

TITLE:**Increases of tumor oxigenation and locoregional blood flow in brain tumors after cervical spinal cord stimulation**

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INTRODUCTION:

Generally, malignant gliomas (MG) have decreased blood flow (ischemia) that results in reduced delivery of chemotherapy and oxygen (hypoxia), with further 200%-300% increase in radiation-resistance. Cervical spinal cord stimulation (cSCS) is being used to treat several ischemic diseases, but it has not been previously evaluated as a potential modifier of MG microenvironment.

MATERIALS AND METHODS:

Twenty-five patients with MG (14 grade-III, 9 grade-IV) with cSCS devices inserted prior to scheduled radio-chemotherapy. Pre- and post-cSCS, they underwent; 1) Middle cerebral artery velocity measurements (cm/s) using Transcranial Doppler (TCD); 2) Common carotid blood flow quantification (ml/min) based on time-domain processing using color Doppler, 3) Single Photon Emission Computed Tomography (SPECT), 4) Tumor pO₂ measurement (mmHg) using the polarographic probe technique (Eppendorf device), and 5) glucose metabolism assessment by Positron Emission Tomography (PET). The last ten patients (4 relapsed grade-III and 6 grade-IV MG) were enrolled to treat under cSCS during the Stupp's protocol: "standard radiotherapy + concurrent Temozolomide + six standard cycles of Temozolomide".

RESULTS:

pre-cSCS blood-flow was significantly lower ($p < 0.001$) in tumor sites than peri-tumor sites (32%) and contra-lateral areas (41%). Post-cSCS results showed: 1) blood-flow increase in middle cerebral arteries $>18\%$ ($p < 0.002$); 2) blood-flow increase in common carotid arteries $>46\%$ ($p < 0.057$); 3) tumor blood-flow increased 15% ($p = 0.033$); 4) tumor oxygenation increased ($p < 0.013$) and hypoxic fraction decreased 50% ($p < 0.018$); 5) glucose metabolism increased 43% ($p = 0.035$) in tumor and 38% ($p = 0.001$) in peri-tumor areas. Eight from ten patients treated under cSCS during the Stupp's protocol are alive (80%), with a median/mean follow-up of 12/16 months.

CONCLUSIONS:

Our preliminary data show that cSCS can modify loco-regional blood flow, oxygen and glucose-metabolism in MG. This suggests that cSCS could be used to increase radiation effect and chemotherapy delivery in MG and, as such, it could prove useful as an adjuvant treatment during radio-chemotherapy, as it is supported by our preliminary clinical results. We think that these data merit further researches and to realize a randomized and multicentre study.

** Some of these data have been published in J Neurosurg 2002, J Neurosurg 2003 and Neuromodulation 2004.*

** Partially supported by Grants FUNCIS 31/98, FUNCIS 9/03 and Grant ICIC ISCiii, RTICCC C03/10.*