Contrast enhanced ultrasound

Contrast enhanced ultrasound (CEUS) is a dynamic intraoperative ultrasound and continuous modality providing real-time view of vascularization and flow distribution patterns of different organs and tumors.

Indications

Contrast-enhanced ultrasound (CEUS) is a relatively new technique that has become progressively more common because it allows, among other things, highlighting of neoplastic lesions:

Glioma

Prada et al., performed CEUS in an off-label setting in 69 patients undergoing surgery for cerebral glioma. An intraoperative qualitative analysis was performed comparing intraoperative contrast enhanced ultrasound (iCEUS) with B-mode imaging. A postprocedural semiquantitative analysis was then performed for each case, according to EFSUMB criteria. Results were related to histopathology.

They observed different CE patterns: LGG show a mild, dotted CE with diffuse appearance and slower, delayed arterial and venous phase. HGG have a high CE with a more nodular, nonhomogeneous appearance and fast perfusion patterns.

This study characterizes for the first time human brain glioma with CEUS, providing further insight regarding these tumors' biology. CEUS is a fast, safe, dynamic, real-time, and economic tool that might be helpful during surgery in differentiating malignant and benign gliomas and refining surgical strategy [1) 2)].

Ultrasound contrast agents might be a safe and effective option in highlighting tumor bulk and borders, differentiating it from healthy brain tissue, in different kinds of lesions.

Metastasis

In our experience, all of the 6 metastasis cases described in our article and other 7 new cases were clearly depicted using contrast-enhanced ultrasound (CEUS) along with their afferent and efferent vessels. However, all of these cases were already quite visible on standard B-mode ultrasound, particularly in comparison with lesions with ill-defined borders such as high-grade gliomas. This might depend, to a certain extent, on the available ultrasound equipment (probes, settings, virtual navigation), but also on the operators' training on ultrasound and his/her experience. We believe that a specific training on ultrasound, and particularly in specific techniques such as CEUS, is very important, addressing both the setup of the equipment and the execution of the examination (performed in a stressful situation compared with diagnostic ultrasound) for the successful visualization of the target.5

It also has to be stressed that other ultrasound techniques are useful to achieve a thorough evaluation of a neoplastic lesion. High-frequency ultrasound allows for an impressive spatial resolution, comparable to that achieved with magnetic resonance imaging.6 High-frequency

ultrasound, however, has its best performance in exploring superficial lesions, in any case not deeper than 4 to 5 cm. Another useful tool is fusion imaging between ioUS and preoperative imaging that allows for virtual navigation, providing real-time ultrasound imaging coupled with the panoramic view and orientation offered by the preoperative magnetic resonance imaging.

We definitely agree with de Lima Oliveira et al that “iCEUS could potentially enhance border definition…,” therefore guiding tumor resection. Furthermore, intraoperative CEUS (iCEUS) adds valuable biological information such as vascularization, microcirculation, tissue perfusion dynamic to those obtained with standard B-mode imaging, and might also guide the surgical strategy and lead to an iCEUS characterization of cerebral metastasis as already obtained for cerebral gliomas.8 Further studies are warranted to evaluate the role of iCEUS in highlighting tumor remnants after gross tumor removal, thus maximizing resection avoiding neurological sequelae due to damaged healthy brain tissue.

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