Using the FOHR as a measurement of hydrocephalus severity in paediatric posterior fossa tumour survivors

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1 Introduction

Hydrocephalus is a risk factor for long-term neurocognitive impairment in paediatric posterior fossa tumour survivors (pPFTs). Reliable quantification could guide timely neuropsychological support, as well as early methylphenidate (MPH) prescription to address impairments in processing speed. As no gold standard exists for measuring hydrocephalus severity in pPFTs, we compared two measurements of ventricular size: the fronto-occipital horn ratio (FOHR) and Evans' Index (EI).

2 Aim

To identify the most reliable measurement of hydrocephalus in pPFTs, in order to develop predictive models of neurocognitive outcomes.

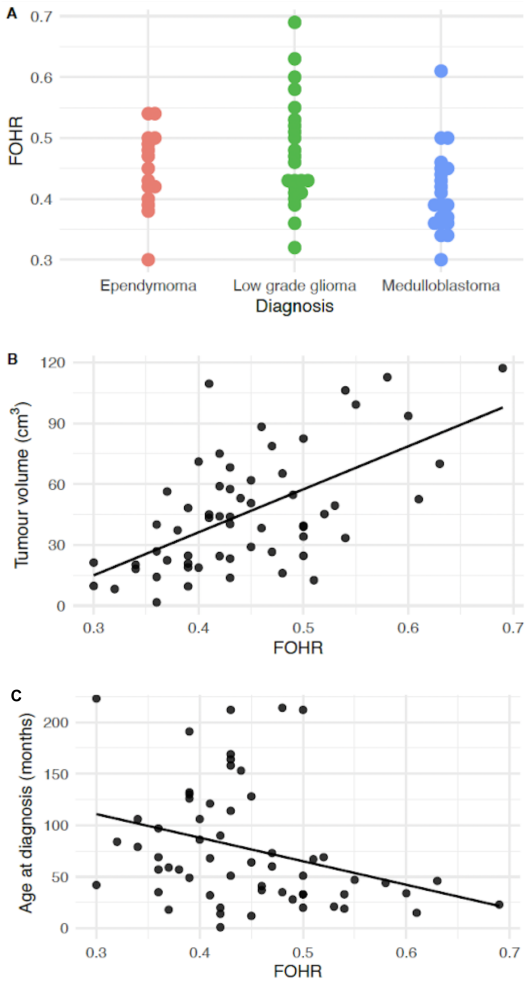

Figure 3: Comparisons of the FOHR.
A: Diagnosis, B: Tumour volume, C: Age at diagnosis (months)

3 Methods

We conducted a retrospective single-centre study of 63 pPFTs treated over 12 years, all surviving >2 years post-diagnosis. Pre-operative MRIs were reviewed to calculate FOHR and EI *(Figure 1)*, with AUC used for validation. Long-term change in processing speed (PSI) was assessed using age-appropriate Wechsler scales.

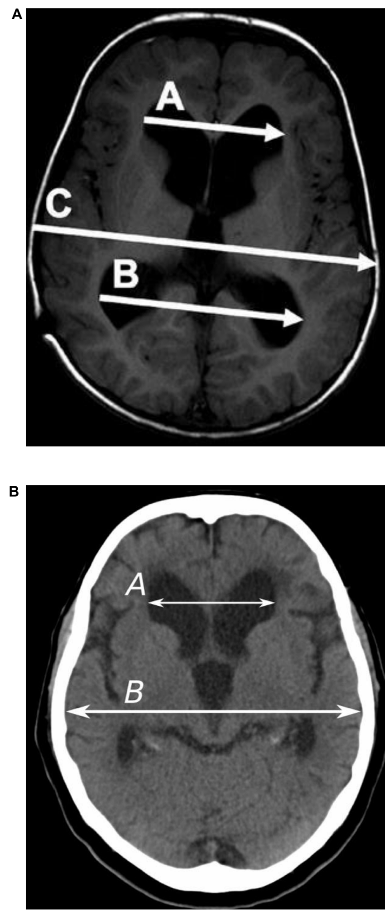

Figure 1: The Fronto-Occipital Horn Ratio (FOHR) and Evan's Index (EI). A: *FOHR = (max frontal horn diameter (A) + max occipital horn diameter (B)) / 2 (biparietal diameter (C)) [1].* ***B:*** *EI = (max width of the frontal horns (A) / the biparietal diameter (B)) [2].*

4 Results

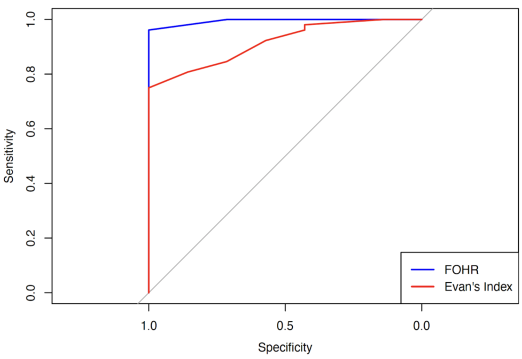

Figure 2: ROC curve comparing the FOHR versus EI
(DeLong's test for two correlated ROC curves: p=0.04)

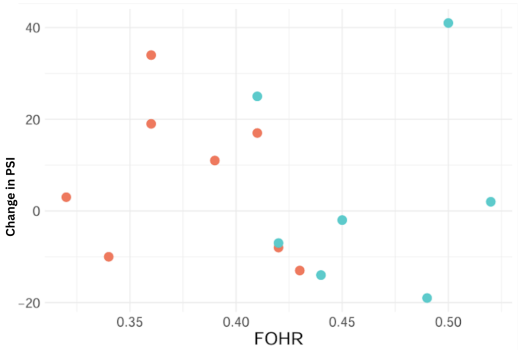

Figure 4: Evaluation of the impact of FOHR on Change in PSI
Blue: On methylphenidate, Red: No methylphenidate.

FOHR showed greater accuracy than EI (AUC 0.99 vs 0.92; p=0.04) *(Figure 2)*. Higher FOHR correlated with low-grade gliomas (p=0.03), tumour volume ($p=6.7\times10^{-7}$), and younger age (p=0.03) *(Figure 3)*. For the cohort pPFTs with neurocognitive testing, **the mean FOHR was higher in the subgroup of patients whom it was determined clinically appropriate to prescribe MPH** (0.47 vs 0.38; p=0.002) *(Figure 4)*. However, FOHR did not significantly correlate with change in PSI for either group (no-MPH r=-0.24, p=0.56; MPH r=0.09, p=0.85).

5 Discussion

FOHR is age-independent [3], but may be unreliable in infants, prior to fontanel closure [4]. As all our infant cases had hydrocephalus, we could not assess the accuracy of the FOHR in this group. We suspect EI correlated less well with ventricular volume as unlike the FOHR, it does not account for occipital horn enlargement frequently observed in paediatric cases [3]. Our preliminary findings suggest FOHR may predict cognitive decline in pPFTs, however, limitations of our study include small sample size, reduced statistical power, and limited neurocognitive data.

6 Conclusion

The FOHR appears to be a sensitive measure of hydrocephalus severity in pPFTs. Despite a small sample size, our findings support further research to refine the use of FOHR, particularly in infants, to predict pPFTs at high-risk of long-term cognitive impairment, and inform early intervention.

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