catheters to fenestrate and decompress the subintimal hematoma and thus improve the results of stenting.[4] There are some small series of patients with SCAD treated with first-generation BRS with good outcomes at follow-up. This strategy favors the possibility of complete vascular recovery and avoids the problem of late malapposition of the device after resorption of the intramural hematoma and the risk of late thrombosis.[3] In the present case, the use of a scoring balloon did not achieve an adequate angiographic result, probably because we used an under-sized device (to avoid excessive insult to the damaged arterial wall), and ultimately we had to use a BRS. Due to the withdrawal of the first-generation BRS, we opted for a magnesium BRS and the choice of size was guided by OCT to accommodate the lamina elastica externa distal to the affected segment. After implanting the first BRS, we confirmed the persistence of hematoma in the proximal uncovered section, so it was necessary to overlap a second magnesium BRS.

The use of magnesium BRS has been described in 1 patient with SCAD, with a good outcome at 12 months on angiography and OCT follow-up.[5] The rapid resorption time of this device (an estimated 12 months) makes it a particularly attractive option in this context. To the best of our knowledge, this is the first described case that shows the value of a combined strategy (fenestration and magnesium BRS) with a good final result confirmed on angiography, OCT, and computed tomography. Use of computed tomography avoids the need for further invasive procedures in these patients who have increased susceptibility to vascular complications. Furthermore, magnesium does not produce imaging artifacts on computed tomography, so this technique allows optimal visualization of the vascular lumen.

APPENDIX. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version, at https://doi.org/10.1016/j.rec.2019.06.015

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Feasibility of a subcutaneous implantable cardioverter-defibrillator in a patient with *pectus excavatum*

Viabilidad del desfibrilador automático implantable subcutáneo en un paciente con pectum excavatum

To the Editor,

The subcutaneous implantable cardioverter-defibrillator (S-ICD) was introduced to reduce complications related to the transvenous leads used with conventional defibrillators. The device has proven to be a safe and effective system for both primary and secondary prevention of sudden cardiac death.[1,2]

The S-ICD creates an extrathoracic defibrillation system by means of subcutaneous defibrillation leads placed along the sternum and tunneled through the subcutaneous inframammary line to a generator located in the chest wall. However, in patients with pectus excavatum, it may be difficult to position the lead around the convexity formed by the left chest and the concavity located around the sternum.

We describe a 41-year-old man who was resuscitated following cardiac arrest due to ventricular fibrillation during physical exercise. The patient had no relevant history, although pectus excavatum (Figure 1A) was observed during the physical examination. In the cardiac study performed, no significant abnormalities were found in either the electrocardiogram or echocardiogram. Coronary angiography showed no coronary abnormalities. Cardiac magnetic resonance imaging revealed fibrosis in the septal segments of the left ventricle, as well as severe pectus excavatum (Haller index, 9.5) (Figure 1B).

In view of the diagnosis of recovered ventricular fibrillation and the possibility of arrhythmogenic cardiomyopathy, ICD therapy was indicated for secondary prevention of sudden cardiac death.

An S-ICD was initially considered because pacing was not required and there was no indication for cardiac resynchronization, based on the patient's age and clinical arrhythmia (lower probability of requiring antitachycardia pacing).

Electrocardiographic screening was positive for the 3 vectors in the left parasternal position. Because screening was successful, the risks of a subcutaneous vs conventional device were evaluated, with assessment of the impact of the chest deformity on subcutaneous lead insertion, detection of ventricular electrical activity, and defibrillation efficacy. Finally, a decision was made to implant an S-ICD (Emblem MRI S-ICD A219).

Implantation was carried out under local anesthesia with conscious sedation. Even though a 2-incision technique with no cranial incision was used, the single-coil defibrillation lead was successfully placed in a conventional position. The generator was positioned laterally between the anterior surface of the serratus muscle and the latissimus dorsi, behind the anterior axillary line. After implantation, ventricular fibrillation was induced and successfully reverted by the S-ICD with a shock of 65 J (safety

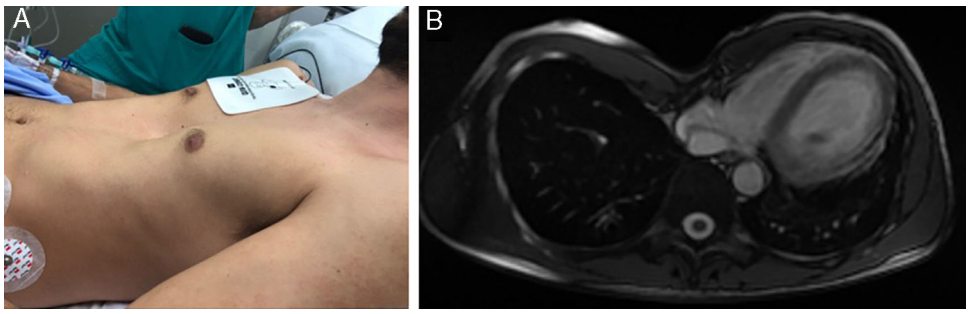

Figure 1. Patient in supine position (A) and cardiac magnetic resonance image (B) showing pectus excavatum.

