

Experience using intraoperative 3D ultrasound in 14 brain tumors cases

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ABSTRACT

Objectives: Many commercial neuronavigation systems offer tracked 2D ultrasound. However, visual comparison of preoperative MRI with intraoperative ultrasound is often limited by a significant misalignment between both modalities. We have developed our own prototype neuronavigation system to facilitate the integration of our latest research work into a system that could be tested and validated in real clinical conditions, while also benefiting the practice of the neurosurgeons at our institution. The system includes a tracked 2D ultrasound probe, which enables acquiring sweeps that can then be reconstructed in 3D. The obtained 3D ultrasound can then be viewed in parallel or superimposed with the preoperative images. Manual and automatic correction of the ultrasound/MRI mismatch is also possible.

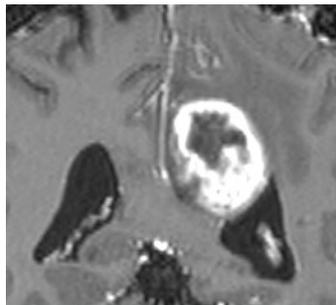
Methods: The system was tested in a series of 14 brain tumor cases including both low grade and high grade gliomas. Ultrasound was generally acquired: 1) on the dura, in order to compare the tumor region with the preoperative MRI and 2) at the end of resection, for residual tumor evaluation.

Results: Image quality from the dura was excellent. All tumor types were clearly visible on ultrasound as bright (hyperechoic) masses. Superficial areas were harder to image. When compared with MRI, tumor size was equivalent or larger on ultrasound (see images below). Images obtained at the end of resection were useful, but sometimes difficult to interpret. In one case, an undetected intraventricular hemorrhage could clearly be seen on ultrasound.

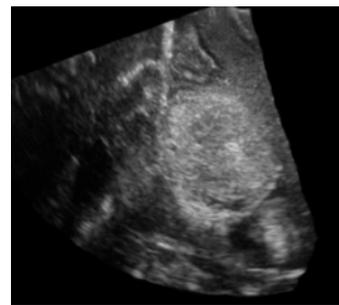
Conclusion: Ultrasound is useful for brain tumor resection, even more when properly aligned with MRI.



Draped ultrasound probe



Preoperative MRI



Intraoperative ultrasound