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PSMA-PET CT in Evaluation and Management of Vestibular Schwannoma

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Pavnesh Kumar [1], Rituraj Upadhyay [2], Brian Dalm [3], Erik H. Middlebrooks [4], Zachary Jordan [5], Joshua D. Palmer [6], Evan M. Thomas [1]

1. Radiation Oncology, The Ohio State University Wexner Medical Center, Columbus, USA 2. Radiation Oncology, The Ohio State University Comprehensive Cancer Center, Columbus, USA 3. Neurosurgery, The Ohio State University College of Medicine, Columbus, USA 4. Neuroradiology, Mayo Clinic Florida, Jacksonville, USA 5. Neurology, The Ohio State University Wexner Medical Center, Columbus, USA 6. Radiation Oncology, The Ohio State University Comprehensive Cancer Center, Arthur G. James Cancer Hospital and Richard J. Solove Research Institute, Columbus, USA

Corresponding author: Pavnesh Kumar, drpavn@gmail.com

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Abstract

Purpose: Vestibular schwannomas (VS) are benign tumors originating from vestibulocochlear nerve Schwann cells. Contrast-enhanced MRI (CEMRI) is the gold standard for initial evaluation, monitoring, and post-treatment assessment. Treatment options include observation, stereotactic radiosurgery, fractionated radiation therapy, or microsurgery, with intervention typically prompted by rapid tumor growth and worsening symptoms. However, reliable clinical parameters to predict tumor growth or future intervention needs are lacking, and MRI may have limitations differentiating between residual/recurrent tumors and post-treatment changes. Prostate Specific Membrane Antigen (PSMA), originally found in prostatic tissue, is also expressed in VS. We report the first clinical application of 68Ga-PSMA PET-CT as an adjunct imaging modality in VS management.

Methodology: Ten patients with 11 VS underwent 68Ga-PSMA PET-CT. All but one patient, who could not have an MRI due to an implant, also had CEMRIs for initial or post-treatment evaluation. PSMA PET avidity was quantified using maximum standardized uptake values (SUVmax) for the tumor and the superior sagittal sinus (SSS) as a cranial blood pool reference. PET data were analyzed using tumor SUVmax and the tumor to SSS SUVmax ratio (SUVRsss). The Pearson correlation coefficient determined correlation, and intergroup comparisons with statistical significance were assessed using the Mann-Whitney test.

Results: All patients had unilateral schwannomas, except one with bilateral tumors. Before undergoing PSMA PET-CT one patient underwent surgery, while another had surgery followed by radiation. Eight treatment-naïve patients had PSMA PET-CT for treatment decision-making and planning; among them, 3 received fractionated stereotactic radiation (SRT), 2 underwent surgery, and 3 chose a wait-and-scan approach. The mean SUVmax and SUVRsss for treated tumors (n=5) versus those under observation (n=4) were 3.1 vs. 0.6 (p=0.014) and 2.1 vs. 0.5 (p=0.027). There was a strong positive correlation between tumor size and SUVmax ($R = 0.899$; $p < 0.001$), SUVRsss ($R = 0.928$; $p < 0.001$) as well as Koos grade and SUVmax ($R = 0.821$; $p = 0.007$), SURsss ($R = 0.780$; $p < 0.013$). Follow-up PET, about a year later, revealed stable to slightly decreased SUVmax (3.5 to 3.2 and 1.8 to 1.3) for 2 patients who had SRT after baseline PET and for one patient with prior surgery and radiation (4.4 to 3.3) before having baseline PET. In a patient with bilateral AS, the growing larger tumor (1.8 cm) had higher SUVmax (1.36) compared to the smaller non-growing tumor (0.3 cm, no uptake). PSMA PET-CT aided in SRT planning alongside CEMRI when available, and for one patient unable to have an MRI, PSMA PET-CT facilitated tumor delineation for SRT planning.

Conclusions: Larger vestibular schwannomas (VS) showed significantly higher avidity on PSMA PET than smaller tumors, with SUVmax ⩾ 1.5 and SUVRsss ratios > 1 linked to a greater likelihood of treatment. PSMA PET may serve as a valuable adjunct in VS management, warranting further prospective studies to clarify its role.