THORACIC ENDOVASCULAR AORTIC REPAIR (TEVAR) IS COMMONLY PERFORMED IN SELECTED PATIENTS to treat thoracic aortic pathologies. Transesophageal echocardiography (TEE) is often used as adjunct to fluoroscopy and angiography (ANGIO) during TEVAR, mainly reducing radiation exposure and contrast load.

Contrast transesophageal echocardiography (cTEE) was superior to both TEE and angiography (ANGIO) alone in the assessment of slow flow and remaining flow in the false lumen/aneurysmal sac after stent-graft implantation and in the detection of incomplete stent-graft apposition. (A) TEE demonstrated the presence of type B dissection with evidence of malperfusion. After stent deployment and true lumen expansion guided by ANGIO (B) and TEE (C), there was no evidence of tears on color flow mapping (D). Contrast administration (Sonovue 2.5 ml, Bracco, Milan, Italy) demonstrated new distal intimal tears after stent-graft positioning (E) that were not visible on ANGIO (F) and TEE (Online Video 1), as bubbles move from the true lumen to the false lumen (arrow). (G) Post-operative computed tomography shows complete exclusion and thrombosis of the false lumen.

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FIGURE 2 Endoleaks

Contrast transesophageal echocardiography (cTEE) was superior to both TEE and angiography (ANGIO) in the detection of endoleaks. After stent deployment, residual flow in the aneurysmal sac due to the presence of endoleak is clearly visible. (A) TEE shows the incomplete thrombosis of the excluded aneurysmal sac (arrow). TEE color flow mapping demonstrates flow within the incompletely excluded aneurysmal sac (B); cTEE shows contrast accumulation within the aneurysmal sac. Because contrast is an intravascular tracer, its presence in the aneurysmal sac outside the stent deployment suggests the persistence of flow between the aorta and the excluded aneurysm (C) [Online Videos 2 and 3].

FIGURE 3 Endoleaks Despite Negative Findings on ANGIO and TEE

When 2-dimensional imaging demonstrates that complete thrombosis of the aneurysmal sac is achieved (A) (asterisk), contrast injection might show a residual flow in the aneurysmal sac due to persistent leak (B) (arrow), which may be necessary to treat with further stenting post-dilation. Therefore, the presence of negative findings on transesophageal echocardiography (TEE) and color TEE (C) and angiography (ANGIO) (D) does not necessarily exclude the presence of an endoleak. In our experience, contrast administration increases TEE sensitivity for endoleak detection because the presence of microbubbles in the aneurysmal sac at the level, for example, of the proximal edge of the stent (E, arrow) is a sign of endoleak (Online Videos 4 and 5).
Contrast TEE (cTEE) has been shown to be feasible and reliable in the diagnostic workup of acute aortic syndromes, providing additional morphological and functional information compared with standard TEE. Endoleak occurrence after TEVAR remains one of the principal limitations of this procedure because mainly type I endoleak could increase the rupture rates of degenerative aneurysms and negatively affect the long-term results of endovascular treatment of type B aortic dissections. Studies have demonstrated that in patients undergoing endovascular abdominal aortic repair, contrast ultrasound has a greater sensitivity for endoleak detection during follow-up than standard ultrasound and has diagnostic value similar to that of computed tomography angiography (CTA) and magnetic resonance. We investigated the use of cTEE in the setting of TEVAR. cTEE provided additional contributions, both in the preoperative characterization of the aortic pathology (identification of number and sites of tears and aneurysmal thrombosis) and in the intra-procedural and immediate post-procedural assessment (slow flow and/or remaining flow in a false lumen or aneurysmal sac, the presence and classification of persistent leaks, and detection of new intimal tears after stent deployment) (Figures 1 to 4).

Therefore, our experience suggests that adding cTEE to TEE and ANGIO provides relevant information in all steps of TEVAR, from disease characterization to deployment and the post-procedural assessment, improving the procedural outcomes.

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**Appendix** For accompanying videos, please see the online version of this paper.