Title: Determination volume of ventricular tap based on the total lateral ventricle volume of neonates with intraventricular hemorrhage

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Structured Abstract:

Introduction: In Canada, about 8% babies are born prematurely. Pre-term neonates are at risk of developing intraventricular hemorrhage (IVH) and subsequent post hemorrhagic ventricle dilatation (PHVD) or post hemorrhagic hydrocephalus (PHH). This condition should be properly diagnosed and treated to avoid further injury to the brain. Clinicians base their intervention mostly on 2D cranial ultrasound (US) and clinical symptoms but more recently 3D US system has been introduced in our lab. A well recognized interventional therapy for PHH is needle aspiration of cerebrospinal fluid (CSF) from anterior fontanelle known as ventricular tap (VT) which is still controversial as to the exact amount. Our aim is to implement this 3D US system in the management of the neonates with PHH which can help to make the decision regarding how much should be tapped.

Methods: This 3D US system consists of a motor device which houses a 2D US probe and tilts it while the 2D US images are acquired into a computer and reconstructed into a 3D US image. The ventricle volumes were measured by our in-house software. In this study we have reanalyzed data of 70 premature neonates having IVH recruited from Victoria hospital, London, Ontario between the year of 2012 to 1016. Among 70 patients, 16 received at least one intervention. In 11 patients we found all information including age, head circumference(HC), weight on the day of VT and lateral ventricular volumes just before and after the tap. We were able to gather information of 42 individual taps and investigated the correlation among various parameters. For this study we have used linear regression and marginal model statistical analysis.

Results: We found poor correlation (R2 = 0.005 to R2 = 0.33) among tap amount with age, HC and weight but we found relatively better correlation (R2 = 0.5531) between tap amount and lateral ventricular volume measured by 3D US just before tap. Analysis using marginal model also supports the findings of linear regression. In both analyses, our result suggests that ventricle volume had the highest correlation with tap amount among the 4 predictors of interest.

Discussion: Traditionally 10 ml/kg CSF is supposed to be drawn in each VT. Removing larger amount of CSF may deteriorate clinical status transiently but removal of too little amount may not improve clinical status and may lead to excessively repeated intervention. Here the weak correlation between tap amount and weight of the neonate suggests that removing CSF based on the weight of the neonates may not accurately represent how much fluid should be drawn during each VT, volumetric measurement of total lateral ventricles by 3D US could be used concurrently with other physical parameters to determine the tap amount.