Using Intraoperative Ultrasound in Neurosurgery: Prof. Geirmund Unsgård

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Geirmund Unsgård is Professor Emeritus of Neurosurgery at the Norwegian University of Science and Technology (NTNU), where he worked for 30 years. For 22 years he served as Chief of the Neurosurgical Department at St. Olavs Hospital, Trondheim University Hospital, in Trondheim, Norway. An expert of ultrasound-guided neurosurgery, Prof. Unsgård has used intraoperative ultrasound imaging to guide his neurosurgical procedures for over two decades.

In the early 1990s, Prof. Unsgård became curious about the use of ultrasound for the imaging of brain tumors during surgery. A cross-disciplinary team of scientists at St. Olavs had started to use ultrasound in cardiology, with a focus on Doppler technology. Soon thereafter, Prof. Unsgård began using ultrasound for the imaging of brain tumors. "It started because I felt I was a little bit insecure about tumor borders in the brain," he says. "I was looking for some technology to help me out with that." In the years that followed, he gained first-hand knowledge of the varied benefits of ultrasound for neurosurgery.

Reliable, Real-Time Ultrasound

Like many neurosurgeons, Prof. Unsgård believes that ultrasound imaging is useful for various neurosurgical procedures. It can, for instance, help the neurosurgeon navigate and identify lesions and anatomical structures. Furthermore, because it is real-time and does not rely on pre-operative data, Prof. Unsgård considers ultrasound to be the only practical intraoperative imaging method. In fact, he is cautious of the use of neuronavigation as the sole means of guiding surgeries such as tumor resections, particularly when the pre-operative images can no longer be considered current.

Neuronavigation relies on a set of preoperative images–usually CT or MR–which can become outdated and unreliable by the time of the surgery. This is due to the phenomenon known as brain shift, wherein "you can see a considerable change in position of the normal tissue," says Prof. Unsgård. This shifting of the brain within the skull occurs during surgery and introduces a potential problem wherein the surgeon might hit the wrong structures, such as a blood vessel or eloquent areas of the brain. Brain shift can be attributed to different sources, including inaccurate registration of the MR image to the patient's head, craniotomy, opening of the dura, or tumor resection.

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According to Prof. Unsgård, the brain can shift as much as 15 mm or, in some higher end cases, several centimeters. "I've seen, in nearly every operation, that the MR image is a little bit off compared to the ultrasound image. So, I wouldn't dare to resect tissue based on neuronavigation alone. We cannot know for sure how much shift exists. That's the problem–the uncertainty–you cannot be sure. In neurosurgery, you should be sure, and ultrasound gives you certainty and makes you feel confident as a surgeon."

Benefits of Intraoperative Ultrasound in Neurosurgery

To achieve this confidence, surgeons like Prof. Unsgård rely on the high level of image quality that is available with current ultrasound technology, including on BK Medical's bk5000. According to Prof. Unsgård, intraoperative ultrasound image quality has greatly improved over the years. "In some situations, the resolution can be better than MR," he says

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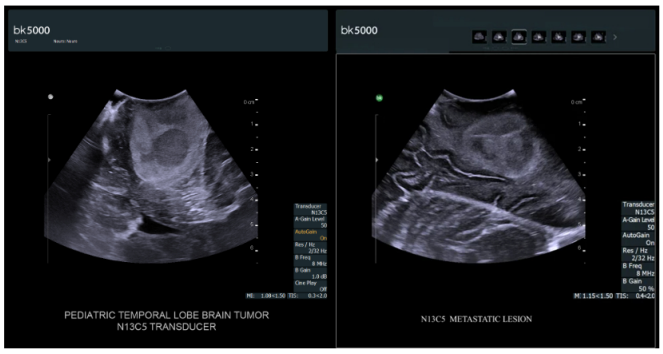

With such high image quality, ultrasound can provide an extra layer of visualization when problematic tissue cannot easily be differentiated from normal tissue through a microscope. "In situations like this," Prof. Unsgård says, "I only trust ultrasound."

According to Prof. Unsgård, another clear benefit of intraoperative ultrasound is the lack of hazards associated with the imaging type. Whereas intraoperative MR bears the risk of impact on metal hazards in the operating room or on metal patient implants, and whereas intraoperative CT bears the risk of radiation, there are no known risks of ultrasound imaging.

Another consideration, he says, is the cost: "I think we all have a responsibility to try to keep costs down in healthcare. It's especially important for developing countries." For neurosurgery clinics in all countries, lower-cost imaging methods, like ultrasound, may be the most sensible option.

Topics: Surgery, Active Imaging, Intraoperative Ultrasound, Neurosurgery and Spine, Tumor Resection

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