American Heart Association model was used for coronary segmentation.4

The mean age of the population was 67 years, 78% were men, and hypertension was the most prevalent risk factor. The mean CAC score was 782 ± 1034 [23–4523], and 14% of patients had a CAC score > 400. The mean heart rate during image acquisition was 66 bpm.

Of the 1648 coronary segments analyzed, 1549 (94%) could be assessed, and MDCT was considered of good quality in 96 patients (93%). Among segments that could not be assessed (n = 99), the most frequent were the mid- and distal right coronary artery, and 84% were in patients with a CAC score > 100. MDCT was rated suboptimal in 7 patients: 5 had a CAC score > 1000, and 2 had an elevated heart rate at image acquisition.

In the MDCT images, CD was detected in 53.2% (824/1549) of the segments evaluated; stenosis was mild in 6% (50/824), moderate in 63% (519/824), and severe in 31% (255/824).

As to the ICA evaluation, QCA was performed in 889 lesions; stenosis was mild in 8% (69/889), moderate in 60% (531/889), and severe in 32% (289/889). In total, 98 significant lesions (> 50%) were detected on ICA, but not on MDCT: 67 of these (68%) were located in the distal segments (distal left anterior descending artery and distal right coronary-posterior descending artery).

In the analysis by segments, excellent correlations (κ > 0.81) were found for most segments. Correlations were good (κ between 0.61 and 0.80) for the main coronary, mid-right coronary artery, distal left anterior descending, and distal posterior descending, with MDCT showing a tendency to overestimate the degree of stenosis in the main coronary and mid-right coronary arteries, and underestimate lesions in the distal segments (Table 1).

The overall sensitivity of MDCT for detecting significant CD, using QCA on ICA as the reference pattern, was 90.5%, with a specificity of 89.8%, positive predictive value of 90.1%, and negative predictive value of 90.3%. Eighty-two lesions showing > 50% stenosis on MDCT were not significant in the ICA QCA analysis (false positives) and 78 lesions showing > 50% stenosis on ICA were not significant on MDCT (false negatives). The net diagnostic yield of MDCT (estimated by ROC curve) was 0.95 (95% confidence interval 0.92–0.97).

In this study, MDCT was suitable for quantifying stenosis of the major coronary vessels, using QCA on ICA as the reference, even in patients with previous stents, coronary calcification, or atrial fibrillation, with the greatest limitation in the assessment of distal lesions. To our knowledge, this is the first study to carry out a correlation analysis between these 2 techniques for each coronary segment in an unselected study population.

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Registro Español de Imagen Cardiaca. II Informe Oficial de la Asociación de Imagen Cardiaca de la Sociedad Española de Cardiología (2019)

To the Editor,

In 2017 the Cardiovascular Imaging Association of the Spanish Society of Cardiology created the first Cardiovascular Imaging Registry.1 Another online survey was conducted in January 2020 to provide a longitudinal analysis, collecting data from 94 Spanish institutions on activity during the year 2019. Responses were received from 60% of those surveyed; 86% of these were from public institutions, and all autonomous communities except the Canary Islands were represented.

Table 1 lists the human and material resources, as well as the activity levels of the various cardiovascular imaging modalities. A total of 68% of clinicians devoted more than 50% of their work hours to cardiovascular imaging. In echocardiography, 69.3% of machines was less than 10 years old, and more than 50% of these in institutions with more than 500 beds had advanced cardiovascular imaging
results were recorded in only 57% of cases, despite the recommenda-
tion that observed in the first registry in 2017 (institutions with fewer
than 500 beds: 27% in 2019 vs 54% in 2017; <P> < 0.05). Scans were
performed at institutions with echocardiography. Cardiologist partici-
patation was lower (21% in scan acquisitions, 38% in analyses, and 35% in
report signatures; 5 h/wk). Radiation exposure levels were recorded at 53% of
institutions. Cardiologist participation was lower (21% in scan acquisitions,
38% in analyses, and 35% in signing reports; 5 h/wk). Radiation
exposure levels were recorded at 53% of institutions.

Cardiologic studies based on computed tomography (cardiac CT
scan) were performed at 35 institutions (64.8%). Eleven of these
institutions performed more than 500 scans per year, and 3
performed more than 1000 scans per year. Two specialists
participated in 51.4% of cases, only 1 radiologist in 42.9%, and only
1 cardiologist in 5.7%. All cardiac CT scans were acquired using 64-
slice scanners with a mean age of 5 years. A cardiologist
participated in 63% of scan acquisitions, 76% of analyses, and 67% of
report signatures. At 51% of institutions, the cardiology
department had a workstation, and the mean time devoted was
8.7 h/wk. Radiation exposure levels were recorded at 63% of
institutions. A total of 14.7% of cardiologists involved had
international accreditation.

