Editorial

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CEUS: what is its role in abdominal aortic diseases?

Vito Cantisani[1], Emanuele David[1,2], Liberatore Mauro[1], Ferdinando D'Ambrosio[1], Dirk André Clevert[3]

[1]Department of Radiology, Anatomical-Patology and Oncology, Sapienza University of Rome, Rome, Italy, [2]Department of Biomedical Sciences and Morphologic and Functional Imaging, Policlinico "G. Martino", University of Messina, Italy, [3]Institut für Klinische Radiologie, Klinikum der Ludwigs-Maximilian-Universität München, Campus Großhadern, München, Deutschland.

In the last decade the sensitivity and specificity of contrast enhanced ultrasonography (CEUS) has greatly improved due to the development of more sophisticated ultrasonographic equipment, the introduction of second-generation contrast agents, and the development of dedicated software able to perform quantitative analysis [1]. Therefore, nowadays CEUS is established as a significant advancement in imaging and an effective technique with several clinical indications, especially for liver pathology as reported also in EFSUMB guidelines published in 2012 [2]. Apart from liver indications, CEUS has proved to be effective in several other fields [1,3] so that in 2011 EFSUMB reported their indications and recommendations for non-liver applications. These recommendations are based on comprehensive literature surveys including results from prospective clinical trials [4].

Among CEUS vascular indications related to abdominal aorta diseases were: aortic dissection, vascular stenosis, complications after vascular intervention, abdominal aortic aneurysm (AAA), inflammatory AAA, and endoleaks.

The most established recommendation was the detection, characterization, and follow up of endoleaks after AAA repair. In fact, CEUS is mainly employed in the assessment of abdominal vascular diseases to support the diagnosis of AAA and the evaluation of post operation complications.

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Corresponding author: Dr. Vito Cantisani, MD, PhD
"Sapienza" University of Rome,
Policlinico Umberto I
Viale del Policlinico 155, 00161 Rome, Italy
Fax: +39 06490243, Phone: +39 064455602
E-mail: vito.cantisani@uniroma1.it

Nowadays the surgeons prefer to treat AAA by using EVAR (Endovascular Aneurysm Repair) and not by performing traditional surgery which is more invasive and aggressive and also incurs hospitalization and early mortality. The most frequent complication of EVAR is the endoleak, the incomplete exclusion of aneurismatic sac from the arterial circulation which can be classified in 5 types according to the Society for Vascular Surgery and the American Association for Vascular Surgery. In 10-45% of cases such complications can be associated with a dilation of the aneurysm sac and rupture [5,6].

At the moment, CT angiography (CTA) is the reference diagnostic method, due to its wide availability, diagnostic value, acquisition speed, resolution, and uniformity of protocols [7]. However, it is an expensive method, uses ionizing radiation and potentially allergenic and nephrotoxic contrast agents.

As reported in literature, some valid alternatives to CT are CEUS and magnetic resonance angiography (MRA) [8,9] but there is no consensus with regard to the optimal work-up with diagnostic imaging modalities in postEVAR surveillance [10]. CEUS could represent the ideal imaging modality to follow up EVAR.

The ideal imaging modality should be inexpensive, repeatable, safe, and accurate [11]. CEUS is cheaper than CTA, uses ultrasound, not ionizing radiation, and employs second generation contrast agents without nephrotoxic risks. It is safe and repeatable. Currently, in literature CEUS has given promising results for the identification of endoleaks and their correct classification [12]. Several authors have pointed out the usefulness of CEUS because it seems to identify and characterize endoleaks better than CTA, with an analysis of velocity and flow direction [13,14]. Moreover, CEUS enhancement quantification

with Time-Intensity Curve (TIC) provides additional accuracy [15].

Conversely, CEUS still presents some clear limitations, especially if excess weight and meteorism are associated. Of particular note are also extensive wall calcification and subcutaneous emphysema after intervention, or limited examination windows [4].

Therefore, each imaging modality has advantages and disadvantages that should be considered when developing a surveillance program. CEUS offers several advantages and limitations compared to CT, already mentioned. CTA is depicted by most as the pivotal imaging modality, while others consider CTA as unnecessary and expensive. MRA seems to offer better accuracy, but with higher costs and less availability [16].

Recently, a combined CEUS, color Doppler (CD) US, and CTA based protocol, that entails a base-line CTA at 3 months and 1 year post-EVAR, followed by periodic CDUS and use of 3D CEUS when a suspicious finding is detected, while MRA is performed in cases evidencing contraindications to CTA or in suspected endotension [10].

In a single case report, the authors reported an endovascular aortic repair in a patient with an asymptomatic infrarenal AAA and renal insufficiency. The precise placement of the stent-graft was performed with CEUS and intraprocedural angiographic fluoroscopy without the use of any nephrotoxic contrast media [17]. Intraoperative CEUS-assisted EVAR in patients with infrarenal AAA was reported to represent a new option for the visualization of aorto-iliac segments required as proximal or distal fixation zones and the identification of endoleaks, especially in those patients with contraindications for usage of iodine-containing contrast agents [18].

In a recently published review, Zimmerman et al summarized that CEUS is increasingly used and enables a quick, non-invasive follow-up examination for patient after EVAR. In addition, interventions such as therapy for endoleaks may be executed using ultrasound. Initial experience with CEUS-guided aortic stenting shows that the amount of contrast media as well as X-ray time may be reduced [19].

In conclusion, CEUS in the pre-, intra- and post-EVAR surveillance is a safe and effective modality and in a well planned surveillance protocol it should be integrated into institutional protocols for EVAR surveillance in order to avoid the nephrotoxicity of contrast agents, the radiation and cost burden of repeated CTA-s in patients.

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