana hospital, Perinthalamanna, Kerala from January 2015 to June 2017. Total 312 preterm babies were enrolled in the study. All these neonates underwent cranial ultrasound (cUS) scan immediately after admission and before discharge.

Results: Total 312 neonates were included with mean age of 7.64 days in neonates with normal cUS findings and 7.33 days in neonates with abnormal cUS findings. Mean gestational age was 31.8 weeks in neonates with normal cUS and 30.09 weeks in neonates with abnormal cUS findings with mean weight 1.81 and 1.79 kg respectively. Among the neonates, 142 (46%) were males and 170 (54.4%) were females. Before discharge, out of 312 preterm neonates, 256 (82%) had normal cUS and 56(18%) had abnormal cUS findings of which 29 (9%) had cerebral edema, 20 (7%) IVH and 7 (2%) had ventricular dilatation.

Conclusion: Routine cranial ultrasound scanning of preterm neonates may help in identifying at risk babies for long term prognostication of neuro-developmental outcomes.

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INTRODUCTION

Babies born at <37 weeks of gestational age are termed as preterm neonates.¹ Neonates born prematurely are at high risk of brain injury. Early diagnosis is important for optimal treatment, prognostication and good neurological outcome.² The fetal or preterm neonates brain is more prone for both hemorrhagic and ischemic injury during the late second and early third trimester.³ This is mainly because of vascular, cellular and anatomical features of the developing cerebral environment, and the tendency for preterm babies to experience periods of physiological instability at a time when their cerebral circulatory auto regulation system is limited.⁴ Even preterm neonates who have relatively uncomplicated neonatal causes are at substantial risk for neuro-developmental delay. Recent reviews of early intervention studies in high risk neonates have proven the potential to improve long term development in children across low and high income countries.⁵

Two main imaging techniques have been implemented for prediction of neuro-developmental outcome in the neonatal period: cranial ultrasound (cUS) and MRI.⁶ The major advantage of these imaging techniques are to direct families of preterm babies toward the most appropriate follow-up facilities to promote early diagnosis and intervention for long term neuro-developmental sequel of various brain injuries.⁷ The major advantages of cUS are: it is relatively low cost and safe compared to other neuro-imaging techniques, can be performed bedside. It can be repeated very often for visualizations of ongoing brain maturation and the evaluation of brain lesion in addition to assessing the timing of brain damage.⁷ Various studies reported the use of cranial USG to detect intra-ventricular and parenchymal hemorrhage, ventricular enlargement and other abnormalities and its outcomes.⁸ Neonates with cerebral lesions, with ventriculomegaly, the incidence of normal neurological outcome decreased to less than 50%.⁸ Intra-parenchymal injury was associated with cerebral palsy as well as other (mental and sensory) neurological deficits in more than 85% of the cases.⁹ Regular follow-up assessments of babies at risk of

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neurological impairment may allow the early detection of problems.

MATERIALS AND METHODS

This observational study was conducted in NICU (Neobless) Moulana hospital, Perinthalamana, Kerala from January 2015 to June 2017. Preterm neonates (<37 weeks of gestational age) admitted in NICU were enrolled in this study. Neonates having perinatal asphyxia, congenital malformations of brain and spinal cord and other neonatal co-morbidities like respiratory distress syndrome (RDS), birth trauma were excluded from the study. All preterm neonates underwent cranial ultrasound (cUS) imaging after admission and again before discharge for evaluation. Results are analyzed in tables. Statistical analysis was done by using software SPSS version 22.0.

RESULTS

In this study, 312 preterm neonates admitted in NICU (Neobless) Moulana hospital, Perinthalamana, Kerala from January 2015 to June 2017 were included. All these babies underwent cranial ultrasound after admission and before discharge. The findings from the data analysis are mentioned below in table:1-3.

Table 1 Distribution of neonates as per age, gestational age and weight in both groups (n=312)

Variables	Normal cranial USG findings (n=256)	Abnormal cranial findings (n=56)	P values
Age in days (mean ± SD)	7.64 ± 6.62	7.33 ± 5.64	0.78
Gestational age in (mean ± SD)	31.87 ± 2.11	30.09 ± 1.19	0.81
Weight in kg (mean ± SD)	1.81 ± 0.18	1.79 ± 0.19	0.58

Table 2 Cranial ultrasound (cUS) findings of neonates on day 1 of admission (n=312)

cUS findings	Number	Percentage
Normal	240	77
Abnormal	72	23
Cerebral edema	32	10
IVH	26	8
Ventricular dilatation	14	5

IVH: intraventricular hemorrhage

Table 3 Cranial ultrasound (cUS) findings of the neonates (n=312) before discharge

cUS findings	Number	Percentage
Normal	256	82
Abnormal	56	18
Cerebral edema	29	9
IVH	20	7
Ventricular dilatation	7	2

IVH: intraventricular hemorrhage

Among the 312 preterm babies 54.4% (170 neonates) were female and 46% (142 neonates) were male. Table: 2 shows cranial ultrasound (cUS) findings of the neonates on day one of admission. Table: 3 shows cranial ultrasound (cUS) findings of the neonates (n=312) before discharge. The final cUS findings were: normal 256 (82%), cerebral edema 29 (9%), IVH 20 (7%) and ventricular dilatation 7 (2%).

DISCUSSION

Prediction of outcome after preterm birth is difficult, especially in the early postnatal period. The ability to predict outcome improves parental counseling and selection of infants for early therapeutic strategies in prevention of cerebral injury.¹⁰ Good prediction is usually achieved for major functional disabilities in early childhood. In this study, the mean age (in days) of neonates with normal cUS finding was 7.64 and neonates with abnormal cUS finding was 7.33. Mean gestational age (in weeks) in neonates with normal cUS was 31.87 and with abnormal cUS was 30.09 and mean weight (in kg) was 1.81 in neonates with normal cUS and 1.79 in neonates with abnormal cUS. Out of 312 preterm neonates, 256 (82%) had normal cUS findings and 56 (18%) had abnormal cUS findings. Among the abnormal cUS findings, 29 (9%) had cerebral edema, 20 (7%) had IVH and 7 (2%) had ventricular dilatation. A study done by de vries et al cUS lesions were detected in the majority of infants (92%) born <32 weeks of gestation.¹¹ Ferriero et al found the incidence of IVH in preterm infants of less than 1500 g from 20-40%.¹² Another study done by hankaran et al on 129 high risk preterm infants, showed that 51.63% had abnormal cUS findings of which 41.08% had IVH, 9.06% had ventricular dilatation.¹³ Grazing et al showed that cranial ultrasound abnormalities were more strongly associated with delayed psychomotor development and the findings of ventriculomegaly and the diagnosis of periventricular hemorrhage were associated with more modest increased risk at 2 years of age.¹⁴ Few other studies also found that ultrasound abnormalities are associated with a two to fourfold increase in the risk of low Bayley Scales of Infant Development (BSID)-II score and mental retardation.^{15,16,17} A study done by Ancel et found that major abnormalities on cUS predict the development of cerebral palsy (CP) and neuromotor delay at variable ages of follow-up.¹⁸ Present study shows that a large number of preterm neonates have abnormal cranial ultrasound findings. Long term follow-up and subsequent therapeutic intervention may significantly reduce the severity of neuro-developmental impairment.

CONCLUSION

Cranial ultrasonography (cUSG) remains the accurate and rapid imaging technique of choice for detecting brain injuries in preterm neonate. This technique is both sensitive and specific for detecting germinal matrix hemorrhage and periventricular leucomalacia.

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