Nuclear medicine was reported at 26 institutions (48.2%): 10 institutions performed more than 500 single-photon emission
computed tomography scans per year, and 4 institutions carried
out more than 1000. Positron emission tomography was reported at
12 institutions (22.2%), but only 1 institution performed more than
100 scans per year. A total of 4647 ventricular function
studies were performed at institutions with echocardiography.
Cardiologist participation was lower (21% in scan acquisitions, 38%
in analyses, and 35% in signing reports; 5 h/wk). Radiation
exposure levels were recorded at 53% of institutions.

In terms of cardiovascular imaging training, 76% of institutions
had cardiology residents. The mean length of training was
6.5 months in echocardiography, 1.1 months in cardiac CT, 1.3 months in cardiac MRI, and 0.5 months in nuclear medicine.
In addition, 24% of institutions also had postresidency training
programs in cardiovascular imaging. Most programs lasted
12 months and covered echocardiography (100%), cardiac MRI
(59%), cardiac CT imaging (65%), and nuclear medicine (18%).

In general, the profile of participating institutions differed from
that observed in the first registry in 2017 (institutions with fewer
than 500 beds: 27% in 2019 vs 54% in 2017; <P> < 0.01). Table 2
provides details on the 34 institutions participating in both

### Table 1

<table>
<thead>
<tr>
<th>Human and material resources and volume of activity according to hospital size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of beds per site</td>
</tr>
<tr>
<td>&lt;250</td>
</tr>
<tr>
<td>Cardiology department, %</td>
</tr>
<tr>
<td>Attending physicians in cardiology ward, n</td>
</tr>
<tr>
<td>Cardiovascular imaging section, %</td>
</tr>
<tr>
<td>Attending physicians in imaging, n</td>
</tr>
<tr>
<td>Attending physicians with imaging time &gt; 50%, %</td>
</tr>
<tr>
<td>RNs in imaging, n</td>
</tr>
<tr>
<td>CNAs in imaging, n</td>
</tr>
<tr>
<td>MITs in imaging, n</td>
</tr>
<tr>
<td>Office staff in imaging, n</td>
</tr>
<tr>
<td>Echocardiography machines in cardiology, n</td>
</tr>
<tr>
<td>Echocardiography machines in imaging, n</td>
</tr>
<tr>
<td>Ultrasound studies</td>
</tr>
<tr>
<td>TTE/TEE/stress echocardiography, %</td>
</tr>
<tr>
<td>TEE probes, n</td>
</tr>
<tr>
<td>3D-echocardiography/STE equipment, %</td>
</tr>
<tr>
<td>Ultrasound devices &gt; 10 years, %</td>
</tr>
<tr>
<td>CT scans, n</td>
</tr>
<tr>
<td>MRI scans, n</td>
</tr>
<tr>
<td>SPECT scans, n</td>
</tr>
<tr>
<td>MUGA scans, n</td>
</tr>
<tr>
<td>PET scans, n</td>
</tr>
</tbody>
</table>

3D, 3-dimensional; CNA, certified nursing assistant; MIT, medical imaging technologist; MUGA, radionuclide ventriculography; PET, positron emission tomography; RN, registered nurse; SPECT, single-photon emission computed tomography; STE, speckle-tracking echocardiography; TTE, transthoracic echocardiography.

Data are expressed as percentages or medians.
registries and reveals an increase in the number of attending physicians, total activity, and time devoted to cardiovascular imaging, as well as modernization of the technology available. A noticeable increase was also seen in the number of echocardiography devices outside the imaging laboratory.

Registries are an essential tool for ensuring consistency within the health system and reducing variability in patient care. The results of this second registry add to information gained from initiatives such as RECALCAR (Resources and Quality in Cardiology Units) and are consistent with the criteria described for managing technological assets used in cardiovascular imaging.

Areas of ongoing improvement include ensuring uniform echocardiography quality both inside and outside the imaging laboratory, enhancing echocardiography resources, increasing certification and participation of the cardiology department in advanced cardiovascular imaging, and using echocardiography studies (particularly when 3D and strain studies are available) rather than radionuclide ventriculography for ventricular function studies.

