High-Frequency Radiosurgery: Surgical Adjunct for Intracranial and Intraspinal Tumor Resection

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INTRODUCTION

High-Frequency Radiosurgery has been utilized in medicine for over 30 years and for 8 years in neurosurgery. Its unique qualities permit the surgeon to dissect, make incisions, and perform coagulation with a minimal amount of lateral heat spread. Clinical studies have shown that proper use of this energy source causes a paucity of tissue alteration, which has been documented on histological examination.

Our clinical trials demonstrated a paucity of lateral heat spread with High-Frequency Radiosurgery when properly used in intracranial and intraspinal procedures. Histological analysis revealed tissue alteration of well under 100 microns in human brain specimens (Figure A).

This lack of lateral heat spread allows for dissection in vital neurological structures. It also permits the surgeon to develop new techniques for tumor resection. Bipolar cautery has been the gold standard to date, mostly due to the control of heat spread. High Frequency Radiosurgery not only offers a favorable bipolar option, but also gives the ability to use monopolar techniques for dissection and tumor resection.

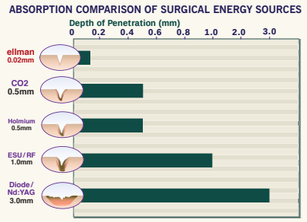
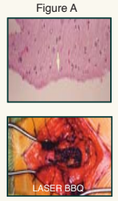
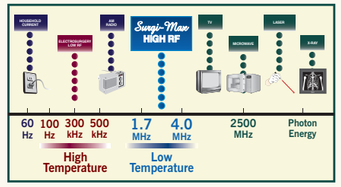


Figure A





OBJECTIVES

- To evaluate High-Frequency Radiosurgery as a useful energy source in various neurosurgical applications.
- To evaluate safety and efficacy of monopolar techniques for intracranial and intraspinal tumor resection.

MATERIALS AND METHODS

We present a series of neurosurgical procedures that demonstrate the safe and efficacious use of High-Frequency Radiosurgery (Figure B). These include: intradural and intramedullary spinal cord tumor excision, brain tumor resection of multiple etiologies, and soft tissue dissection. Monopolar handpieces with various electrode configurations, (Figure C) were employed for tumor resection.

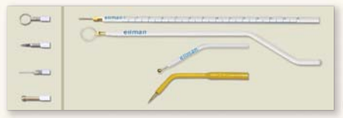


Figure C

Figure B

RESULTS

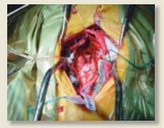
Gross total or radical resection were achieved in all cases. No post-operative complications or new neurological deficits occurred. Resected tumor specimens were reviewed by pathology. Diagnosis was attained in all cases and no specimen was rejected due to heat damage. When resection was performed under high power magnification, significant reduction in surgical time was noted.

CONCLUSION

This unique energy source, combined with numerous electrode configurations, allows for monopolar neurosurgical applications. This concept was not feasible with other standard electrosurgical energy sources. Our series shows favorable outcomes with blood loss, clinical outcomes, and surgical time. It also permits the neurosurgeon to engage in new approaches and microsurgical techniques for treating pathologies in eloquent regions of the brain and spinal cord.

CLINICAL CASE EXAMPLES

BRAIN STEM GLIOMA



- 8 year old female
- Open biopsy
- Dx: Low grade astrocytoma
- Radiographic progression post biopsy
- Loss of gag reflex

- Sub occipital craniotomy
- C1 Laminectomy / “Y” Durotomy
- Cytoreductive surgery
- Induce senescence
- More responsive to adjuvant therapy

- 75% Debulking
- No new neurological deficits
- NO HARM

METASTASES

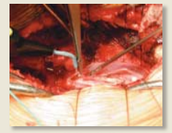
- 68 year old female
- 30 year smoking history
- 3 weeks of headache
- Right dysmetria / disdiadochokinesia

- Sub occipital craniotomy
- “Y” Durotomy
- Small right cortisectomy
- Gross total resection

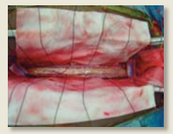
- Monopolar dissection of scalp and durotomy
- Monopolar and bipolar resection of tumor
- Total blood loss = 50cc

SPINAL CORD EPENDYMOMA

- 47 year old male
- 2 month history of unsteady gait
- Numbness in lower extremities
- Hyper reflexic
- T3 sensory level

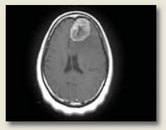


- T2 – T10 Laminectomy
- Durotomy / Myelotomy
- Tumor biopsy and excision



- Empire monopolar for soft tissue dissection
- Monopolar durotomy
- Monopolar myelotomy and resection
- Gross total resection
- Disease free at 24 months

MENINGIOMA



- 47 year old female
- Mental status change
- Seizures

- Right frontal stereotactic craniotomy
- Monopolar durotomy
- Monopolar resection with H-FRS

- Loop excision
- Gross total resection
- Disease free at 18 months