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Constantin Tuleasca, Jean Regis, Marc Levivier. Letter: A Retrospective Cohort Study of Longitudinal Audiologic Assessment in Single and Fractionated Stereotactic Radiosurgery for Vestibular Schwannoma. *Neurosurgery*, inPress, 10.1093/neuros/nyz371 . hal-02290037

HAL Id: hal-02290037

<https://hal.sorbonne-universite.fr/hal-02290037>

Submitted on 17 Sep 2019

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Letter: A retrospective cohort study of longitudinal audiologic assessment in single and fractionated stereotactic radiosurgery for vestibular schwannoma

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Funding:

Constantin Tuleasca gratefully acknowledges receipt of a ‘Young Researcher in Clinical Research Grant’ (Jeune Chercheur en Recherche Clinique) from the University of Lausanne (UNIL), Faculty of Biology and Medicine (FBM) and the Lausanne University Hospital (CHUV).

Conflict of interest:

None.

Dear Editor,

We have read with great interest the recent article by Khattab et al., related to hearing preservation in patients with vestibular schwannomas (VSs) undergoing single fraction versus hypofractionated radiosurgery (RS, by Novalis, TX Linear Accelerator, Varian Medical Systems, Palo Alto, California)¹. This retrospective analysis apparently supports the use of fractionated RS to preserve hearing. However, the reader must be aware of several potential bias of the present paper, which are endangering the external validity.

Firstly, this is not a randomized controlled trial, but a retrospective review of data. Moreover, the sample size is extremely small in two of the three selected groups, mainly in the ones corresponding to single and three fractions. In this sense, the conclusion of the paper should be cautiously interpreted.

Secondly, different target volumes (TV) were treated for 1 (n=12), 3 (n=12) or 5 (n=32) fractions, with a median of 0.745 cc, 1.42 cc and 2.13 cc. One has to acknowledge that all these presented volumes are compatible with single fraction RS by other devices, such as the Gamma Knife (GK, Elekta Instruments, AB, Sweden), for example, without any major technical difficulties. This is particularly important due to the relationship with critical surrounding structures, such as the cochlea and the brainstem, as it is now well acknowledged that the SRS dose follow-off in VSs is not the same for Novalis or for GK².

A third comment is that the single fraction group received a mean dose to the cochlea, which was 10.49 Gy (range 6.75-10.99). This dose is undesirable higher in patients with serviceable hearing before SRS³. In the same sense, what would be the equivalent of the single fraction maximal cochlear dose corresponding to the 3 and 5 fraction cases, if we would have considered 5 Gy as the upper limit for one fraction? It is now well acknowledged that while treating VSs with serviceable hearing with SRS, the maximal dose received by the cochlea should be kept below 5 Gy, so as to give maximal chances to preserve hearing on short and long-term basis⁴⁻⁷. In this sense, hearing loss is not really astonishing in the single fraction group. Furthermore, smaller intracanalicular tumors have somewhat more challenging dosimetries, due to the small distance (if such exist) with regards to the cochlea. Khattab et al.¹ acknowledge the importance of the cochlear dose in the introduction. However, the maximal cochlear dose is not reported, as one would usually do, but the mean dose. Another point which might be questionable is the reported cochlear 0.035 cc point max, which is we suppose arbitrary chosen. It is unclear how the 0.035 cc point max of the cochlea has been established and on what grounds, and how this has or not an impact on hearing preservation.

Fourthly, it is stated that speech awareness threshold (SAT) did not correlate with the reported mean dose received by the cochlea. Speech Detection Threshold (SDT)/Speech Awareness Threshold (SAT) is the minimum hearing level for speech at which an individual can just detect the presence of speech material 50% of the time. The listener does not have to identify the material as speech, but must indicate awareness of the presence of speech sounds. The material used to obtain a speech detection threshold should be noted in recording and reporting the results. In this sense, it is not necessarily associated with serviceable hearing, as one would consider the Gardner-Robertson (GR) class⁸ I and II, as classically and standardly described. In fact, the reported outcome might be even considered as extremely subjective. The GR class is usually reported as an objective measure in most of the published single fraction SRS by GK data on hearing preservation for vestibular schwannoma⁸. This allows for an objective and clear comparison of pre- and post-therapeutic outcomes, at the same follow-up periods. The GR class contains the pure tonal average (PTA), as a mean of 4 different frequencies, allowing to both evaluate the low and high frequency potential loss. No mention on this objective scale is made by the present paper.

A fifth comment is related to whether the authors applied cochlear sparing in their dosimetry. If the answer is yes, has this being performed for all cases described in this paper? In the same sense, it is stated that a clinician blinded from the treatment has counted the cochlea. Was this performed before, or after SRS? Protecting the cochlea and sparing it from higher radiation doses has been a constant preoccupation in the single fraction SRS community, especially in the GK users one, during at least the past 10-15 years.

A sixth comment and extremely important as major source of bias, is that the authors state that “due to significant variability in follow-up time and the relatively stable audiologic assessment at late time-point, audiologic outcomes at the last time of follow-up were compared”. In other words, they state that the mean radiological follow-up was 2 years (range 0.5, 9.45 years). Did the authors compare a 6 months, 2 years and 9 years audiological follow-up between these groups or even inside the same group? And would this make sense especially in a cohort which received multiple regimen of fractionations, including single fraction?

Lastly, factors associated with serviceable hearing at baseline are, beside those previously evoked: GR class I⁹, a speech discrimination score (SDS) \geq 80%, a pure tone average (PTA) $<$ 20 dB, a patient age $<$ 60 years¹⁰ or SRS within 2 years after diagnosis of VS in normal hearing patients¹¹. How were the three groups presented by Khattab et al.¹ relating to these type of preoperative measurements?

In the light of the previous, one would have to reflect of the main purpose of the paper by Khattab et al.¹ in terms of its main message. While being a pure retrospective review, lacking of randomization, would this paper consider patients with serviceable hearing as reported by the standard GR class (and with high level of hearing) or simply patients who subjectively detect the presence of speech material during 50% of the time? After at least 10 years of SRS cochlear sparing, is this a parameter really taken into account by the present study while considering only the mean dose to the cochlea and delivering an extremely high dose to the single fraction group? Subjective audiologist assessments are being compared at different time-points, and this might also reflect hearing loss due to aging etc? Should we believe that fractionation is the ultimate tool for hearing preservation after this analysis, which has a low statistical power and raises an important number of questions, which put in danger its external validity? The authors state only partially their own bias...

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