Table 2
Comparison of the 34 participating institutions in the first and second cardiovascular imaging registry in Spain*

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2019</th>
<th>Difference</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging physicians, n</td>
<td>3.7</td>
<td>4.3</td>
<td>0.7</td>
<td>.04</td>
</tr>
<tr>
<td>RNs, n</td>
<td>1.9</td>
<td>1.9</td>
<td>-</td>
<td>.87</td>
</tr>
<tr>
<td>CNAs, n</td>
<td>1.3</td>
<td>1.1</td>
<td>-0.2</td>
<td>.17</td>
</tr>
<tr>
<td>MITs, n</td>
<td>0.5</td>
<td>0.6</td>
<td>0.1</td>
<td>.56</td>
</tr>
</tbody>
</table>

Echocardiography
- Echocardiography machines in cardiology, n 5 8.3 3.3 < .01
- Echocardiography machines in imaging, n 5 5 - 1
- Imaging studies, n 9908 11 222 1314 .07
- TTE/TEE/stress echocardiography, % 89/4/4 88/4/3.5 - .85
- Equipment > 10 years, % 37.3 25.7 11.6 .03

Computed tomography
- Scans, n 379 484 105 .12
- Attending physicians, n 2.5 2.4 -0.1 .79
- Dedication, h/wk 8.4 15 6.5 .06
- Equipment age, y 7.2 5.4 -1.9 .35

Magnetic resonance
- Scans, n 488 593 105 .20
- Attending physicians, n 2.7 2.6 -0.1 .81
- Dedication, h/wk 11.2 17.1 5.9 .15
- Equipment age, y 7.7 6.8 -0.9 .61

Nuclear medicine
- SPECT, n 525 453 -71 .48
- MUGA, n 488 484 -4 .98
- PET, n 37 94 57 .54
- Attending physicians, n 1 1.3 0.3 .39
- Dedication, h/wk 12.8 9.9 -2.9 .25
- Equipment age, y 6.3 7.7 1.3 .18

CNA, certified nursing assistant; MIT, medical imaging technologist; MUGA, radionuclide ventriculography; PET, positron emission tomography; RN, registered nurse; SPECT, single-photon emission computed tomography; TTE, transthoracic echocardiography.

Data are expressed as percentages or medians.

* 8.8% with less than 250 beds, 23.5% with 250-500 beds, 11.8% with 500-750 beds, 26.5% with 750-1000 beds, and 29.4% with more than 1000 beds.

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Combined transcatheter mitral and tricuspid repair with MitraClip: first experience in Spain

Tratamiento percutáneo combinado de la insuficiencia mitral y tricuspide con sistema MitraClip: primera experiencia en España

To the Editor,

We present the case of an 84-year-old woman with a history of atrial fibrillation who was admitted to our hospital with heart failure and signs of systemic and pulmonary congestion. On admission, echocardiography showed severe mitral regurgitation (MR) due to annular dilatation and loss of leaflet coaptation, and torrential tricuspid regurgitation (TR) due to annular dilatation. Before a treatment decision was made, transesophageal echocardiography (TEE) was performed, showing a small coaptation defect between the A2-P2 scallops of the mitral valve (figure 1A, video 1 of supplementary data), and at the tricuspid valve there was loss of coaptation along the line between the anteroseptal and posteroseptal commissures, more marked centrally, causing a torrential TR jet (figure 1B,C, video 2 of supplementary data).

During discussion between medical and surgical teams, the case was considered to be high risk, and conventional surgery was ruled out. Given the poor response to medical treatment, combined treatment using MitraClip (Abbott Vascular, USA) was planned. The procedure was carried out under general anaesthetic with fluoroscopy and TEE guidance.

First, after transseptal puncture, a MitraClip NTR system was advanced toward the mitral valve, and 1 clip was implanted centrally, reducing the MR from 4+ to 1+ (figure 1D-F). Next, the guide catheter was withdrawn to the right atrium. Using the modified Munich technique, 2 XTR clips were implanted to capture the anterior and septal leaflets, reducing the TR from torrential to moderate (figure 2A-D, video 3 of supplementary data).

The patient progressed well and was discharged at 48 hours. At 5 months post-procedure, she was stable, in New York Heart Association functional class II, and had had no readmissions. Transthoracic echocardiography showed good biventricular function, with mild MR and moderate TR, with no pulmonary hypertension (figure 2E,F, video 4 of supplementary data).

Tricuspid regurgitation often occurs along with MR. According to the clinical guidelines, and from a surgical point of view, when both conditions are present at diagnosis, concomitant treatment of the tricuspid valve should be considered, as it improves long-term outcomes.1 In recent years, growing use and advances in percutaneous treatment of the mitral valve have shown it to be a safe and effective strategy in patients with primary and secondary MR.2 Successful tricuspid repair with this device has also been described.3 However, there is little information on percutaneous repair of both valves in a single procedure. One of the main advantages of transcatheter treatment is that the procedures can be staged, allowing assessment of the right valve disease after correction of the left. However, combined treatment has been reported to be safe and may even be associated with better prognosis compared with isolated mitral valve repair.4 Nonethe-