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## Scientific letters

### Multidetector Computed Tomography Usefulness in Infective Endocarditis

***Utilidad de la tomografía computarizada con multidetectores en la endocarditis infecciosa***

**To the Editor,**

Infectious endocarditis (IE) still carries high morbidity and mortality. Currently, transesophageal echocardiography (TEE) is the reference imaging technique for the diagnosis and assessment of IE and its complications, but a series of noteworthy results have been published with multidetector computed tomography (MDCT) for presurgical assessment of IE.[1–3] The new European Guidelines[4] reinforce the role of MDCT both in suspected IE and in confirmed cases for assessment of complications with an extension of the major diagnostic criteria to include paravalvular lesions in MDCT. The European Society of Cardiology[5] recommends preoperative assessment of coronary artery disease prior to surgery in selected patients; however, in the context of IE, invasive coronary angiography is associated with a nonnegligible risk of embolism.

We conducted a prospective study with the objective of assessing the utility of MDCT in IE. The study included 27 consecutive patients who met the diagnostic criteria for possible IE (41%) or definite IE (59%) according to the modified Duke criteria.[4] A 64-detector device (thickness/cut increment 0.6/0.3 mm, electrocardiogram-gated, field of view extended to the upper abdomen) was used with 80 mL of intravenous contrast (350 mg/mL, 5.5 mL/s).

The results were compared with the findings from TEE and surgery in patients who underwent an intervention (Table).

Five of the patients (18.5%) had device-associated IE (3 lead-associated and 2 central-catheter–associated) and 22 had valve-associated disease (57% associated with the native valve, 29% with a bioprosthesis, and 14% with mechanical valves).

Of note among the MDCT findings was the following:

- Suspected aortic fistula to the pulmonary trunk was ruled out and 2 suspected periaortic abscesses were appropriately assessed. These turned out to be pseudoaneurysms (Figure), in all cases associated with mechanical aortic valve prosthesis.
- Supracoronary prosthetic graft was assessed and a large hematoma was appropriately characterized in the graft region, without leaks or endocardial complications; a graft from the right ventricle to the pulmonary artery was assessed, with exact determination of the diameter of the ascending aorta in a patient who finally required implantation of a valve tube.
- Four of the 6 abscesses of the mitral-aortic junction were diagnosed with TEE and confirmed by surgery. One of these abscesses, which was an extensive lesion, could not be evaluated by echocardiography. Tomography was able to adequately define the limits of the abscess, which extended to the aortopulmonary window and which encompassed the coronary artery origin.
- In 77% of the patients, the native coronary arteries or the bypass were assessed.
- In all patients who had undergone a repeat procedure, the distance from the apex of the right ventricle or bypass to the sternum was determined.
- In 70% of the patients, extracardiac findings were reported. This is particularly important as these are minor criteria for peripheral arterial embolic events (26%), pulmonary infarction (7.4%), and mycotic aneurysms (3.7%).

**Table**
Clinical Characteristics, Type of Endocarditis, Presence of Vegetation, Complications, and Coronary Anatomy

| Patient | Sex, age, y | Probability of IE | Heart disease/ underlying condition | Vegetation observed in TEE | Vegetation observed in MDCT | Complication diagnosed in TEE | Complication diagnosed in MDCT | Coronary arteries in MDCT | Extracardiac findings in MDCT |
|---|---|---|---|---|---|---|---|---|---|
| 1 | F, 74 | Possible | Mechanical mitral and aortic valve prostheses | No | No | Periaortic abscess<br>Suspected fistula | Pseudoaneurysm<br>Fistula ruled out | No lesions | Mycotic aneurysm in superior mesenteric artery |
| 2 | M, 81 | Possible | No | No | No | No | No | Two-vessel disease | Mural thrombus in ascending aorta |
| 3 | M, 62 | Definite | No | Yes (native aortic) | No | No | No | Unassessable<br>Intense calcification | Embolization in spleen and psoas |
| 4 | M, 76 | Definite | Biological aortic valve prosthesis + ACBS | Yes (aortic biological) | Yes | MAJ abscess | No | Single-vessel disease<br>Patent bypass | |
| 5 | M, 41 | Definite | No<br>Intravenous drug user | Yes (native tricuspid) | No | No | No | No lesions | Pulmonary infarction |
| 6 | F, 82 | Possible | Biological aortic valve prosthesis + ACBS | Yes (native mitral) | No | No | No | Unassessable<br>Intense calcification | |
| 7 | M, 65 | Definite | ACBS | Yes (native aortic) | Yes | No | Perforated leaflet | Three-vessel disease<br>Patent bypass | Bilateral pleural effusion |

