

## Utilising functional imaging to predict survival in paediatric brain tumours

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**Title:** Utilising functional imaging to predict survival in paediatric brain tumours.

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## **Intro**

Brain tumours are a common cause of death in the paediatric population. We have previously shown that MR imaging and spectroscopy can be used to non-invasively differentiate between tumour types. Here, we demonstrate that functional imaging can be highly predictive of survival and grade in a paediatric cohort.

## **Methods**

Perfusion (PWI) and diffusion weighted imaging (DWI) were performed in a multi-site (Birmingham Children's Hospital, Royal Victoria Infirmary, Alder Hey, Nottingham) cohort ([grade, 5-year survival alive:dead number] = [I,15:1],[II, 5:1],[III,2:3],[IV,8:11]). ROIs were drawn on T<sub>2</sub> imaging and functional imaging features (mean, standard deviation, skewness, and kurtosis) were derived. Supervised machine learning was used to predict 5-year survival and tumour grade from features. ANOVA and post-hoc tests were used to assess differences in features between grade and 5-year survival status.

## **Results**

5-year survival was predicted with 89%, 85%, and 87% accuracy with all imaging, perfusion, or diffusion features, respectively.

A significant difference in perfusion was found between surviving and diseased participants ( $1.71 \pm 0.82$  vs  $2.62 \pm 1$  mL/100g/min, respectively,  $p < 0.05$ ). A significant difference in ADC ( $\text{mm}^2 \text{s}^{-1}$ ) between tumour grades was found (1 vs 4 ( $1533 \pm 458$  vs  $857 \pm 239$ ), 4 vs 3 ( $857 \pm 239$  vs  $1197 \pm 137$ ), 4 vs 2 ( $857 \pm 239$  vs  $1440 \pm 557$ ), corrected  $p < 0.05$ ).

## **Conclusion**

We have shown that perfusion and diffusion imaging features can be used to non-invasively assess tumour grade and estimate 5-year survival status in a cohort of paediatric brain tumours.