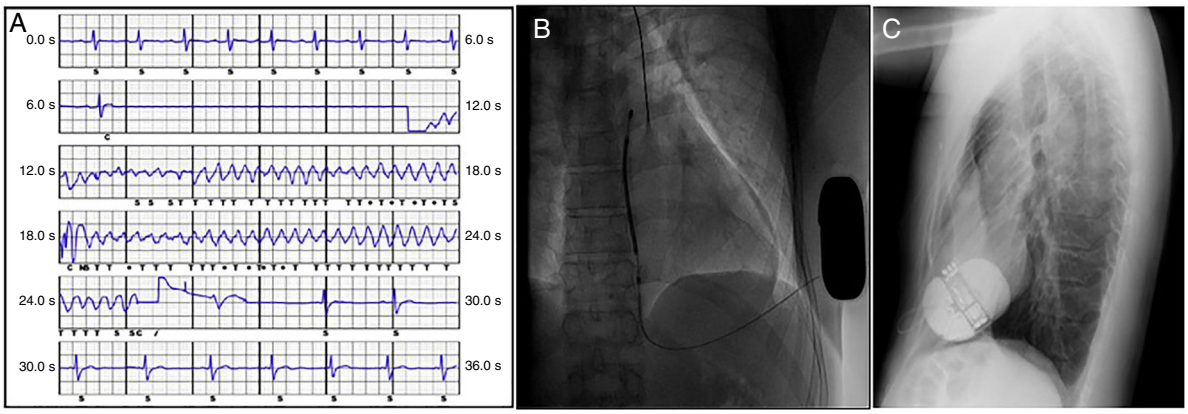

Figure 2. Ventricular fibrillation induction report (A), posteroanterior chest radiography (B), and lateral chest radiography (C) following placement of a subcutaneous implantable cardioverter-defibrillator.

margin, 15 J) (Figure 2A) and defibrillation impedance of 42 Ω. The primary sensing vector was programmed (proximal lead to can), and 2 detection zones were also programmed: a conditional zone at 200 bpm and a shock zone above 250 bpm. There were no complications following the procedure, and proper positioning of the lead and generator were confirmed by chest radiography (Figure 2B-C).

At the 3-month follow-up visit, the patient was asymptomatic, the incisions had healed properly, and device interrogation revealed no arrhythmic events.

The S-ICD is a valid alternative to transvenous ICD, and several prospective registries have shown similar safety and efficacy for the 2 devices.[1,2] Further experience with S-ICD use has been gained in recent years in aspects related to therapy indication, implantation techniques, and device programming. In Spain, the S-ICD accounts for 5% of all ICD devices implanted.[3] The S-ICD has obvious advantages for younger patients with indications for an ICD, as a way to prevent complications associated with the use of transvenous leads.

This report is the first description of S-ICD implantation through a 2-incision technique in a patient with pectus excavatum. While it is conceivable that a chest deformity could limit the use of S-ICD, in our patient there was no impact on electrocardiographic screening, defibrillator lead placement, detection of induced ventricular fibrillation, or shock effectiveness. In other published cases, a 3-incision technique was employed,[4] showing that implantation is feasible in these patients. Our report provides further evidence of the efficacy of a simpler surgical procedure with a shorter implantation time.[2] The outcome achieved in our patient suggests that the S-ICD can be used in individuals with chest deformities when it is clinically suitable and electrocardiographic screening is successful.

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Feasibility of absolute coronary blood flow and microvascular resistance quantification in tako-tsubo cardiomyopathy

Factibilidad de la cuantificación del flujo coronario absoluto y de la resistencia microvascular en la miocardiopatía de tako-tsubo

To the Editor,

Despite some evidence suggesting microvascular dysfunction involvement, the pathophysiology of tako-tsubo cardiomyopathy (TTC) remains unclear. Recently, a new method has been validated to quantify volumetric coronary absolute flow (AF) and myocardial resistance (MR), based on the principle of thermodilution, using continuous saline infusion.[1] We sought to evaluate the safety and feasibility of this new method in the setting of TTC.

