

iUS-iCT-iUS: Proposal for a Simple Intraoperative Imaging Protocol to Correct Brain Shift in Brain Tumor Surgery.

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Introduction

The main limit of neuronavigation is the brain-shift phenomenon. This is responsible for a progressive loss of accuracy of neuronavigation during brain tumor surgery. We propose a new method to correct brain shift and update neuronavigation data based on the combination of intraoperative Ultrasound (i-US) and intraoperative Computed Tomography (i-CT).

Methods

8 patients underwent microsurgical resection of brain tumor (4 metastases, 4 gliomas). Navigated ultrasound system and portable small bore CT scanner were used to update neuronavigation data and to correct brain shift. Navigated B-mode ultrasound were used after dural opening to identify the lesion and to correct the brain shift due to CSF leak. After tumor resection, post-contrast iCT was performed in order to detect small tumor remnants and correct brain shift. A final i-US check was performed to verify the completeness of resection.

Results

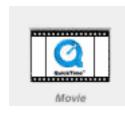
Adjunctive resection was performed in 3 of 8 cases after i-CT. The progressive shifting of the brain was documented and recorded during all the procedures. Mean brain shift along the main vector was 15 mms comparing i-CT with pre-operative imaging. Final i-US control was useful to verify the completeness of remnants resection.

Conclusions

The combination of different intraoperative imaging modalities may increase the safety and the extension of resection of brain malignant tumors. Our preliminary experience is promising, but further studies are required to validate this intraoperative imaging protocol.



Navigated pre-resection i-US shows the hyperecoic image of tumor.



Post-resection navigated i-US shows surgical cavity, but brain shift is visible by fusion with pre-operative MR. Therefore, i-CT is used to correct brain shift and confirm GTR.

Video shows the intraoperative demonstration and correction of brain-shift.

References

Barbagallo GM, Palmucci S, Visocchi M, Paratore S, Attinà G, Sortino G, Albanese V, Certo F.Portable Intraoperative Computed Tomography Scan in Image -Guided Surgery for Brain High-grade Gliomas: Analysis of Technical Feasibility and Impact on Extent of Tumor Resection. *Neurosurgery*. 2015 Nov 9.



Introperative CT-scan, used to update neuronavigation and confirm tumor resection.

