UT AUSTIN PORTUGAL ANNUAL CONFERENCE 2023
MODELLING THE FUTURE

UTAustin Portugal

Methodologies for estimating MRI brain volumes in preterm neonates at term

MEDICAL PHYSICS

Tânia F. Vaz [1], Nuno Matela [1], Nuno Canto Moreira [2], Hugo A. Ferreira [1]

INTRODUCTION

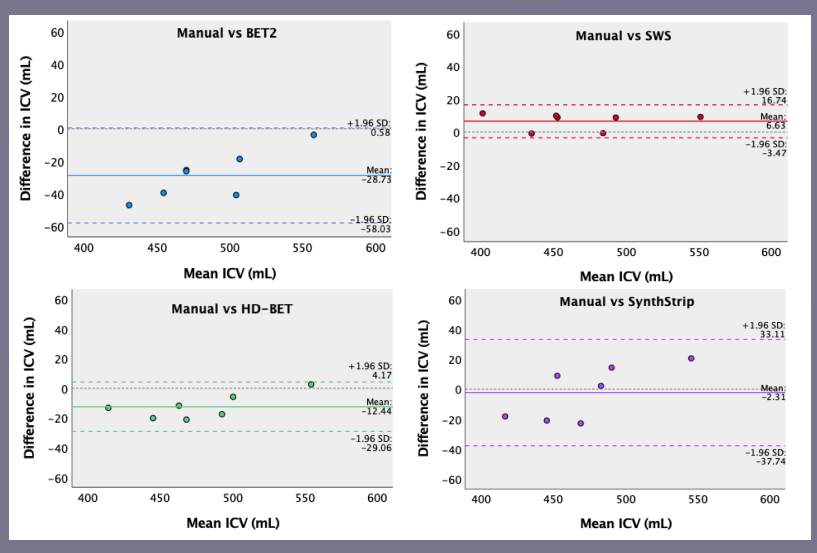
Magnetic resonance imaging (MRI) plays an important role in assessing early brain development and injury in neonates. Volumetric analysis trough brain tissue segmentation is preceded by brain extraction (BE) to remove non-brain tissue. BE remains a challenge in neonatal brain MRI because of the low spatial resolution, low signal-to-noise ratio, low contrast-to-noise ratio, wide variation in intensity within tissues, small brain size and shape, and motion artifacts, when compared with adult brain images. There are several methods for BE (*i.e.*, manual, semi-automated, and automated algorithms), but manual segmentation is still considered the "gold standard".
The main goal was to assess different BE methods in MRI of preterm neonates and their effects on intracranial volumes (ICVs).

METHODS

Subjects: Seven premature neonates (mean gestational age ± standard deviation: 27.3±1.5 weeks) with MRI brain scans acquired at term-equivalent age (TEA), without detectable lesions and congenital conditions.
Brain extraction methods: Manual segmentation of the ICVs was performed using 3D Slicer for all 2D T2-weighted scans to establish reference standards. Four automated BE methods were also used: Brain Extraction Tool (BET2); Simple Watershed Scalping (SWS); HD Brain Extraction Tool (HD-BET); and SynthStrip.
Statistical analysis: The similarity between BE methods was determined using the Dice Coefficient (DC) and Bland-Altman analysis. Paired samples t-test (significance value of 5%) were used to compare the results from manual vs automated methods, resorting to the IBM SPSS v27 software.

RESULTS & DISCUSSION

Results suggest that HD-BET and SWS are the automated brain extraction methods most similar to manual segmentation, given the high DC (>0.96) and few volumetric differences. Nonetheless, further studies with larger samples are warranted to validate such findings in premature neonates scanned at TEA.



Bland-Altman plots comparing ICV differences measured with manual versus automated BE methods.

Acknowledgements

[1]Instituto de Biofísica e Engenharia Biomédica, Faculdade de Ciências da Universidade de Lisboa, Portugal; [2]Department of Neuroradiology, Karolinska University Hospital, Sweden; Contact: tania.vaz@alunos.fc.ul.pt
This work was funded by FCT (project UIDB/00645/2020 and PhD Scholarship 2022.12483.BD).

IBEB Instituto de Biofísica e Engenharia Biomédica
Ciências ULisboa Faculdade de Ciências da Universidade de Lisboa
KAROLINSKA UNIVERSITETSSJUKHUSET
AKADEMISKA SJUKHUSET
fct Fundação para a Ciência e a Tecnologia

INL INTERNATIONAL IBERIAN NANOTECHNOLOGY LABORATORY
fct Fundação para a Ciência e a Tecnologia
TEXAS The University of Texas at Austin