



## EDITORIAL COMMENT

## Intracardiac echocardiography-guided left atrial appendage occlusion – A path worth following?

### Encerramento de apêndice auricular esquerdo guiado por ecocardiografia intracardiaca – um trajeto que vale a pena percorrer?

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Percutaneous left atrial appendage (LAA) occlusion (LAAO) has now been used in everyday clinical practice for well over a decade. Multiple clinical trials have shown it to be an effective prevention strategy for stroke and systemic embolization, as compared to oral anticoagulation (OAC) with vitamin K antagonists in the pivotal trials,<sup>1–3</sup> as well as with direct oral anticoagulants (DOACs) in the more recent PRAGUE-17 trial.<sup>4</sup> Furthermore, large registries have consistently reported reductions in stroke rate comparable to what would be expected had the patients been on DOACs,<sup>5</sup> as have Portuguese centers, which have now accumulated considerable experience with LAAO.<sup>6</sup> Not surprisingly, available data have also repeatedly shown fewer bleeding events in patients undergoing LAAO vs. OAC.<sup>3,5</sup> Notwithstanding, some controversy remains, especially due to safety concerns regarding the rates of procedural complications, stemming mostly from the early years of the technique. These have since been drastically reduced, as operators have gained experience and devices have improved, with some of the largest and most up-to-date studies now reporting complication rates as low as <1%.<sup>7</sup>

Despite all of the above, operators are well aware that LAAO is not a forgiving procedure from a technical point of view, given the fragile nature of the left atrial appendage itself, as well as the meticulous procedural steps required. Thus, the procedure has traditionally been undertaken under the guidance of transesophageal echocardiography (TEE), together with fluoroscopy, preceded by a detailed assessment of the LAA anatomy by either TEE or computed tomography. Accordingly, general anesthesia, or at the very least deep sedation, under the supervision of an anesthesiologist, has been a requirement to ensure that TEE is well tolerated and the procedure is not affected by patient movement or difficulty in collaboration. However, this somewhat complex approach is at odds with the standard ‘keep it simple’ approach of percutaneous interventions. Indeed, the examples of percutaneous coronary interventions and, more recently, transcatheter aortic valve implantation, have both moved in the direction of increasingly streamlined and efficient procedures, largely foregoing the use of a femoral approach in the former and the use of TEE and general anesthesia in the latter. Thus, for LAAO, a simpler approach would also be desirable, ideally one that would render general anesthesia unnecessary, which in turn essentially requires abandoning the use of TEE during the procedure. And, in fact, both of these may be especially relevant in

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candidates for LAAO. As operators familiar with this technique are keenly aware, LAAO candidates are usually very frail, as they are selected mostly because of their poor tolerance of OAC, which in the era of DOACs is now less often the case. Hence, they often present with extensive and significant comorbidities, not uncommonly including recurrent gastrointestinal bleeding. Thus, the risk involved in general anesthesia is often not trivial in these patients. Moreover, the presence of upper gastrointestinal disease, known or unknown, is also a concern, rendering the avoidance of TEE all the more important. Lastly, constraints on the availability of anesthesiology are commonplace in Portugal, further exacerbating the problem.

Some advocate the use of pediatric TEE probes as a means of overcoming the above-mentioned issues. However, in my personal experience, patient tolerance of these probes is neither universal nor entirely predictable, and often involves having anesthesiology as backup. Additionally, the image quality is inferior to traditional TEE probes, and lastly, the issue of esophageal damage remains, at least partially. On the other hand, the use of intracardiac echocardiography (ICE) seems an interesting approach for these cases, as it enables both general anesthesia and TEE to be avoided, while delivering imaging capabilities beyond those of fluoroscopy, a critical issue given the meticulous nature of this procedure. Its only requirement is an additional venous access, which is usually fairly straightforward. However, ICE cannot be safely and effectively used without a significant learning curve, and the image details are inferior to those of TEE, especially for imaging the LAA. Thus, while several centers have now used this technique for quite some time, data regarding the feasibility, effectiveness and safety of this approach are essential.

The information currently available on ICE-guided LAAO is scarce and consists mostly of small retrospective studies. As a result, the paper by Grazina et al. in this issue of the *Journal*<sup>8</sup> is highly relevant, as more data are very much needed. The authors provide a detailed account of their now considerable experience of LAAO using ICE, while also comparing it with the traditional approach. It should also be noted that in addition to technical and clinical outcomes, the methods section explores their technical approach in great educational detail, providing a tutorial of sorts for others.