**Table** *(Continued)*
Clinical Characteristics, Type of Endocarditis, Presence of Vegetation, Complications, and Coronary Anatomy

| Patient | Sex, age, y | Probability of IE | Heart disease/ underlying condition | Vegetation observed in TEE | Vegetation observed in MDCT | Complication diagnosed in TEE | Complication diagnosed in MDCT | Coronary arteries in MDCT | Extracardiac findings in MDCT |
|---|---|---|---|---|---|---|---|---|---|
| 8 | M, 59 | Definite | Mechanical aortic valve prosthesis | Yes (mechanical aortic) | No | No | No | No lesions | Pleural effusion |
| 9 | F, 80 | Possible | ICD-CRT | Yes (lead) | No | No | No | Unassessable Intense calcification | |
| 10 | M, 30 | Possible | ICD | Yes (lead) | Yes | No | No | No lesions | |
| 11 | F, 66 | Definite | Mechanical aortic valve prosthesis and pacemaker | Yes (lead) | No | No | No | No lesions | |
| 12 | M, 68 | Definite | No | Yes (native mitral and aortic) | Yes | Perforated aortic leaflet Mitral chord rupture | Mitral chord rupture | No lesions | Splenic infarction Pleural effusion |
| 13 | M, 48 | Possible | Aortic prosthetic tube | No | No | No | Assessment aortic tube | No synchronization | Periaortic hematoma |
| 14 | F, 51 | Possible | Central catheter | Yes (catheter) | Yes | No | No | Not assessable due to contrast failure | Subclavian vein thrombosis |
| 15 | M, 84 | Possible | Central catheter | Yes (catheter) | No | No | No | Three-vessel disease | Pulmonary consolidation Jugular thrombosis |
| 16 | M, 60 | Definite | No | Yes (native mitral) | Yes | No | No | Right coronary and circumflex artery not assessable | Splenic infarction |
| 17 | F, 57 | Definite | Obstructive hypertrophic cardiomyopathy | Yes (native mitral) | Yes | MAJ abscess | MAJ abscess | No lesions | |
| 18 | M, 70 | Definite | Biological aortic valve prosthesis | Yes (aortic biological and native mitral) | Yes | MAJ abscess Prosthesis removal | MAJ abscess Prosthesis removal | No lesions | Aneurysm of ascending aorta Pleural effusion |
| 19 | M, 76 | Definite | Biological aortic valve prosthesis + ACBS | Yes (biological aortic) | Yes | MAJ abscess | MAJ abscess | LMCA disease + 3 vessels Patent bypass | Splenic infarction Pleural effusion |
| 20 | F, 79 | Definite | Biological aortic valve prosthesis | Yes (MAJ) | Yes | MAJ abscess | MAJ abscess | No lesions | |
| 21 | M, 32 | Definite | Subaortic ventricular septal defect | Yes (native aortic) | Yes | No | No | No lesions | Splenic infarction |
| 22 | M, 60 | Definite | No | Yes (native mitral) | No | MAJ thickening | No | No lesions | Splenic infarction |
| 23 | F, 23 | Definite | Tetralogy of Fallot. Right ventricle to pulmonary artery conduit | Yes (biological pulmonary) | Yes | No | No | No lesions Assessment right ventricle-pulmonary artery conduit | Pulmonary thromboembolism |
| 24 | M, 39 | Possible | Bicuspid aortic valve | Yes (native aortic) | Yes | No | No | No lesions | Paraseptal emphysema |
| 25 | M, 78 | Definite | Biological aortic valve prosthesis | Yes (native mitral) | Yes | No | No | No lesions | Pleural effusion |
| 26 | M, 81 | Definite | Biological aortic valve prosthesis | No | No | Periaortic abscess | Periaortic abscess that infiltrates MAJ and encompasses LMCA, LADA, and CxA | LADA not assessable due to calcification Remaining arteries without lesions | Splenic infarction Pleural effusion |
| 27 | M, 59 | Definite | Mechanical aortic valve prosthesis | Yes (aortic root) | Yes | Periaortic abscess | Pseudoaneurysm in the sinus of Valsalva | No lesions | |

