Spanish Cardiac Catheterization and Coronary Intervention Registry. Seventeenth Official Report of the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology (1990-2007)

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This article summarizes findings from the 2007 registry of the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology. Data were obtained from 129 hospitals that performed catheterization, mainly in adults: 74 public and 55 private.

In 2007, 136 231 diagnostic procedures were performed; 122 260 were coronary angiograms, a 7.9% increase on 2006. The rate was 2725 angiograms per million inhabitants. There were also 60 457 percutaneous coronary interventions, 6% more than in 2006; the rate was 1347 per million inhabitants. Some 94 966 stents were implanted, 57.7% of which were drug-eluting. In addition, 11 322 interventions were carried out in acute myocardial infarctions, 12.5% more than in 2006. They accounted for 18.7% of all percutaneous coronary interventions.

Noncoronary interventions were carried out most frequently for adult congenital heart disease, with closure of an atrial septal defect accounting for most procedures (ie, 334). The most common valvular procedure was percutaneous mitral valvuloplasty, which was performed in 367 cases, with a success rate of 90.7%. This year saw the first percutaneous valve implantations in Spain and 18 prosthetic aortic or pulmonary valves were implanted.

The proportion of procedures utilizing radial access increased to 40%, for both diagnostic and interventional procedures.

The remarkably high level of participation by the different centers has ensured that the registry can serve an international reference source on catheterization in Spain.

Key words: *Registry. Cardiac catheterization. Coronary angiography. Coronary angioplasty. Stent.*

Registro Español de Hemodinámica y Cardiología Intervencionista. XVII Informe Oficial de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología (1990-2007)

Se presentan los resultados del Registro de Actividad de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología del año 2007. Se recogen los datos de 129 hospitales que realizan su actividad predominante en adultos; de esos centros, 74 realizan actividad pública y 55, privada.

Se realizaron 136.231 estudios diagnósticos, con 122.260 coronariografías, lo que representa un aumento del 7,9% respecto al año 2006 y una tasa de 2.725 coronariografías/millón de habitantes. Los procedimientos intervencionistas coronarios practicados fueron 60.457, con un incremento del 6% respecto al 2006 y una tasa de 1.347 intervenciones/millón de habitantes. Se implantaron 94.966 *stents,* de los que el 57,7% fueron farmacoactivos. Se llevaron a cabo 11.322 procedimientos de intervencionismo en el infarto agudo de miocardio, lo que supone un incremento del 12,5% respecto al año anterior y el 18,7% del total de intervenciones coronarias percutáneas.

El intervencionismo no coronario más frecuente se realiza en las cardiopatías congénitas del adulto; el cierre de la comunicación interauricular es el de mayor número, con 334 procedimientos. La valvuloplastia mitral, con 367 casos tratados y una tasa de éxito del 90,7%, es el procedimiento percutáneo valvular más realizado. Este año han avanzado los procedimientos de implante de válvulas percutáneas, pues se ha implantado 18 válvulas entre pulmonares y aórticas.

La vía de acceso radial alcanza el 40% tanto en el diagnóstico como en el intervencionismo.

Es de destacar el alto grado de participación de los diferentes centros en el actual Registro, que hace que sea un referente internacional de la actividad hemodinámica en nuestro país.

Palabras clave: *Registro. Cateterismo cardiaco. Coronariografía. Angioplastia coronaria.* Stent.

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ABBREVIATIONS

AMI: acute myocardial infarction
DES: drug-eluting stent
LMCA: left main coronary artery
PCI: percutaneous coronary intervention

INTRODUCTION

Interventional cardiology is at a decisive moment, with the appearance of new therapies such as percutaneous aortic valve implants and the development of new approaches to manage known situations, as is the case with the different techniques in chronic occlusions, bifurcations, or percutaneous treatment of disease of the left main coronary artery. Furthermore, we are still investigating when is the best time for intervention in acute coronary syndrome with or without ST elevation. In Spain, we are using these approaches and with the Working Group on Cardiac Catheterization and Interventional Cardiology as a platform, we are trying to compile as much information as possible on this type of activity to provide the scientific community with the necessary information. Since 1990, the primary aim of the Working Group has been to collect and analyze the data from Spanish hospitals that practice catheterization procedures with data collection methods that are improving each year.[1-16] The collection and analysis of this information is a clear reflection of the fact that the scientific community associated with interventional cardiology wishes to better itself. