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SRS Hypophysectomy for Refractory Cancer Pain

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Purpose

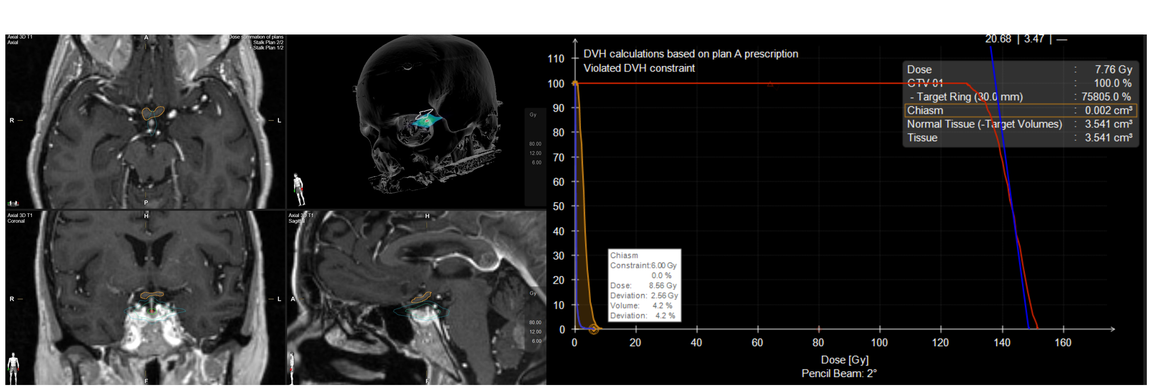
Many end-stage cancer patients suffer from pain not controlled with available treatment methods, reducing the quality of their remaining life. As supported by World Health Organization guidelines, aggressive opioid management effectively manages pain in 70% of cancer patients, with 30% continuing to have refractory pain. Furthermore, tight regulatory opioid dispenser rules have led to the under-treatment of cancer pain. When medications are no longer sufficient, there are other available procedural options, which include intrathecal drug delivery and other ablative techniques (i.e., myelotomy, cordotomy, cingulotomy, and neuromodulation). However, the treatment of cancer-related pain remains a considerable challenge today. Additional palliative options aimed at mitigating cancer pain refractory to the above modalities and reducing opioid use are desperately needed. Surgical hypophysectomy has been shown to be effective in achieving rapid pain relief, however it is also prone to complications[1]. Stereotactic radiosurgery (SRS) hypophysectomy has shown to be a potential viable option for palliation of refractory cancer pain due to its non-invasive nature, and earlier studies have relied on framed Gamma Knife SRS due to target's proximity to the optic chiasm[2]. However, the treatment tends to be long and would often require anesthesia for patients who are already in significant pain. The goal of this study is to explore the technical feasibility of LINAC SRS hypophysectomy with an aim to reduce treatment time.

Materials and Methods

This feasibility study was carried out using a simulated patient. MRI brain was acquired on a 3T MRI scanner. T1 weighted images with contrast were obtained at 1.0 mm slice thickness. The proximal pituitary stalk was contoured as the target, and the optic chiasm was contoured as the avoidance structure. Using Brainlab SRS Cranial Element (VMAT) version 3.0.0.454, we created a composite plan of 4 asymmetric 6MV FFF arcs, planned to 128Gy at 80%.

Results

The composite plan yielded an acceptable point max dose of 8.56 Gy to the optic chiasm. Similarly, the dose exposure to other adjacent normal brain structures including the brainstem were limited. The entire plan required 40000 MU, which resulted in an approximate beam on time of 30 minutes.



Conclusion

We have demonstrated that LINAC based SRS is capable of delivering the necessary dose for SRS hypophysectomy with shorter treatment time compared to framed Gamma Knife, while maintaining excellent sparing of the optic chiasm. This could potentially improve the delivery of SRS hypophysectomy and expand its utilization. The current study planned SRS hypophysectomy with multi-leaf collimation, therefore our next step is to investigate cone-based SRS to hopefully further improve dose delivery to the target while simultaneously reduce dose exposure to the optic chiasm and other normal structures.

1. Luft R, Olivecrona H. Experiences with Hypophysectomy in Man. J Neurosurg. 1953;10(3):301-316.
2. May J, Liscak R. Effectiveness of Leksell gamma knife hypophysectomy on cancer-related intractable pain. Neuro endocrinol Lett. 2022 Dec 20;43(5):265-269