Between May 2017 and January 2019, 8 consecutive patients diagnosed with TTC and admitted for chest pain in the 2 participating centers were prospectively included in our study. Informed consent was obtained in all patients. After coronary angiography and left ventricular angiography showing highly suggestive contractility alterations, a comprehensive invasive physiological assessment of the microcirculation in the left anterior descending coronary artery was systematically obtained in each patient by using a pressure-temperature sensor-equipped wire, as previously reported.[2] The index of microvascular resistance (IMR) and coronary flow reserve were obtained by administering intravenous adenosine to induce hyperemia and then three 3-mL injections of room-temperature saline were given. The technique for AF and MR measurement requires continuous saline infusion through a specific catheter positioned in the proximal coronary artery (Figure 1).[1,3] The procedure was repeated 2 weeks later in 2 patients, taking care that the same wire position was used at the second examination.

In all patients, left ventricular ejection fraction (LVEF) recovery after the acute phase was confirmed by cardiac magnetic resonance (6/8 patients, 75%), angiography (2/8 patients, 25%), or echocardiography (8/8, 100%). Seven patients were female (87.5%) and the mean age was 75 ± 7 years. A typical apical ventricular morphology was identified in the ventriculogram in 5 patients (62.5%) and the rest were atypical morphologies. Mean left ventricular ejection was 43 ± 6% and mean peak troponin T was 594 ± 465 ng/mL. Coronary angiography revealed no nonsignificant epicardial coronary lesions in any of the patients; interestingly, 1 patient had angiographically moderate diffuse disease showing a grey-zone fractional flow reserve value (0.76); optical coherence tomography evaluation confirmed diffuse disease and a stable fibrocalcified plaque with a minimum luminal area of 4.1 mm^2. The average time needed to complete all the physiological measurements was 19 ± 3 minutes. There were no significant adverse events. The median time from symptom onset to coronary measurements was 32 (IQR: 11-41) hours. Most patients had normal or borderline IMR index values. However, coronary flow reserve was reduced in all but 2 patients; in these patients, normal

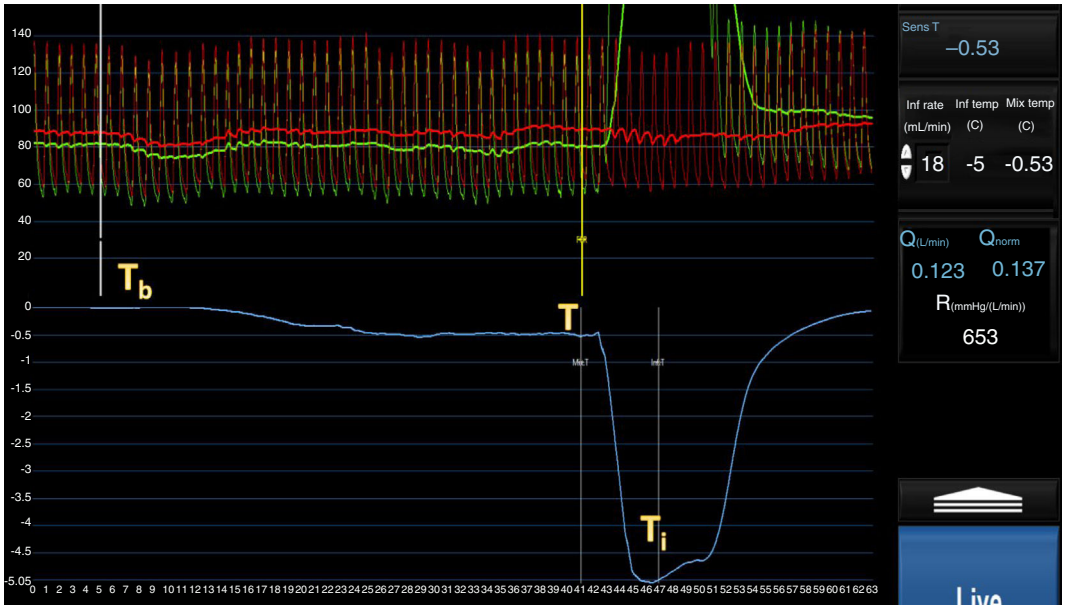

Figure 1. Example measurement of absolute flow (AF). Room temperature saline solution is infused into the coronary artery at a preset rate (10-20 mL/min) through a specific catheter. The screen displays a real-time readout of the baseline temperature (Tb) and, after the infusion begins, there is a gradual decrease in temperature (T). Once the temperature stabilizes, the guidewire is positioned at the microcatheter tip to measure the infusion temperature (Ti). This allows quantitative measurement of AF according to the formula Qb = 1.08 Ti/T Qi, where Qi is the preset saline infusion rate. Aortic pressure (red trace) and distal coronary pressure (green trace) are monitored simultaneously; this allows estimation of MR with the formula R = Pd/Qb, where Pd is the distal intracoronary pressure and Qb is the AF.