Predicting Deep Vein Thrombosis in Glioblastoma: A Competing Risk Regression Analysis

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Background: Glioblastoma multiforme (GBM) patients face a high risk of developing venous thromboembolism (VTE), such as deep vein thrombosis (DVT). VTE is linked to worse survival. Typical DVT treatment is anti-coagulation but 25% of GBM patients suffer major intercranial bleeding within 1 year. This study addresses a research gap by assessing both genetic and clinical variables to predict DVT development in GBM patients.

Objective: Identify DVT predictors in GBM using clinical and next-generation sequencing (NGS) data

Methods: This retrospective cohort study analyzed clinical/NGS data from GBM patients at University of Pittsburgh Medical Center from 2008-2020. NGS data included 32 genes. To account for the competing risk of death, common in GBM patients, Fine-Gray CRR (Competing Risk Regression) models were used. An unadjusted cumulative incidence function (CIF) curve showed lifetime DVT risk. Univariate, multivariate, and backwards stepwise selection CRR analyses were performed to identify significant DVT predictors.

Results: Of 578 patients with NGS data, 87 developed DVT, 367 died, and 124 were censored (lack of follow-up). 1-year cumulative incidence of DVT was 14% with median survival of 10 months. Avastin (bevacizumab) use, increased BMI, and a TP53 mutation were significant predictors of increased DVT risk ($p<0.05$, SHR>1) in the final stepwise selection model. In a 3-predictor model, Avastin and BMI remained significant, with a 2.48- and 1.03-fold increased DVT risk, respectively. Adjusted CIF curves for Avastin and BMI showed a 5.6% and 2.7% increased DVT risk 1-year post-surgery, respectively. Although TP53 had a *p*-value of 0.053, its significance in the broader stepwise model indicates predictive power among other variables.

Impact: Avastin use, increased BMI, and a TP53 mutation predict DVT risk in GBM patients, supporting a clinical-genetic risk tool for DVT prediction. This combined model can guide clinical trials to include DVT treatment for high-risk GBM patients post-surgery, improving survival.