Intraoperative imaging

Imaging techniques play a pivotal role during surgical resection of brain lesions. They help when planning a surgical strategy before the operation, and during surgery, they indicate tumor boundaries and the relationships of the tumor with nearby vital structures, thus enhancing precision, accuracy, and safety for the patients, allowing maximal resection [1].

In glioma surgery, intraoperative imaging is regarded highly valuable to improve extent of resection. Current distribution of intraoperative imaging techniques is largely unknown. Further, controversy exists which method might be most beneficial [2].

Fluorescence imaging

see Fluorescence imaging

Intraoperative magnetic resonance imaging

see Intraoperative magnetic resonance imaging

Intraoperative ultrasound

see Intraoperative ultrasound.

Intraoperative stereovision

Stereovision is an important intraoperative imaging technique that captures the exposed parenchymal surface noninvasively during open cranial surgery.

see Intraoperative stereovision.

Coburger et al. performed a web-based survey among members of the European Association of Neurological Surgeons(EANS) from April to May 2017. The questionnaire included Intraoperative magnetic resonance imaging(iMRI), 5-aminolevulinic acid(5-ALA), intraoperative ultrasound(iUS),Na-Fluorescein and Intraoperative Computed Tomography(iCT). The value of each method in resection of glioblastoma(GB) and [Low-grade glioma]](LGG) and their role for intraoperative orientation and usability were rated based on Likert-scales from 1(not valuable/important) to 5(very valuable/important). A total score was calculated based on each sub-score. Mann-Whitney-U-test was used to compare ratings of imaging methods.

Among the 310 participants, iMRI and 5-ALA were regarded as the most valuable intraoperative

imaging methods in GB-surgery (iMRIvs.5-ALA,p=0.573;mean 4.05(SE0.149)vs.4.22(SE0.216)). Both were considered significantly more valuable than iUS, Na-Fluorescein and iCT(p≤0.001).Compared to all other methods, iMRI received significantly higher ratings for the resection of LGGs (p<0.01,mean 4.21(SE 0.143)) as well as for intraoperative orientation (mean 4.00(SE0.166)).5-ALA was rated highest regarding intraoperative usability (mean 4.07(SE0.082)). iMRI showed the highest total score compared to all other imaging modalities(p<0.001,mean 15.95(SE 0.484)).

iMRI and 5-ALA were rated most valuable for GB-surgery, while only iMRI reached higher ratings in LGG cases. iMRI was the best imaging method for intraoperative orientation as well as the most valuable method in overall rating. Considering the total score, 5-ALA and iUS received similar values and were rated second highest, followed by Na-Fluorescein and iCT [3].

[1]
Upadhyay UM, Golby AJ. Role of pre- and intraoperative imaging and neuronavigation in neurosurgery. Expert Rev Med Devices. 2008;5(1):65-73.
[2], [3]
Coburger J, Nabavi A, König R, Wirtz CR, Pala A. Contemporary use of intraoperative imaging in glioma surgery: A survey among EANS members. Clin Neurol Neurosurg. 2017 Oct 31;163:133-141. doi: 10.1016/j.clineuro.2017.10.033. [Epub ahead of print] PubMed PMID: 29101863.