ACBS, aortocoronary bypass surgery; CRT, cardiac resynchronization therapy; CxA, circumflex artery; ICD, implantable cardioverter device; IE, infectious endocarditis; F, female; LADA, left anterior descending artery; LMCA, left main coronary artery; M, male; MAJ, mitral-aortic junction; MDCT, multidetector computed tomography; TEE, transesophageal echocardiography.

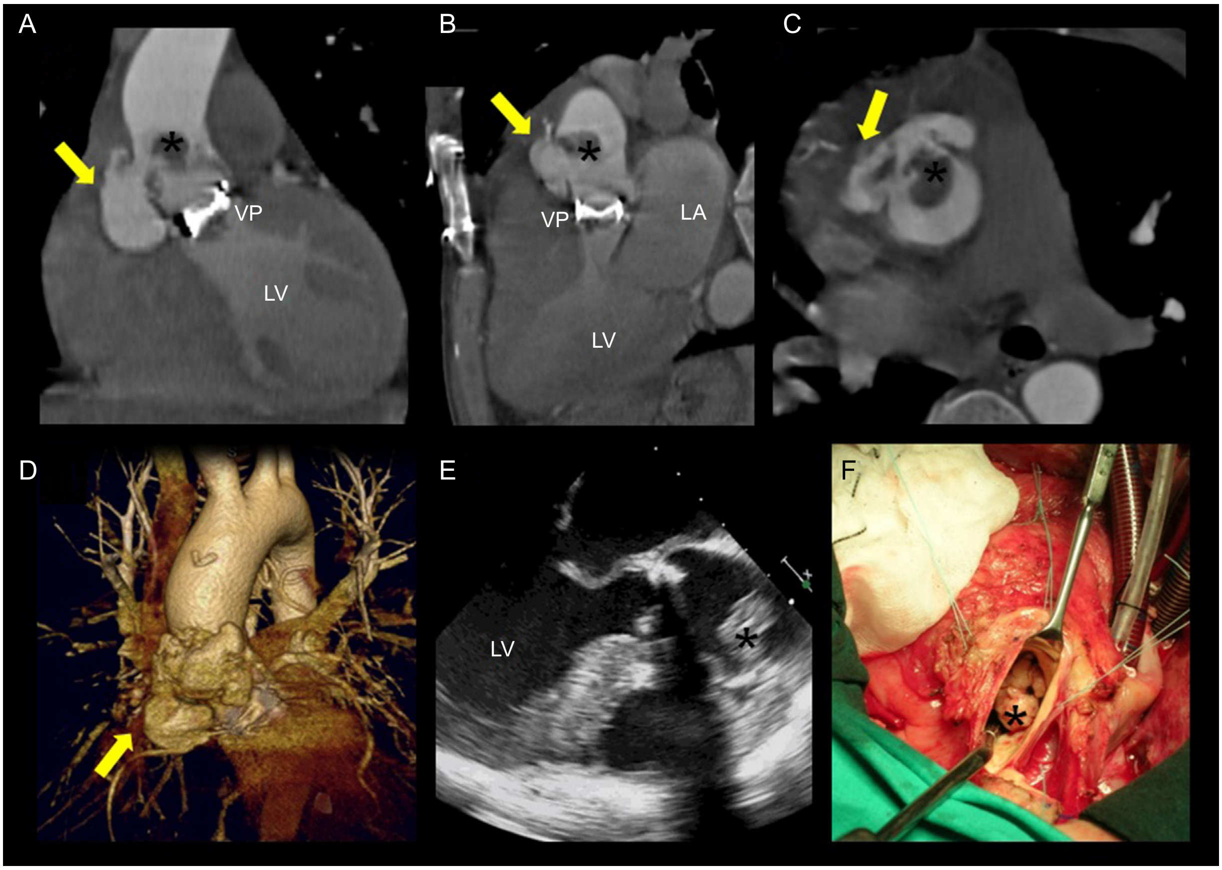


**Figure.** Mechanical aortic-valve-prosthesis–associated endocarditis with pseudoaneurysm of the aortic root. Multidetector computed tomography identified a pseudoaneurysm in the right sinus of Valsalva (yellow arrow) in the coronal (A), sagittal (B), and axial (C) plane, and in the 3-dimensional reconstruction (D), along with a large vegetation affixed to the proximal ascending aorta (*). The vegetation was observed in transesophageal echocardiography (E), but the pseudoaneurysm was not detected. These findings were confirmed during surgery (F). LA, left atrium; LV, left ventricle; VP, mechanical aortic valve prosthesis.

- Of the 17 vegetations detected in TEE, 12 were valve-associated (both native and prosthetic) in the MDCT and an additional 3 device-associated vegetations were detected. The thread-like and hypermobile vegetations were those not detected.

The use of MDCT in IE, reinforced in the new guidelines,[4] has not yet been assessed in Spain. In the present study, based on an extensive series, we would highlight several conclusions:

- In valvular IE, MDCT is key for visualizing the aortic wall, which is usually incompletely assessed with echocardiography. This structure is often affected by fistulas, pseudoaneurysms, and abscesses. The greatest advantage is apparent in IE associated with mechanical aortic valve prosthesis, in which complications are frequently present. Assessment with TEE can be particularly complicated given the presence of acoustic shadows.
- In addition, the technique allows assessment of the coronary artery and estimation of the distance from the right ventricular apex or coronary bypass to the sternum in patients with prior surgery and is also useful in right-sided IE for diagnosis of pulmonary embolism.
- However, in our experience, the information provided by MDCT is less relevant both for assessment of vegetations (mainly thread-like ones) and for device-associated IE, given that in the latter case, local complications are not usually present and major surgery is not required, and so assessment of coronary anatomy is not necessary.

