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The Impact of Distortion Correction Brainlab's software in Vestibular Schwannomas Radiosurgery

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Purpose

The aim of this study was to evaluate the impact of distortion correction using Elements Distortion Correction software for Radiosurgery (SRS) to treat vestibular schwannomas.

Materials and Methods

A retrospective comparative study of 7 (seven) patients whose targets (GTV) were delineated in the elements brainlab's software was perfomed. In the first group, the magnetic resonance image (MRI) distortion correction was used to the coregistration with Computer Tomography (CT); in the second group, coregistration of the MRI to the CT was without distortion correction. The SRS plans used the contoured GTV in the MRI with correction as a basis. The patients were treated using the TrueBeam linear accelerator (Varian) from Real Hospital Português (Recife / Brazil), with the HyperArc™ technique, energy of 6MV FFF with a single dose of 12 Gy (99% target coverage) in six patients and 5x5 Gy for one patient (7).

- To evaluate the impact of distortion on the **contour** of the target, the DICE similarity coefficient was used, where A is the contoured target on the MRI without correction and B with correction.

$$DSC = \frac{2 * A \cap B}{A + B}$$

- The impact on target prescription dose coverage was assessed using two **Conformity index.**

$IC_{RTOG} = \frac{PIV}{TV}$ and $IC_{IanPaddick} = \frac{TV_{PIV}^2}{PIV * TV}$

- The **minimum target dose** as well as **coverage** were also evaluated.

Results

Table 1 shows the difference in volume and in the similarity coefficient (DSC), and it becomes more relevant in small volume lesions, as in the case of patient 1 whose volume is 0,18 cc (illustrated in figure 1). When analyzing the impact of this difference in relation to the Conformity index, the mean values change from IC_{RTOG} = 1,07 ± 0,04 to 1,15 ± 0,13 (figure 2) and $IC_{Paddick}$ = 0,90 ± 0,04 to 0,79 ± 0,11 (figure 3).
Regarding target coverage, from 99% to 94,8 % and mean minimum dose changed from 86,9 9,0% to 75,9 14,2% (figure 4).

Conclusion

Distortion correction for MRI is a fundamental tool as it avoids under dose the tumor or unnecessary irradiation of healthy tissue especially for small volume lesions.

Table 1:
Volumetric differences and DSC

Pct	TV (cc) MRI_{corr}	TV (cc) MRI_{uncor}	DSC
1	0,18	0,15	0,70
2	0,37	0,34	0,97
3	0,46	0,47	0,85
4	1,09	1,00	0,91
5	2,20	2,16	0,94
6	3,16	3,23	0,90
7	7,67	6,97	0,92

Figure 1: difference from patient 1 applying distortion correction

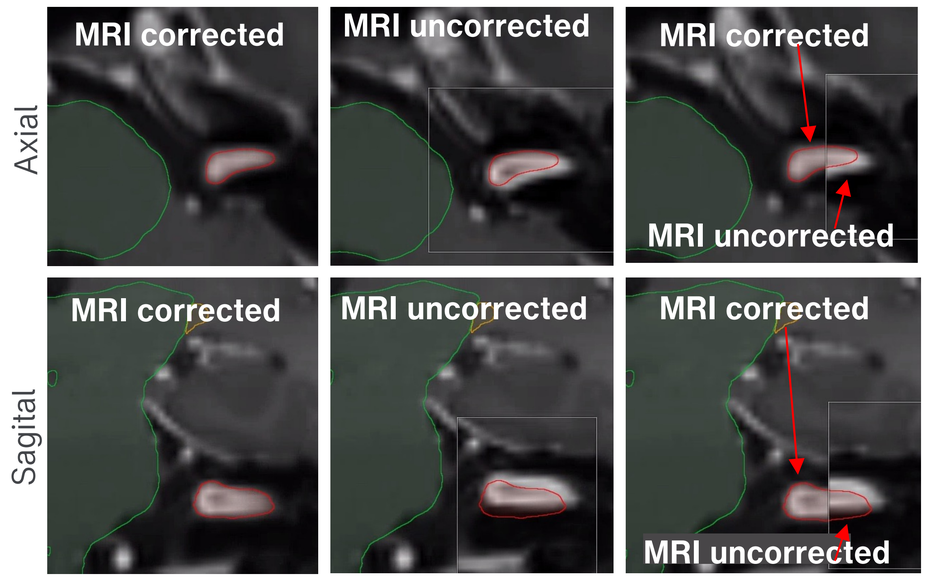

Figure 2: differences IC RTOG

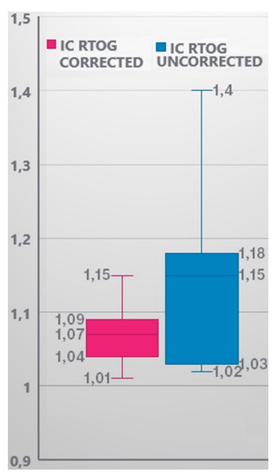

Figure 3: differences IC Paddick

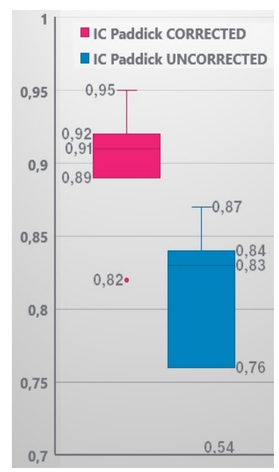

Figure 4: differences Dmin