CORRELATION BETWEEN SEMIAUTOMATED QUANTIFICATION OF CRANIAL ULTRASOUND IMAGES AND NEUROBEHAVIOR IN VERY PRETERM INFANTS AT TERM

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Background: Cranial ultrasound (CrUS) is widely used in preterm infants but is still subject to inter-observer variability. Previous works showed that quantitative analysis of brain ultrasound might carry information of changes in tissue microstructure. In this work, we compared the value of a semiautomated image processing method with conventional CrUS to predict neurobehavior at term equivalent age in very preterm infants.

Methods: A cohort of 100 very preterm infants was evaluated. Serial CrUS scans were performed until term equivalent age, when a neurobehavioral exam (NBAS) was performed. Four Regions of Interest (ROIs): periventricular areas, choroid plexuses, cerebellum and subcortical white matter, were delineated and used for analysis. A feature selection algorithm for tissue characteristics was applied to the ROIs. The resulting US tissue score was correlated to NBAS scores.

Results: Median gestational was 29+1 weeks and mean birth weight 1076g. On standard CrUS, severe brain lesions (ventricular dilatation and post-hemorrhagic periventricular infarction) were predictive of abnormal NBAS motor cluster ($p=0.007$ and $p=0.005$, respectively), but with a low sensitivity. The quantitative texture scores were highly significantly correlated to all NBAS scores, achieving sensitivities over 80% for all domains.

NBAS cluster	OR (CI 95%)	Accuracy
Habituation	62.2 (5.7-669.9)	87.2
Social	33.3 (5.9-185.5)	86.4
Motor	15.2 (4.5-51.0)	76.2
State organization	115.9 (7.2-185.4)	87.0
Regulation of state	29.6 (5.8-150.8)	70.3
Attention	8.5 (1.4-48.5)	98.5

[OR and accuracy of the method for every cluster]

Conclusions: This study provides preliminary evidence that texture analysis of neonatal CrUS can extract quantitative features that correlate with neurobehavior with a higher predictive value than the presence of abnormalities in conventional CrUS. This results support further research in this direction.