Currently, with the development of a range of different imaging modalities, it is the responsibility of the cardiologist to be aware of the advantages of each technique to achieve the highest diagnostic accuracy. We believe that MDCT undoubtedly complements TEE in the management of IE.

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## Two-incision Technique for Subcutaneous Cardioverter-defibrillator Implantation: Method of Choice?

### *Técnica de dos incisiones para implante de desfibrilador subcutáneo: ¿técnica de elección?*

**To the Editor,**

Subcutaneous implantable cardioverter-defibrillators (S-ICD) are becoming established as an effective and safe therapy for a broad spectrum of patients.[1,2] These devices do not require placement of endovascular leads in or around the heart and allow the sensing and appropriate treatment of malignant ventricular arrhythmias.[3] Implantation is relatively simple, and the procedure times and results are very predictable. Nonetheless, physicians require a learning curve of about 13 implants in order to minimize potential complications.[4] The implantation procedure recommended by the manufacturer involves 3 incisions (Figure A). A pocket incision on the lateral chest wall houses the pulse generator, and 2 parasternal incisions are made to position the defibrillation electrode: an inferior incision close to the xiphoid process and a superior incision to position the distal electrode parasternally at the level of the sternal angle.[3] To minimize the risks associated with making 3 incisions, Knops et al[5] developed a simplified implantation technique that omits the superior parasternal incision (Figure B). This incision is a frequent cause of discomfort, is difficult to suture, and is cosmetically unappealing to patients. In their series, Knops et al reported excellent results with this technique; however, their center has more experience with S-ICD implantation than any other in the world, and there are no other data in the literature. Here, we report our experience at a center with a less established track record with the 2-incision technique, used as first-line treatment in all patients from an early phase in the experience of the center.

