Does Alternating wide-angle arrangement of proton therapy to skull base lesion reduce the dose to temporal lobe?

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Concept
Bilateral opposite direction is a common treatment beam arrangement for proton therapy to skull base lesion. It could avoid direct shooting to brain stem and keep distal uncertainty far away from the most critical organ, which is brain stem. However, the radiation doses in the proximal part of proton beam are still high that makes a certain dose to bilateral temporal lobe when lateral opposite irradiation applying. Temporal lobe radiation injury may cause memory and cognitive function impairment that effect the quality of life. Therefore, we designed an alternating wide-angle arrangement to reduce temporal lobe dose while irradiating to skull base lesions.

Hypnosis
Alternating wide-angle arrangement could reduce the temporal lobe dose comparing to conventional bilateral opposite direction in proton therapy.

Evaluation
We evaluated the alternating wide-angle arrangement proton beams to skull base lesion in phantom to evaluated the effectiveness to sparing temporal lobe comparing to bilateral opposite direction.

Bilateral opposite beams (Conventional)

Alternative wide-angle beams

Day 1 240-90 degrees  Day 2 120-270 degrees

The alternating wide-angle proton beam angles were paired as 240-90 degrees and 120-270 degrees for treatment each day. One day treated with 240-90 degrees beams and 120-270 degrees on the other for the treatment course.

Prescription
69.96GyE/33 Fractions to skull base target volume

Results

The mean doses of right temporal lobe were 41.78GyE and 39.40GyE for alternating wide-angle and bilateral opposite beam arrangements. The mean doses of left temporal lobe were 43.08GyE and 40.29GyE for alternating wide-angle and bilateral opposite beam arrangements.

Conclusions
Although the iso-dose coverage area of temporal lobe seems to less by alternating wide-angle proton beam arrangement in visual intuition, the alternating wide-angle proton plan did not demonstrate a numerical benefit for temporal lobe in dose volume histogram evaluation in this study.

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