BRAIN BIOMETRY IN PRETERM USING TRANSCRANIAL SONOGRAPHY

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Introduction

Globally, approximately 15 million of preterm babies are born annual. Preterm babies are facing major health concern of poor neurodevelopment due to poor brain growth, which is a global burden. Transcranial sonography showed good accuracy to study brain growth. It is easily accessible, done at bedside, inexpensive imaging tool, and can be easily obtainable in limited resource areas comparing to MRI. However, there is still existing gap in usage of transcranial sonography during neonatal period.

Aim of the work

The aim of this study, is to assess brain growth using pons and corpus callosum measurements in preterm babies, and their relations to perinatal risk factors. Moreover, to assess relation between those measurements and resistive indices of cerebral arteries in basilar and middle cerebral artery.

PATIENTS and METHODS

A prospective study was conducted in newborn at ≤ 32 weeks of gestation, and who didn't get major brain injury. We measured corpus callosum length, corpus callosum-fastigium length, anterior-posterior diameter of pons, pons belly size (length*width), height of cerebellar vemis, weight, and head circumference on day 1, day 7, and day 28. We collected perinatal history and clinical information while admitted.

Results

A total of 64 preterm babies were followed over a period of 28-day, 56% were female, gestation age ranging from 27 to 32 weeks at birth, birth weight was 1.099 ± 0.171 kg, and 64% had initial step during resuscitation after birth. 12% received surfactant, 32% passed on mechanical ventilation, and median of total days passed on oxygen supplementation (either via mechanical ventilation or continuous positive airway pressure or free flow) was 7 days, and most who passed on mechanical ventilation had mean duration of 14 days on oxygen supplementation.

There was statistically significant (p = 0.000) increase of all brain biometry measurements, head circumference, weight, and cerebral blood flow in basilar and middle cerebral artery over period of 28-day.

There was statistical significant correlation (p = 0.000) which was strong positive linear between anterior-posterior diameter of pons and pons belly size, while moderate between all measurements with head circumference and weight over 28 days as well as between corpus callosum-fastgium length and vermis cerebellar measurements. Being on mechanical ventilation was statistical significant associated with slow change of pons belly size (p = 0.0001), and anterior-posterior diameter of pons (p = 0.006), but other measurements were not statistically significant.

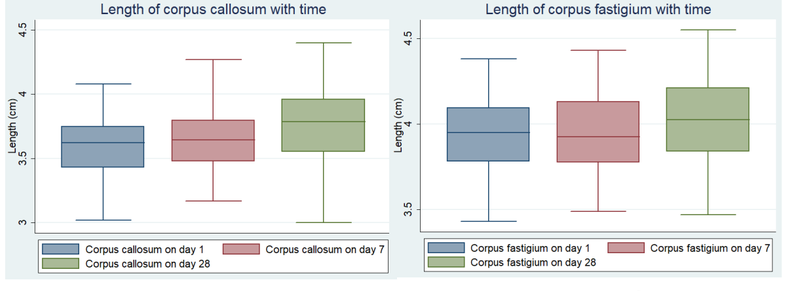

Fig 1: Brain growth by assessing corpus callosum over a period of 28-day

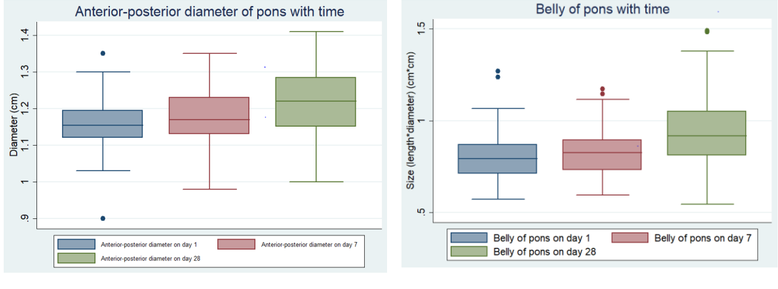

Fig 2 : Brain growth by assessing pons over a period of 28-day

An increase of weight and postnatal age were statistical significant with an increase of corpus callosum length, corpus callosum-fastigium length, pons belly size, and anterior-posterior diameter of pons. Long duration on oxygen supplementation was statistically significant associated with a decrease of both measurement of pons. On contrast, resuscitation with positive pressure ventilation was statistically significant associated a decrease of pons belly. A change of brain biometry measurements in first month was not statistically significant associated retinopathy of premature. Having surfactant at birth was statistically significant associated with a decrease of cerebral blood flow in all arteries. Over a period of 28-day, an increase of cerebral blood flow was statistically significant correlated with an increase of pons and corpus callosum measurements. Cerebral blood flow at birth in all artery was not associated with any brain biometry measurement over a period of 28-day.

Conclusion

Poor brain growth is major health concern for preterm babies. Nevertheless, there is still existing gap in usage of transcranial sonography to prevent poor brain growth. Pons belly size (basal pons) as new measurement is highly accurate than anterior-posterior diameter of pons which is used to assess pons growth. Corpus callosum-fastigium length may well foretell the growth of cerebellar vermis. Continuous monitoring weight and head circumference during neonatal period are good indicators of brain growth. Long duration on oxygen supplementation predispose preterm babies to have poor brain growth specifically pons, considering that being on mechanical ventilation is risk factor to spend more time on oxygen supplementation, and having low APGAR score requiring resuscitation with positive ventilation, predispose to have poor brain growth. Brain biometry measurements in the first month of life were not evident to predict retinopathy of prematurity, however further study could explore more. Cerebral blood flow increase with postnatal age, and the brain growth during neonatal period. Preterm babies who took surfactant are prone to have a decrease of peak systolic velocity which predispose them to have brain injury. Cerebral blood flow on day 1 didn't predict brain growth. This study indicate there is a high need to prevent poor brain growth before birth, while admitted, and after discharge.