Since October 2013, our team has implanted 17 S-ICDs in 17 patients, with follow-up for at least 1 month. For both the 3-incision and the 2-incision techniques, implantation was guided by anatomical landmarks, and fluoroscopy was not used in any procedure. The first 5 implantations were performed with the 3-incision technique. Subsequently, the 2-incision technique was selected as the first-line approach, with the option to revert to the 3-incision technique if difficulties were encountered in achieving a satisfactory implant. For the 2-incision technique, the insertion tool supplied with the S-ICD system was used in combination with an 11 Fr peel-away sheath of the type commonly used for transvenous lead placement.[3] After the device-pocket and xyphoid incisions were made, the sheath was mounted over the insertion tool and the combined structure was tunneled parasternally. The insertion tool was then removed, leaving the peel-away sheath in place, and the electrode was introduced into the sheath. Once the electrode tip emerged subcutaneously from the sheath opening, it was held in place manually to prevent downward displacement, and the sheath was peeled away, leaving the distal sensing electrode in the desired position.[5] The proximal sensing electrode was then secured at the paraxyphoid level, the pulse generator was connected, and both incisions were closed. The 2-incision technique was performed satisfactorily in all 12 patients in whom it was attempted, with no need for reversion to the 3-incision technique. General patient characteristics are shown in the Table. A ventricular fibrillation induction test was performed, and sustained arrhythmia was induced in 11 patients. Of these patients, 10 were adequately defibrillated with a single 65 J shock, and 1 patient required a second 65 J shock with reversed polarity. The mean treatment time for the 11 episodes of induced ventricular fibrillation was $16.6 \pm 3.4$ s, and the mean effective-shock impedance was $81.5 \pm 13.6$ $\Omega$. Mean total procedure time ($58.25 \pm 17.5$ min) was notably shorter than for the 5 patients who underwent the 3-incision procedure ($107.8 \pm 31$ min); however, this

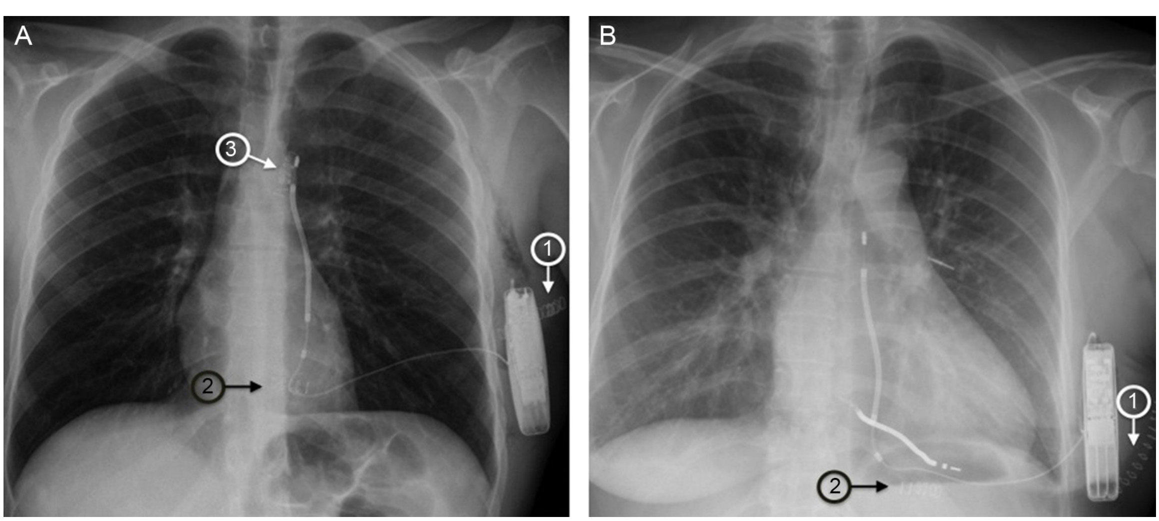


**Figure.** Chest X-rays showing automatic subcutaneous implantable cardioverter-defibrillators implanted by the 3-incision method (A) and the 2-incision method (B).