Intraoperative ultrasound indications

1. **Tumor Localization and Resection**

    1. IOUS helps delineate tumor boundaries and assess resection margins intraoperatively.
    2. Particularly useful for gliomas, meningiomas, and metastases.
    3. High-resolution ultrasound probes can visualize tissue planes and differentiate between normal and pathological tissues.

2. **Cyst and Abscess Management**

    1. Guides aspiration or drainage by providing real-time feedback on needle or catheter positioning.

3. **Hematoma Evacuation**

    1. Helps identify the location and extent of intracerebral hematomas, guiding the evacuation process.

4. **Hydrocephalus and Shunt Placement**

    1. Facilitates catheter placement in ventricles, especially in distorted or small ventricles.

5. **Spinal Surgery**

    1. Enhances the visualization of spinal cord and nerve roots, guiding decompression or tumor removal.

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The use of intraoperative ultrasound (US) during neurosurgical procedures is becoming more widespread. Multiple studies have shown that US is a valuable tool in tumor detection during surgery [1) 2) 3) 4) 5)].

Intraoperative ultrasound for focal cortical dysplasia

Combining awake surgery with intraoperative magnetic resonance is logistically challenging.

Navigable ultrasound (US) is a useful alternative in such cases.

It is a sensitive imaging modality when used in patients with Cushing's disease in whom findings on pituitary MR imaging are negative. The improved ability to detect and localize these tumors positively affects surgical outcome [6)].

Intraoperative scanning of the pituitary gland with high-frequency-ultrasound probes may identify intrapituitary anatomy and pathologies even in MRI-negative cases. This may prevent extensive exploration of the gland with the risk of subsequent hypopituitarism [7)].

Cavernous malformation.

Intra-operative brain swelling consider intraoperative ultrasound if rapidly available to rule-out hematoma (intracerebral, EDH, SDH) which could potentially be immediately evacuated.

Intraoperative Ultrasound for Brain Tumor Surgery

Intraoperative Ultrasound for Brain Tumor Surgery

Spine surgery

see Intraoperative Ultrasound for Spine Surgery.

References

1)
Sosna J, Barth MM, Kruskal JB, Kane RA. Intraoperative sonography for neurosurgery. J Ultrasound Med. 2005;24(12):1671-1682.
2)
Unsgaard G, Gronningsaeter A, Ommedal S, Nagelhus Hernes TA. Brain operations guided by real-time two-dimensional ultrasound: new possibilities as a result of improved image quality. Neurosurgery. 2002;51(2):402-411; discussion 411-412.
3)
Selbekk T, Jakola AS, Solheim O, et al. Ultrasound imaging in neurosurgery: approaches to minimize surgically induced image artefacts for improved resection control. Acta Neurochir (Wien). 2013;155(6):973-980.
4)
WoydtM,KroneA,BeckerG,SchmidtK,RoggendorfW,RoosenK.Correlation of intra-operative ultrasound with histopathologic findings after tumour resection in supratentorial gliomas: a method to improve gross total tumour resection. Acta Neurochir (Wien). 1996;138(12):1391-1398.
5)
Woydt M, Vince GH, Krauss J, Krone A, Soerensen N, Roosen K. New ultrasound techniques and their application in neurosurgical intra-operative sonography. Neurol Res. 2001;23(7):697-705.
6)
Watson JC, Shawker TH, Nieman LK, DeVroom HL, Doppman JL, Oldfield EH. Localization of pituitary neuroendocrine tumors by using intraoperative ultrasound in patients with Cushing's disease and no demonstrable pituitary tumor on magnetic resonance imaging. J Neurosurg. 1998 Dec;89(6):927-32. PubMed PMID: 9833817.
7)
Knappe UJ, Engelbach M, Konz K, Lakomek HJ, Saeger W, Schönmayr R, Mann WA. Ultrasound-assisted microsurgery for Cushing's disease. Exp Clin Endocrinol Diabetes. 2011 Apr;119(4):191-200. doi: 10.1055/s-0029-1241207. Epub 2009 Dec 11. PubMed PMID: 20013609.