The authors found no major differences between ICE-guided LAAO and TEE-guided traditional LAAO regarding feasibility, efficacy and safety. Importantly, the stroke rates in their populations are in line with previous large datasets<sup>5</sup> and were similar to the rates to be expected had patients been on OAC therapy, adding further evidence supporting the efficacy of LAAO in preventing stroke and/or systemic embolism. Bleeding during follow-up was significant, likely reflecting a somewhat short mean follow-up of 19 months. As bleeding events are more likely early after the procedure due to more aggressive antithrombotic therapy in this period, the annualized rate approach likely overestimates actual bleeding rates. This is likely the main reason that these results are not in complete agreement with previous publications.<sup>3,5,6</sup> But the issue that will likely draw the most attention was the major complication rate, which comprised pericardial tamponade (two cases) and device embolization (two cases). At a not negligible 8.8% rate, especially if one

considers that one was fatal (2.2%) and that the ICE approach was undertaken by operators already experienced with the traditional procedure, the results highlight that ICE imposes an additional learning curve, even with seasoned interventionalists. Perhaps importantly, the two embolization cases occurred with non-WATCHMAN devices. This is especially interesting considering the very good safety profile of the latest device of this family, which may be a consideration when ICE-guided LAAO is undertaken, as another study suggests.<sup>9</sup> Lastly, while fluoroscopy time was slightly greater, overall radiation and contrast were not significantly different, and the impact on these particular issues is only likely to become smaller as operators become more experienced.

Recently, a large dataset from the US National Inpatient Sample was published,<sup>10</sup> comprising ~1400 patients in whom ICE-guided LAAO was employed, a mere ~2% of the overall LAAO population, reflecting the still low usage rates of this technique. Like Grazina et al.,<sup>8</sup> the authors found no differences in outcomes between ICE-guided LAAO and the traditional approach, including regarding complications. Like previously published studies and that of Grazina et al., however, this large sample also covers the entirety of the LAAO experience from the very beginning, reflecting the early learning curve, when no one anywhere was truly highly experienced. In contrast, in a recent prospective multicenter study in which only centers already experienced with ICE-guided LAAO participated, procedural success was 100% and no major complications occurred.<sup>9</sup>

Lastly, there is the issue of cost and reimbursement, which differ widely across countries and institutions. While the avoidance of general anesthesia and potential reduction of cath lab turnover times may offset the additional cost of the ICE probe, no definitive cost-effectiveness studies are available, although recent data suggest that this approach may be, for now, more expensive.<sup>10</sup> Considering that the situation in Portugal is, however, very different from that in the US, a definitive answer cannot be provided.

In conclusion, the study by Grazina et al.<sup>8</sup> supports the use of ICE-guided LAAO as an alternative to the traditional approach, while also providing an informative and detailed technical roadmap, together with valuable insights regarding specific technical considerations when this approach is selected. I am sure all LAAO operators, including myself, may benefit from it, and therefore thank them for both following and sharing this difficult path.

## Conflicts of interest

The author has no conflicts of interest to declare.

## References

1. Holmes DR, Kar S, Price MJ, et al. Prospective randomized evaluation of the Watchman Left Atrial Appendage Closure device in patients with atrial fibrillation versus long-term warfarin therapy: the PREVAIL trial. *J Am Coll Cardiol*. 2014;64:1–12.
2. Reddy VY, Sievert H, Halperin J, et al. Percutaneous left atrial appendage closure vs warfarin for atrial fibrillation: a randomized clinical trial. *JAMA*. 2014;312:1988–98.
3. Reddy VY, Doshi SK, Kar S, et al. 5-Year outcomes after left atrial appendage closure: from the PREVAIL and PROTECT AF trials. *J Am Coll Cardiol*. 2017;70:2964–75.

4. Osmancik P, Herman D, Neuzil P, et al. 4-Year outcomes after left atrial appendage closure versus nonwarfarin oral anticoagulation for atrial fibrillation. *J Am Coll Cardiol*. 2022;79:1–14.
5. Boersma LV, Ince H, Kische S, et al. Evaluating real-world clinical outcomes in atrial fibrillation patients receiving the WATCHMAN Left Atrial Appendage Closure Technology: final 2-year outcome data of the EWOLUTION Trial Focusing on History of Stroke and Hemorrhage. *Circ Arrhythm Electrophysiol*. 2019;12:e006841.
6. Reis L, Paiva L, Costa M, et al. Registry of left atrial appendage closure and initial experience with intracardiac echocardiography. *Rev Port Cardiol (Engl Ed)*. 2018;37:763–72.
7. Kar S, Doshi SK, Sadhu A, et al. Primary outcome evaluation of a next-generation left atrial appendage closure device: results from the PINNACLE FLX Trial. *Circulation*. 2021; 143:1754–62.
8. Grazina A, Fiarresga A, Ramos R, et al. Intracardiac echocardiography-guided atrial appendage occlusion: the path to independence. *Rev Port Cardiol*. 2023;42, <http://dx.doi.org/10.1016/j.repc.2023.01.028>.
9. Nielsen-Kudsk JE, Berti S, Caprioglio F, et al. Intracardiac echocardiography to guide Watchman FLX implantation. *JACC Cardiovasc Interv*. 2023;16:643–51.
10. Zahid S, Gowda S, Hashem A, et al. Feasibility and safety of intracardiac echocardiography use in transcatheter left atrial appendage closure procedures. *J Soc Cardiovasc Angiogr Interv*. 2022;1:100510.