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High Frequency, Low Temperature Radiosurgery: Adjunct for Brain Tumor Resections

Introduction

High frequency low temperature radiosurgery is gaining popularity to many surgical subspecialties including neurosurgery. With radio wave surgery, high frequency radio waves are directed to tissue through electrode tips. Impedance to passage of radio waves through tissue generates heat within the cells resulting in volitization with specific and precise cutting or coagulation. The radio frequency electrode does not provide resistance and therefore, remains cold limiting collateral damage. Paucity of heat generated to the surgical site allows the surgeon to work in direct proximity to functional neuro elements.

Methods

Over an eight-month period, 90 patients ranging from 20 to 73 years of age were treated for symptomatic brain tumors defined in radio graphic and /or clinical progressions. Tumors consisted of cerebral metastases, primary malignant brain tumors and also biologically malignant yet histologically benign brain tumors. Image guidance was used in the majority of cases with optimization of power intensity; waveform, frequency, tissue contact, and use of a variety of electrode tips achieve safe, precise and thorough resections.

Results

Radical resections were achieved in the majority of procedures, confirmed operatively and by postoperative MRI. Lateral thermal tissue destruction was minimized and no new neurological defects were recorded. Variable characteristics of radio wave surgery include tissue contact time, power intensity, and waveform with variety of electrodes used. Optimization of above characterization achieved safe, precise and complete resections in over 80 brain tumor cases. Collateral damage was minimized with work in direct promixity with delicate structures with controlled hemostasis, dissection and debulking. Bipolar waveform enhances pinpoint hemostasis and local oblation. Turbo waveform was used for maximum tissue destruction. The empire needle was used to dissect the radio wave through the tissue to make incision without pressure with hemostasis. The active electro tip can also be bent to better navigate anatomical surfaces and angles. The vari-tip can be extended or released to adjust to depth. Large 2.0 mm tip diameter was able to spread the radio frequency evenly to a larger surface for controlled hemostasis (i.e. large vascular tumor). With 0.5 tip diameter and variety of waveforms allowed for careful dissection and preservation of small arteries, veins and nerves away from the pathological substrate. Vari-tip electrical heat spread is measured at 10 – 20 microns. Ellman loop 3/8 inch were often used for rapid debulking of large tumor mass.

Using high frequency low temperature radiosurgery can be a valuable adjunct for brain tumor surgery especially when precision and total resection is mandatory. The positive heat generated with minimal lateral tissue injury allows the surgeon to work in promixity of delicate neurostructure. Waveform, power intensity, electro tips are optimized for successful surgery. With high frequency radiosurgery greater resections and low morbidity can be obtained in brain tumor surgery.

Objectives

Include the use of high frequency radio wave surgery for brain tumors. Minimal heat generated at the surgical site allows the surgeon to work in direct promixity to delicate neurostructure for safe and thorough resections.