Tumor shape

Tumors can have any irregular shape; however, tumor masses are broadly categorized into round, oval, and irregular shapes.

In a study, the effects of tumor shape irregularity (TSI) on GK dose-plan quality and treatment outcomes were analyzed in 234 vestibular schwannomas. TSI was quantified using seven different metrics including a volumetric index of sphericity (VioS). GK treatment plans were created on a single GK-Perfexion/ICON platform. The plan quality was measured using the selectivity index (SI), gradient index (GI), Paddick's conformity index (PCI), and efficiency index (EI). Correlation and linear regression analyses were conducted between shape irregularity features and dose plan indices. Machine learning was employed to identify the shape feature that predicted dose plan quality most effectively. The treatment outcome analysis including tumor growth control and serviceable hearing preservation at 2 years, was conducted using Cox regression analyses. All TSI features correlated significantly with the dose plan indices ($P < 0.0012$). With increasing tumor volume, vestibular schwannomas became more spherical ($P < 0.05$) and the dose plan indices varied significantly between tumor volume subgroups ($P < 0.001$ and $P < 0.01$). VioS was the most effective predictor of GK indices ($P < 0.001$) and we obtained 89.36% accuracy (79.17% sensitivity and 100% specificity) for predicting PCI. The results indicated that TSI had significant effects on the plan quality but did not adversely affect treatment outcomes [1)].

1)
Sümer E, Tek E, Türe OA, Şengöz M, Dinçer A, Özcan A, Pamir MN, Özduman K, Ozturk-Isik E. The effect of tumor shape irregularity on Gamma Knife treatment plan quality and treatment outcome: an analysis of 234 vestibular schwannomas. Sci Rep. 2022 Dec 17;12(1):21809. doi: 10.1038/s41598-022-25422-9. PMID: 36528740.