Despite being an accurate replica of the patient's coronary tree, the model has limitations for the simulation of coronary intervention: *a)* it does not reproduce the mechanical properties of the tissues that form the artery wall; and *b)* exposure of the model to light and sound mean that the OCT and IVUS images obtained differ from those obtained in the patient. However, as our report shows, the 3D model proved useful for stent evaluation.

In our view, 3D opens up a multitude of possibilities for coronary intervention in both coronary and structural heart disease. The potential of this technology has been demonstrated in diverse industrial applications and in biomedicine, with the implantation in patients of 3D printed prostheses made with biocompatible materials. The cardiological applications of these types of models range from teaching anatomy and angiographic projections to training in complex interventions, such as imaging-guided coronary interventions, treatment of bifurcations or ostial lesions, the development of new procedures, and support for structural interventions. Finally, it is possible to envision a future in which 3D modeling is used to generate personalized devices for cardiovascular intervention.

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## CONFLICTS OF INTEREST

D3 Applied Technologies provided assistance and equipment used in the performance of this study.

## SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found in the online version available at https://doi.org/10.1016/j.rec.2018.04.025.

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## Spanish Cardiovascular Imaging Registry. First Official Report of the Spanish Society of Cardiology Working Group on Cardiovascular Imaging (2017)

### *Registro Español de Imagen Cardiaca. I Informe Oficial de la Sección de Imagen Cardiaca de la Sociedad Española de Cardiología (2017)*

**To the Editor,**

In recent years, cardiac imaging has become increasingly complex and technical while the indications for imaging procedures have been extended. To analyze the current situation, the Working Group on Cardiovascular Imaging of the Spanish Society of Cardiology (SEC), in line with other similar initiatives,[1–5] conducted a voluntary online survey of members of the working group to collect information on activity in 2016. The survey was distributed to 86 hospitals in Spain, with a response rate of 61% (89% in public hospitals, with the only autonomous communities not represented being Castile-La Mancha and the Basque Country). The human resources assigned to cardiac imaging in centers at different levels of care are shown in Table 1. The results for activity and echocardiography equipment are detailed in Table 2. The number of studies, their complexity, and the ratio of studies/device increased; there were a greater number of beds in the institution, 38.6% of devices were more than 10 years old, and 89% of centers had digital image storage capability. The studies performed in the echocardiography laboratory were stored on the server and subject to standard reporting in 91% and 73%, respectively. For studies performed outside the laboratory (eg, clinic, emergency room, acute coronary unit), these percentages decreased to 74% and 60%. The echocardiography laboratories had a registry of indications in 26.5% (the most frequent were ventricular function, arrhythmias, and cardiac valve regurgitation), a registry of events in 47%, and internal quality control procedures in 48% (local protocols, 72%; expert review of reports, 65%; analysis of variability, 40%). Of the total number of attending physicians who performed echocardiography, Spanish or European accreditation had been obtained in transthoracic echocardiography by 26.6%, in transesophageal echocardiography by 8.9%, and in congenital diseases by 3.6%.

With regard to nonechocardiographic imaging, Table 2 shows the number of studies performed with each technique according to the complexity of the institution. The main indications for cardiac computed tomography were screening for coronary disease (52%), valve disease study (18%), and study prior to percutaneous aortic valve placement (12%). Overall, 96% of detectors were arrays of 64 or more. Cardiologists participated in the acquisition, analysis, and signing of the report in 56%, 65%, and 56% of cases, respectively. Overall, 30% of the centers had an analysis station in the cardiology

**Table 1**
Human and Organizational Resources for Cardiology and Cardiac Imaging by Hospital Size

| | No. of beds per center | | | | |
|---|---|---|---|---|---|
| | < 250 | 250-500 | 500-750 | 750-1000 | > 1000 |
| Response to questionnaire, % | 23 | 31 | 16 | 15 | 16 |
| Cardiology department, % | 35.7 | 78.9 | 90 | 100 | 100 |
| No. of beds in cardiology ward, median | 5 | 20 | 38 | 40 | 45 |
| No. of attending physicians in cardiology ward, median | 4 | 11 | 20 | 24 | 29 |
| Cardiac imaging department, % | 7.1 | 73.7 | 90 | 77.8 | 100 |
| No. of attending physicians who perform imaging, median | 2 | 3 | 4 | 5 | 4 |
| Attending physicians with imaging time > 50%, % | 42 | 56 | 79 | 83 | 81 |
| No. of nurses in imaging, median | 1 | 1 | 2 | 2 | 3 |
| No. of assistants in imaging, median | 0 | 1 | 2 | 1 | 2 |
| No. of technicians in imaging, median | 0 | 0.1 | 0.2 | 0.5 | 0.8 |

