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Intracardiac Echocardiography for Patent Foramen Ovale Closure: Justification of Routine Use

We read with interest the report by Hildick-Smith (1) and the accompanying editorial comment (2) in *JACC: Cardiovascular Interventions*. Dr. Meier (2) discussed the arguments for and against the use of ultrasound guidance during patent foramen ovale (PFO) closure. We wish to add further reasons to support the routine use of intracardiac echocardiography (ICE).

- ICE is ideal for evaluating the inferior interatrial septum and inferior vena cava rim—a region hard to fully assess with transesophageal echocardiography—to exclude additional shunts. A comprehensive study can be performed while the PFO closure device is being prepared and will not add to the procedure time.
- ICE requires experience, and limiting its use to only those PFO cases that are difficult or unusual restricts training and may therefore hamper interpretation of unusual anatomy.
- ICE can readily identify thrombus formation on the delivery sheath that can occur despite the use of full heparinization (3) and prevent procedural-related embolic events
- ICE assessment of the device and its relation to both the primum and secundum septum before final release is useful to confirm a stable position and adequate capture of the surrounding septum, as well as the alignment of the device with the aortic root and anterior mitral valve leaflet
- ICE reduces the fluoroscopy requirements, and in experienced hands, the majority of the procedure can be performed under ultrasound guidance only. This is useful in the rare cases of PFO closure being required during pregnancy.

We agree that ICE guidance during PFO closure usually necessitates a second operator experienced in intracardiac ultrasound. However, we disagree that introduction is a “fairly rough act” with a doubling in the risk of puncture site complications: the use of a long 11-F sheath and gentle passage of the probe along the inferior vena cava minimizes the risk of trauma with a 0%

complication rate in a review of 155 cases of ICE-guided closure of atrial septal defect and PFO (4). It is possible that these complications are more likely to occur when operators use ICE infrequently.

We believe the routine use of ICE for PFO closure facilitates anatomical assessment and choice of closure device, reduces procedural complications with minimal additional risk, and ensures operators are sufficiently skilled to use ICE safely when a difficult PFO is encountered. These advantages offset the additional cost of the disposable probe.

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Reply

I thank Dr. Newton and colleagues for their interest in the paper of Hildick-Smith et al. (1) and my commentary (2). Obviously, neither the paper nor my commentary have convinced Dr. Newton and colleagues. Their letter will be appreciated by colleagues looking for reasons to stick to their habits of using intracardiac echocardiography (ICE) guidance during closure of the patent foramen ovale (PFO).

The inferior rim of a PFO is invariably at least 3 cm long and never a problem. I agree that tiny atrial septal defects in the flimsy central part of the septum primum are detectable by ICE and not by fluoroscopy. Yet they are very easily overlooked even with ICE, and they lack clinical significance. Paradoxical embolism through such a defect is highly unlikely as they are way off the inflow current of the inferior vena cava.