Proton Radiation Therapy for Chordomas and Chondrosarcomas of the Skull Base

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Background:  
The treatment of tumors of the skull base poses technical difficulties for conventional photon therapy due to the presence of critical adjacent normal structures. Proton therapy provides a physical beam that conforms to the target without exit dose beyond the target volume. This can dramatically impact the total dose utilized and ultimately tumor control and complications. This study examined the utility of proton radiation for skull based tumors including chordomas and chondrosarcomas.

Materials and Methods:  
- The Loma Linda University Proton Center utilizes a 250 MEV beam which provides a maximal depth of penetration of 33.9 cm
- 58 patients with base of skull tumors (33 chordomas and 25 Chondrosarcomas) have been treated at Loma Linda
- Patients were treated to a mean dose of 71 cobalt Gy equivalent (GCE) in 1.8 CGE doses
- 24% of patients were treated for recurrence, 76% were treated for primary disease
- 91% of patients had gross tumor after surgery
- The mean follow-up was 33 months

Results:  
- Overall survival is 88% for chordomas and 100% for chondrosarcomas
- There is a 5 year actuarial local control of 75% for chondrosarcomas and 60% for chordomas
- All failures had a tumor volume > 25 ml
- Those with brainstem involvement had a decreased rate of tumor control

Clinical/Scientific Implications:  
- Fractionated 3-D proton radiotherapy allows increase dose delivery to base of skull tumors
- Poor prognostic factors for tumor control include tumor volume > 25 ml and brainstem involvement
- Many patients with poor prognostic factors can still achieve high rates of local control
- The overall survival in this series may approach the local control rates with longer follow-up because salvage of recurrences is rarely possible
- This series confirms the data from the MGH proton facility
- Proton radiotherapy offers long-term tumor control and survival for a majority of patients with chordomas and chondrosarcomas of the skull base

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