**Table 2**
Volume of Activity and Equipment for Each Cardiac Imaging Technique by Hospital Size

| | No. of beds per center | | | | |
|---|---|---|---|---|---|
| *Echocardiography* | <250 | 250-500 | 500-750 | 750-1000 | > 1000 |
| No. of studies, median | 1809 | 7534 | 9507 | 12797 | 13155 |
| TTE/TEE/stress, % | 92.1/3/3 | 91.3/1.9/4.9 | 89/4/3 | 87.5/4.8/3.8 | 85/3.6/4.7 |
| No. of echocardiographers, median/mean studies per device | 2/905 | 4/1884 | 4/2377 | 5/2559 | 6/2193 |
| 3D/STE devices, % | 0/0 | 25/38 | 38/38 | 40/80 | 50/58 |
| Devices > 10 years, % | 31 | 40 | 42 | 41 | 39 |
| *Computed Tomography* | <250 | 250-500 | 500-750 | 750-1000 | > 1000 |
| No. of studies, median | 102 | 220 | 75 | 490 | 486 |
| *Magnetic resonance imaging* | <250 | 250-500 | 500-750 | 750-1000 | > 1000 |
| No. of studies, median | 80 | 275 | 285 | 492 | 484 |
| *Nuclear medicine* | <250 | 250-500 | 500-750 | 750-1000 | > 1000 |
| No. of studies, median | - | - | 220 | 310 | 1141 |

3D, 3-dimensional echocardiography; STE, speckle-tracking echocardiography, TEE, transesophageal echocardiography; TTE, transthoracic echocardiography

department, and the mean time dedicated to this activity was 6.7 hours per week. Overall, 83% of the centers measured radiation exposure, but only 25% recorded their results for invasive angiography. In the case of magnetic resonance imaging, the main indications were cardiomyopathies (23%), ventricular function (21%), and viability study (17%). In 73%, the devices used had a 1.5 T field. Cardiologists participated to a greater extent (acquisition, analysis, and signing: 70%, 82%, and 74%, respectively). However, only 7.7% of the centers had an analysis station in the cardiology department, and the mean time dedicated to the activity was similar (7.9 hours per week). International accreditation in cardiac study with computed tomography and cardiac magnetic resonance imaging was obtained by 14 institutions and 52% of the cardiologists involved in these techniques. Nuclear medicine studies were performed exclusively in studies with greatest volume. Of the 6653 studies reported, 60% were monophoton emission tomography, 37% were isotope ventriculography (2461 isotope studies to investigate ventricular function in institutions with echocardiography available), and 3% were positron emission tomography studies. The main indications were ischemia (50%) and ventricular function (44%). Cardiologists participated to a lesser extent than in other techniques (acquisition, analysis, and signing: 44%, 33%, and 33%, respectively) and the time dedicated was 8.1 hours per week. In 82% of the centers, radiation exposure was measured but only 18% recorded their results for invasive angiography.

With regard to training in cardiac imaging, 65% of the institutions had cardiology residents. The mean duration of training in echocardiography was 7 months, and 1 month was dedicated to each of the other techniques. During their stay in echocardiography, a resident performed a mean of 547 transthoracic studies, 53 transesophageal studies, and 40 stress tests. In addition, 17% of the centers had specialists in cardiology participating in training programs in cardiac imaging after their residency. The mean duration was 12 months and the techniques covered were echocardiography (100%), cardiac magnetic resonance imaging (82%), and cardiac study with computed tomography (64%).

