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 ($\kappa > 0.81$) 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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Spanish Cardiovascular Imaging Registry. Second Official Report of the Cardiovascular Imaging Association of the Spanish Society of Cardiology (2019)

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 69% 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 those in institutions with more than 500 beds had advanced cardiovascular imaging

Table 1
Human and material resources and volume of activity according to hospital size

	Number of beds per site				
	< 250	250-500	500-750	750-1000	> 1000
Cardiology department, %	40	80	91.6	100	91.6
Attending physicians in cardiology ward, n	4	12.5	19.5	28.5	30
Cardiovascular imaging section, %	40	90	100	93.8	100
Attending physicians in imaging, n	1.9	3.6	4.1	4.6	4.9
Attending physicians with imaging time > 50%, %	62	47	68	80	74
RNs in imaging, n	1.2	1.5	1.7	1.6	2.5
CNAs in imaging, n	0.2	0.8	0.9	1.4	1.4
MITs in imaging, n	0	0.6	0.6	0.6	0.6
Office staff in imaging, n	0	0.4	0.2	0.6	0.9
Echocardiography machines in cardiology, n	3	6	6.5	10	11
Echocardiography machines in imaging, n	3	4	4	5	5
Ultrasound studies	2266	7599	8735	12 060	12 353
TTE/TEE/stress echocardiography, %	92/3/4	90/3/5	90/4/3	88/5/3	88/4/4
TEE probes, n	1	2	3	3	3
3D-echocardiography/STE equipment, %	33/33	38/38	75/75	40/60	60/90
Ultrasound devices > 10 years, %	23	33	34	31	29
CT scans, n	172	160	304	540	555
MRI scans, n	110	150	435	328	673
SPECT scans, n	—	200	200	532	550
MUGA scans, n	—	20	—	10	397
PET scans, n	30	—	17.5	30	50

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; TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.
Data are expressed as percentages or medians.

capabilities (strain and 3 D). Records were kept on indications at 47% of echocardiography laboratories, on events at 63%, and on internal quality control at 82%. Clinicians performing echocardiography had obtained accreditation in transthoracic echocardiography (44.2%), transesophageal echocardiography (22.8%), and congenital diseases (4.5%). Scans were performed outside the laboratory by noncardiovascular imaging professionals at 42% of institutions. These were directed scans (up to 67% in emergency rooms) with semiquantitative reports (56%-80%). Scan images were stored in only 60% of cases, although 91% of institutions had storage capability. At 84% of institutions, echocardiography was performed by departments other than cardiology. Agreement on the diagnosis was acceptable or good in 48% of cases in departments supervised by cardiology. Examination results were recorded in only 57% of cases, despite the recommendations of the current consensus document.[2]

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, 78% 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 (European, available since 2019).

Cardiac magnetic resonance imaging (cardiac MRI) was performed at 38 (64.8%) of institutions: scan volume was over 500 scans per year at 10 institutions and over 1000 scans per year at 3. Stress MRI was performed at 15 institutions (more than 100 scans/y at 4 institutions), accounting for 7% of all cardiovascular MRI activity. Of these scans, 42.1% were performed jointly, 44.7% only by radiology, and 13.2% only by cardiology. 1.5-T MRI machines were used in 68% of scans, and 3.0-T MRI machines were used in the rest; the mean machine age was 7 years. A cardiologist participated in 67% of scan acquisitions, 76% of analyses, and 67% of report signatures. A workstation was available in the cardiology department at 46% of institutions, and the time devoted was 12.2 h/wk. A total of 48.7% 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; $P < .01$). Table 2 provides details on the 34 institutions participating in both

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

	2017	2019	Difference	*P*
Imaging physicians, n	3.7	4.3	0.7	.04
RNs, n	1.9	1.9	-	.87
CNAs, n	1.3	1.1	−0.2	.17
MITs, n	0.5	0.6	0.1	.56
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.

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)[3] and are consistent with the criteria described for managing technological assets used in cardiovascular imaging.[4] 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 3 D and strain studies are available) rather than radionuclide ventriculography for ventricular function studies.

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

Tratamiento percutáneo combinado de la insuficiencia mitral y tricuspídea 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 anesthetic 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-

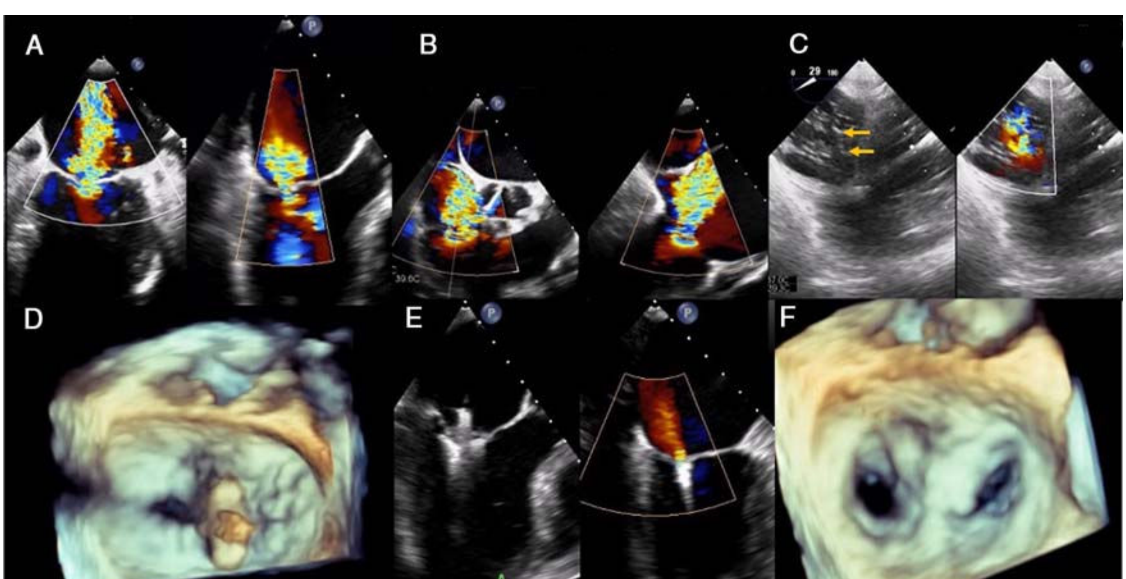

Figure 1. A: TEE showing severe mitral regurgitation. B: TEE mid-esophageal view of the torrential tricuspid regurgitation. C: TEE showing gaps along the line between the anteroseptal and posteroseptal commissures (arrows). D: 3D TEE showing clip at the mitral valve. E: TEE of insertion of leaflets in the clip and result. F: 3D TEE of the mitral clip final result. TEE: transesophageal echocardiography.