Report for the Australian and New Zealand Head and Neck Cancer Society: The Utility of 7T MRI in Skull Base Tumours

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Introduction

Anterior skull base tumours are a heterogenous group of neoplasms that commonly impinge the optic apparatus, resulting in vision loss. While treatment decision-making is more straightforward in patients with significant vision loss, the decision towards surgery is more complex in those that are asymptomatic or have mild vision loss. A dilemma exists between 1) early surgical intervention when the patient has mild/asymptomatic vision loss, with the risk of iatrogenic injury to the optic apparatus, and 2) waiting for greater vision loss to occur knowing that surgery does not always fully reverse this vision loss. Better tools are therefore needed to guide surgical decision making. Seven tesla (7T) MRI is a new ultra-high field strength MRI that provides a greater field strength, signal to noise ratio and overall resolution when compared to standard clinical field strength MRI. This is with a trade-off of increased levels of artifact, which is often particularly prominent at the skull base region. The goal of this project was to investigate whether the utility of 7T MRI as compared to the current gold standard 3T MRI in assessing optic neuropathies in skull base tumours.

Methods

Fifteen participants with anterior skull base tumours and single-sided vision loss identified on prior cross-sectional imaging and ophthalmology review have been recruited to date. Each participant underwent a 7T MRI, 3T MRI and formal ophthalmological testing. Radiographic markers characterising the nerve included cross-sectional area at multiple sites, signal intensity and nerve length. Radiographic markers were compared between the compressed and non-compressed nerves at each field strength, then compared between 3T and 7T. These markers were also correlated with ophthalmic markers.

Results

All radiographic markers were found to be significantly different ($p<0.05$) when comparing

the compressed and the non-compressed optic nerve at 7T, while only measures of cross sectional area at different sites where found to be significantly different at 3T. Correlation analysis revealed variable correlation between radiographic markers at both 7T and 3T with the patient's current vision function, with 7T having in general more radiographic markers correlate with ophthalmic markers.

Conclusion

The purpose of our exploratory pilot study was to identify and compare the radiological markers of compressive optic neuropathy with ophthalmic markers at 3T and 7T MRI in the setting of anterior skull base tumours. To the author's knowledge, this is the first study to quantitatively examine radiographic markers of compressive optic neuropathy in the setting of spheno-orbital meningiomas at either 3T or 7T. Our study has demonstrated promise in correlating a greater number of radiologic markers at 7T when compared with 3T to the patient's vision status. Further investigation to validate these findings, explore trends within these findings and examine longitudinal correlation (i.e. correlating radiographic markers with post operative outcomes) should be performed.