Finally, echocardiography performed by departments other than cardiology was analyzed. This occurred in 80% of the centers. Agreement in the diagnosis was good or acceptable in 52% of the cases. In contrast to the recommendations of the current consensus document,[6] the result of this study was only recorded in 44% of the cases.

A registry is an essential element for homogenizing the system and reducing variability in patient care. The present initiative should be the first step for establishing a proper registry and improving knowledge of cardiac imaging in Spain.

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## Predictors of Sterile Aortic Valve Following Aortic Infective Endocarditis. Preliminary Analysis of Potential Candidates for TAVI

### *Predictores de esterilidad de la válvula aórtica tras endocarditis infecciosa aórtica. Análisis preliminar de potenciales candidatos para TAVI*

**To the Editor,**

There are only a few anecdotic reports of aortic infective endocarditis (IE) treated with transcatheter aortic valve replacement (TAVR).[1,2] Although dysfunction of a damaged valve can be treated with a TAVR device, persistent local infection requires debridement of the affected tissue and precludes the use of TAVR since reinfection would carry a dreadful prognosis.[2] Thereafter, IE has been an exclusion criterion in most landmark studies and the use of TAVR in this context has been empirically disregarded. In contrast, it is well known that antibiotic treatment in IE is highly effective in some particular etiologies and, often, the only reason for cardiac surgery is the residual symptomatic severe valvular dysfunction.[3] On this basis, TAVR might represent a novel alternative in this particular high operative risk subset if specific markers of healed infection could be determined.

The aim of this study was to identify the main predictors of active local infection at the time of intervention that would preclude TAVR use in IE. Among a total of 732 episodes of left-sided IE consecutively diagnosed in 2 tertiary centers between 1996 and 2015, 432 patients underwent cardiac surgery and 224 of them had involvement of either native or biological prosthetic aortic valves. Only patients with culture of the removed cardiac tissue (n = 182) were included. In addition, patients with discordant positive valve culture (n = 14) were excluded due to the impossibility of ruling out culture contamination.

We defined active local infection at the time of intervention as the presence of either periannular complications or concordant positive cultures (same microorganism in the blood and the cardiac tissue removed during surgery). Biological tissues were grown on brain heart broth and thioglycollate, and on 4 types of agar media (Columbia sheep blood, chocolate supplemented with IsoVitaleX, McKonkey, and Schaedler).

To determine predictors of active local infection at the time of intervention, we built a predictive model using a logistic regression model with the maximum likelihood method and backward stepwise selection, which included the variables that were clinically relevant and statistically significant in the univariable analysis. Only the last step is shown. The goodness-of-fit for each model was determined with the Hosmer–Lemershow test and the area under the receiver operating characteristics curve (AUC-ROC).

The Table summarizes the univariable and multivariable predictors of active local infection at the time of intervention. The main independent predictors of active local infection were diabetes mellitus (odds ratio [OR], 2.8; 95% confidence interval [95%CI], 1.1-7.4), *Staphylococcus aureus* (OR, 4.3; 95%CI, 1.4-13.4) and concomitant mitral involvement (OR, 2.5; 95%CI, 1.1-5.8). In contrast, an interval between diagnosis and intervention $\geq$ 10 days (estimated cut-off value) was a predictive factor of healed infection (OR, 0.25; 95%CI, 0.1-0.5). The model had an AUC-ROC of 0.776 (95%CI, 0.705-0.847) and a Hosmer–Lemershow *P* value of .848. Indeed, after 10 days of appropriate antibiotic treatment and in the absence of diabetes mellitus, *Staphylococcus aureus*, concomitant mitral involvement, or aortic prosthesis, only 1 patient out of 29 (3.5%) had a positive culture at the time of intervention.

Recommendations against the use of TAVR in the context of uncomplicated aortic valve IE are based on unfounded but extensively accepted arguments. For the first time, we have evaluated the actual risk of this potential management in a large population of surgical patients whose resected tissue was cultured, demonstrating that most patients have a predictable lack of local infection after antibiotic therapy. This hypothesis-generating finding might support the use of TAVR in selected cases of IE with "healed" infection but residual lesion and high surgical risk. Conversely, periannular complications, the need for extensive