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Pictorial Essay

Cardiac CT imaging in the context of left atrial appendage occlusion

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ABSTRACT

Left atrial occlusion devices are a recognized treatment option in patients with difficult to treat atrial fibrillation or intolerance to warfarin therapy. There are an increasing number of devices on the market, and good quality preoperative imaging is crucial to assess the feasibility of the procedure and help plan the occlusion. Electrocardiography-gated cardiac CT is ideal for this purpose as the high spatial and temporal resolution allow accurate measurements and reformats in multiple planes. As the imaging specialist reporting the CT may not necessarily be the interventionalist performing the implantation, this review will illustrate the important points in reporting the preimplant CT. The expected post-operative appearances and potential complications will also be described.

1. Introduction

Atrial fibrillation (AF) is the most common cardiac arrhythmia and is a major cause of embolic stroke.[1] Systemic anticoagulation is the standard treatment to prevent thromboembolism, but a significant number of patients have intolerance to warfarin or have major contraindications to anticoagulation. As 90% of strokes in patients with AF arise from emboli in the left atrial appendage (LAA), a recently developed strategy is to occlude the LAA using a number of percutaneously inserted devices, usually via a trans-septal approach.[2–4] A recent large trial has shown that LAA occluders are at least noninferior to warfarin in preventing stroke, cardiovascular death, and systemic embolism.[1]

There is undeniably a learning curve among operators in the insertion of LAA occluders.[1,5] Preimplantation CT can provide crucial information during the patient's workup, and CT has been shown to be more accurate than echocardiography in assessing LAA measurements and the overall geometry of this eccentric structure.[6] The purpose of this article is to describe the important components of a comprehensive report to assist in planning the procedure and to avoid complications. The postimplantation appearances are also reviewed.

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Fig. 1 – Morphology of the left atrial appendage (LAA). *Black arrows* indicate the ostium. (A) The windsock type of LAA is composed of a dominant lobe with sufficient length for implant insertion. (B) The cactus type has several small lobes arising from a dominant lobe, but these do not contraindicate insertion. (C, D) The chicken wing type has a sharp kink (*white arrows*). The usable length of the LAA should be measured (*black line*) as a short usable length (as in D) would contraindicate insertion. (E) The broccoli type has a complex morphology with no single dominant lobe. This is generally considered unsuitable for occlusion.

2. Imaging technique

All images in this article were acquired using a 320-row detector CT scanner (Aquilion ONE; Toshiba Medical Systems, Tochigi, Japan). One hundred milliliter of intravenous contrast (Omnipaque 350; GE Healthcare, Milwaukee, WI) was injected through a pump injector, into a 20 ga cannula in the antecubital fossa. An automatic bolus tracking technique was used, with a region of interest placed in the left atrium, and the scan was triggered when a threshold of 130 Hounsfield units was reached.

The scan parameters were as follows: detector collimation 320 × 0.5 mm; tube current 300 to 500 mA (depending on body mass index [BMI]); tube voltage 120 kV if BMI $\geq$25 kg/m^2, 100 kV if BMI $<$25 mg/m^2; gantry rotation time 350 ms; and temporal resolution 175 ms. Prospective electrocardiography triggering was used, with imaging at 75% of the R-R interval. The effective radiation dose varied from 1.9 to 3.2 mSv. AF is not considered a contraindication to imaging as the large size appendage is less sensitive to motion than coronary arteries. Multiplanar reformats were performed on a dedicated workstation (Vitrea 2; Vital Images).

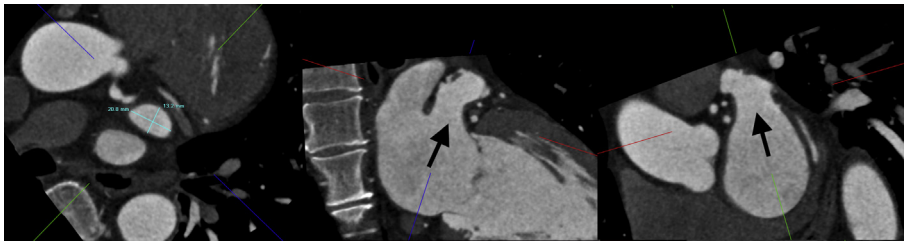

Fig. 2 – Measurement of the left atrial appendage (LAA) ostium after aligning in orthogonal planes (left panel). The maximum and minimum diameters should be reported to assess if a suitable prosthesis is available. The ostium of the LAA is indicated (*arrow*; middle and right panels).