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CyberKnife Stereotactic Radiosurgery for Vestibular Schwannoma: Meta-Analysis of Long-Term Tumor Control and Hearing Preservation Outcomes

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Abstract
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Abstract

Objectives:

CyberKnife radiotherapy (CKRS) is a rapidly emerging technique for treatment of vestibular schwannoma (VS). In the present study, we systematically review the literature describing outcomes of CKRS as treatment for VS, with a particular focus on hypofractionated therapy and trends in Gy dose over the years

Methods:

We queried the PubMed, Scopus, and Web of Science databases in order to identify all primary retrospective studies reporting local tumor control and hearing preservation rates following CKRS for treatment of vestibular schwannoma. All studies returned across the three databases were subject to systematic screen according to pre-defined inclusion and exclusion criteria in a multi-step process performed by two investigators. Pooled meta-analysis of long-term tumor control and hearing preservation rates was then performed.

Results:

Following a comprehensive systematic search, a total of 15 studies (study period 1998-2018) reporting CKRS treatment protocol, long-term tumor control, and hearing preservation rates comprising 2018 vestibular schwannoma patients were included. Across the 15 studies, the proportion of females ranged from 30% to 60.3%, and the mean age of all 2,018 patients was 60.2 years. There were 64 patients who had neurofibromatosis type 2 (NF-2). Additionally, 309 patients had previously undergone surgical resection and/or radiosurgery for VS. The mean follow-up duration was 40 months. Pooled rate of tumor control using the random effects model was 96% (95% CI: 95%-98%), and that of hearing preservation was 73% (95% CI: 66%-81%). The most common major complications following CKRS were trigeminal neuralgia, facial neuropathy, and hydrocephalus.

Conclusion(s):

As studies on CyberKnife radiosurgery, one of the SRS modalities administered via LINAC, are far less common than studies on Gamma Knife radiosurgery for treatment of VS, more studies are needed in order to solidify the findings reported in the present meta-analysis. Although there are currently only 15 single-institution retrospective studies available in the neurosurgical literature, this study provides the most comprehensive and up-to-date analysis of the most relevant outcomes of interest in CyberKnife treatment of vestibular schwannoma. From a temporal perspective it is important to assess the current state of CyberKnife treatment as SRS is very different in 2023 than SRS in 1998 (the first year included in this review).