Deep learning volumetry of the posterior limb of the internal capsule and motor outcomes in extremely and very preterm neonates

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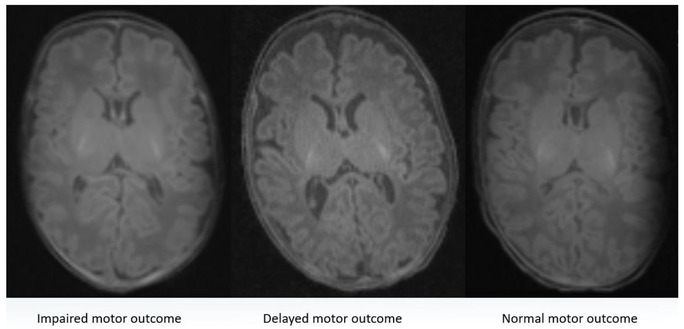
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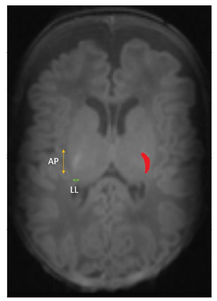
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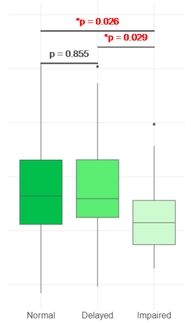
Introduction

Manual segmentation of brain structures is a labor-intensive process that is often prone to human error. The posterior limb of the internal capsule (PLIC) is an important white matter structure that plays a pivotal role in motor signal transmission, making its accurate identification essential for understanding normal and pathological development in the infant brain. This study explores the relationship between the volume of the PLIC, measured using a custom-developed deep learning (DL) algorithm, and the motor outcomes observed in extremely and very preterm infants (VPI) at one year of age. By leveraging advanced DL techniques, the research aims to determine whether accurate PLIC volumetry can serve as a predictive marker for early motor development.

Figures







Methods and Materials

430 VPIs born before the gestational age of 32 weeks were imaged at term. Using 100 manually segmented MRI volumes as a training set, we developed a convolutional neural network (CNN) algorithm for automatic segmentation of the PLIC. The extracted volumetry was then used for the correlation with the motor outcome at 1 year of age.

Results and Conclusion

The volumetric results from the automatic segmentation correlated with the motor outcome in very preterm neonates. The infants with the smaller PLICs had significantly worse motor outcomes at 1 year of age (p = 0.026). Our CNN algorithm showed potential in differentiating between the VPIs with impaired motor outcomes compared with those with normal and delayed outcomes.

Literature

Gruber N, Galijasevic M et al. "*A deep learning pipeline for the automated segmentation of posterior limb of internal capsule in preterm neonates*." Artificial Intelligence in Medicine 132 (2022): 102384.
Galijasevic M, Gruber N et al. "*Deep learning assisted volumetry of the posterior limb of internal capsule correlates with the motor outcome in very preterm neonates*." In publication process.

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