

therapeutical impact. In all cases both the source of infection and the 'infected aneurysm' itself have to be addressed.

## Reference

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### Comments regarding "A Retrospective Study of Intravascular Ultrasound use in Patients Undergoing Endovascular Aneurysm Repair: Its Usefulness and a Description of the Procedure"

**The use of Contrast Enhanced Ultrasound for Intra-procedural EVAR deployment completely eliminates the need for nephrotoxic iodinated intra-arterial contrast.**

Dear Editor,

I was delighted to read your retrospective study using Intravascular Ultrasound (IVUS) during EVAR stent-graft deployment<sup>1</sup> and commend you for describing a technique to significantly reduce the intra-arterial contrast used. The availability of EVAR and the number of patients deemed suitable for these procedures is growing immensely. As techniques evolve and become more complex, such as fenestrated and branched grafts, the corresponding procedure times and thus exposure to greater volumes of nephrotoxic iodinated contrast and radiation<sup>2,3</sup> also increases.

I agree that your IVUS technique will help with these matters but will not eliminate them completely. In 2008 Dr Dirk Clevert first described the use of real-time intra-operative microbubble contrast-enhanced ultrasound for EVAR stent deployment and for post-procedural endoleak detection<sup>4</sup> (both immediate and late as part of a surveillance programme). I have visited Munich and witnessed this procedure that requires no intra-arterial contrast but does require the use of much reduced doses of intra-procedural angiographic fluoroscopy. More recently the German group has published their longer experience and refinement of the technique with a series of 17 patients<sup>5</sup> and compared this

group with 20 treated using "conventional EVAR" consisting of iodine contrast media with intra-operative fluoroscopy.

The use of intra-operative microbubble contrast ultrasound for stent deployment completely eliminates the need for any completion angiography or the use of any intra-arterial contrast and significantly reducing the radiation exposure, which IVUS does not appear to match. I look forward to your further work that you allude to regarding the combined use of IVUS and ultrasound contrast, but suggest that this should not be limited to those with a contraindication to iodinated media but can be applied more widely.

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### Response to comments regarding "A Retrospective Study Of Intravascular Ultrasound Use In Patients Undergoing Endovascular Aneurysm Repair: Its Usefulness And A Description Of The Procedure."

Dear Editor,

We thank Dr. Dindyal for his comments regarding our paper; we have provided a response regarding the issue that he had raised, mainly regarding the usefulness of contrast-enhanced ultrasonography (CEUS).

We are extremely pleased to obtain his endorsement for our paper, which reports an intravascular ultrasonography (IVUS) technique for reducing the use of contrast agents. We agree that IVUS cannot completely substitute for contrast agents with regard to completion angiography for detecting endoleaks and that CEUS with second-generation contrast agents would be a powerful diagnostic method. The development of CEUS with second-generation agents would be a great boon for patients with renal dysfunction or allergy to contrast agents. Regretfully, in our country, health insurance coverage for CEUS with second-generation contrast agents has only been approved for hepatic diseases; this technique is a more practical one because of the clear images obtained and the durability of echo sound waves. Therefore, we plan to use it in the near future after it is approved.

The complete substitution of conventional contrast agents with CEUS has 2 disadvantages. Firstly, the resonance in ultrasonography (US) may not be adequate for detecting the orifices of the aortic branches.

CEUS appears to be adequate for detecting obvious perigraft leakage and the pooling of endoleaks in the aneurysmal sac. However, it is important to know which branch of the aorta is causing the endoleaks.

In addition, we usually check the route (collateral vessels) of backflow into the sac in order to prepare for future re-intervention.

The resolution of the currently used CEUS technique may not be adequate for detecting the lumbar artery or the median sacral artery, and the artifact of colon gas may impede precise examination. We agree with your

recommendation of preoperative simulation with the US device; however, this requires skills and a lot of experience.

Secondly, evaluation of US imaging results is less objective than that of fluoroscopy imaging results, i.e. US imaging can be evaluated by only a small number of technicians. This is not desirable with respect to the training of vascular surgeons in our institute for this technique as well as with respect to the risk-management aspect such as overlooking minor endoleaks.

However, the combination of CEUS and IVUS would be a powerful weapon for patients with aneurysms, in cases where there is a contraindication for the use of contrast agents. Our dream is the real-time three-dimensional construction of each US cross section during surgery. If this can be achieved, then CEUS can provide a complete and non-invasive alternative to contrast agents.

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