Eur J Vasc Endovasc Surg (2018) ■, 1—2

EDITORIAL

Transthoracic Ultrasound Imaging of the Descending Thoracic Aorta: Could We, Should We, and Would We?

As we enter the era of multimodality imaging, we are presented with a barrage of imaging modalities, which at times offer comparable or even overlapping clinical solutions. Technological advancements have also brought new life to established imaging modalities such as ultrasound. Recent studies have shown that 4D contrast enhanced ultrasound could possibly assess fenestrated endovascular aneurysm in the future,[1] while 3D ultrasound has been shown to accurately diagnose endoleaks and assess abdominal aortic aneurysm diameter.[2] Whether we can capitalise on the various imaging modalities depends on a good understanding of the pros and cons of each modality, as well as sound clinical judgement.

Ultrasound retains its appeal in the era of multimodality imaging because of its relatively low cost, easy availability, and safety. However, when it comes to diagnosing thoracic aortic pathology, its widespread use has been hampered by limitations such as poor far field resolution and difficult imaging windows because of patient's body habitus, presence of lung tissue, or ribs. Consequently, imaging modalities such as computed tomographic angiography and magnetic resonance angiography, which offer multiplanar reconstruction, comprehensive coverage, superior image quality and ability to depict fine details, such as thrombus formation, aortic dissection entry site, or endoleaks, are becoming increasingly commonplace in routine clinical practice.

Published guidelines on multimodality imaging of the thoracic aorta, for example the European Association of Cardiovascular Imaging/American Society of Echocardiography Guidelines published in 2015 and the latest Clinical Practice Guidelines by the European Society of Vascular Surgery (ESVS) published in 2017, provided similar recommendations on the topic of thoracic aortic imaging.[3,4] Both guidelines acknowledge the use of transthoracic echocardiography (TTE) as a useful tool for evaluating the aortic root, ascending aorta, and aortic arch in patients with good acoustic windows. However, TTE is deemed less useful for evaluating the descending aorta as TTE cannot reliably evaluate the entire thoracic aorta in patients with suspected aortic disease.[3] Currently, multidetector computed tomographic (CT) angiography is the first line diagnostic modality for descending aorta pathology (Class I, Level of evidence C), while transoesophageal echocardiography (TOE) is considered the second line imaging modality when CT is unavailable, contraindicated, or inconclusive (Class IIa, Level of evidence C).[4]

In the work by D'abate et al., the authors examined the feasibility of transthoracic ultrasound for imaging the descending thoracic aorta using a dedicated protocol.[5] The study positioned ultrasound as a gatekeeper to CT scan and raised the possibility of ultrasound being an alternative to CT angiography, especially in patients who required annual surveillance CT scans. The authors also outlined a protocol comprising four acoustic windows, namely the suprasternal, parasternal long axis, apical two chamber, and subcostal windows to assess the descending thoracic aorta. In fact, these imaging windows are not novel. They have been described in major echocardiographic textbooks and society guidelines,[6,7] albeit not routinely performed or reported for two reasons. First, these imaging windows may not be reliably acquired in all patients. Also, TTE has been shown to perform poorly at detecting descending thoracic aortic pathology compared with TOE, CT, and magnetic resonance imaging (MRI).[8] A previous study, which included 78 patients who underwent TTE, reported a 40.0% sensitivity of TTE at detecting acute Type B aortic dissection and the sensitivity dropped to 29.4% for subacute Type B dissection.[8] In the study, TTE could detect the site of entry in only 26.2% of the cases and thrombus formation in 11.8%. While the sensitivity of detecting acute Type B aortic dissection was 100% for TOE, CT, and MRI. In the case of subacute Type B aortic dissection, the detection sensitivity was 100% for TOE, 93.3% for CT, and 94.4% for MRI. In comparison, D'abate and colleagues were able to obtain technically complete assessment in 18 out of 39 (46%) patients, and partial assessment in 20 out of 39 (51%) patients, which left a lot to be desired, even by the standard set by the authors: that a 'satisfactory' image was defined by visualising at least two of the three regions of descending aorta, while 'partially satisfactory' was defined as obtaining just one view. The authors also tested the sensitivity and specificity of using 35 mm and 40 mm as cutoffs for descending thoracic aortic dilatation, although it is not entirely clear how the thresholds were chosen or their prognostic significance. Studies of the natural history of thoracic aortic aneurysm have shown that the risk of rupture increased when the aortic diameter was more than 6 cm,[9] while a diameter over 5 cm is considered aneurysmal and diameter above 4 cm is called dilatation.[10]

This brings us to the three pertinent aspects that we ought to ask ourselves while choosing any imaging modality: could we, should we, and would we? The fact that one could use ultrasound to image the descending thoracic aorta, albeit not consistently, does not mean that one should embrace it in a non-discriminatory manner. Its inability to image the entire length of the aorta reliably means that it does not have the diagnostic certainty to be a standalone test, especially when the clinical stakes are high and the consequence of missing the diagnosis is catastrophic.[11] The idea of using ultrasound as a gatekeeper to CT scan is plausible, although its cost-effectiveness is doubtful as patients will be subjected to multiple testing and the proportion of patients with non-conclusive ultrasound reports is not

DOI of original article: https://doi.org/10.1016/j.ejvs.2017.12.012.

10.1016/j.ejvs.2018.02.007

Please cite this article in press as: Go YY, Transthoracic Ultrasound Imaging of the Descending Thoracic Aorta: Could We, Should We, and Would We?, European Journal of Vascular and Endovascular Surgery (2018), https://doi.org/10.1016/j.ejvs.2018.02.007

negligible. However, just because we should not use TTE in some clinical scenarios does not mean that we would not use it at all. A thoracic aortic ultrasound protocol could be a useful adjunct to focused assessment with sonography for trauma (FAST), performed by the emergency physicians, trauma surgeons, or other trained operators. Aortic imaging can also be incorporated into routine TTE examination in patients with a history of aortic pathology.[6] As an adjunctive protocol, it adds value to the ultrasound examination, although a negative test in the context of high clinical suspicion still warrants further, more definitive imaging, such as CT angiography.

One major impetus for seeking an alternative imaging modality to the current gold standard of CT angiography, is that CT carries the risk of radiation exposure and contrast induced nephropathy in patients with renal impairment. To put things into perspective, the effective dose of high pitch CT angiography approximates 10 mSV,[12] which is comparable with natural background radiation for 3 years. The risk of death from cancer associated with this radiation dose range is comparable with driving 2000 miles, that is driving from the East to the West coast of the United States (1 in 10^4 chance of death).[13,14] For a non-invasive imaging alternative without ionising radiation, MR angiography, often performed without contrast is an ideal alternative to CT angiography for serial imaging, or imaging in pregnant or paediatric subjects.

Now more than ever, we have the opportunity of choosing from various imaging modalities to answer the clinical question at hand. With opportunity of course, comes responsibility. The onus is on us to exercise it wisely, selecting the modality that best suits the clinical context, the one most likely to clinch a definitive diagnosis, the most cost-effective, least invasive if possible, and at the heart of it all, the one that best serves the patient.

CONFLICT OF INTEREST

None.

FUNDING

None.

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Please cite this article in press as: Go YY, Transthoracic Ultrasound Imaging of the Descending Thoracic Aorta: Could We, Should We, and Would We?, European Journal of Vascular and Endovascular Surgery (2018), https://doi.org/10.1016/j.ejvs.2018.02.007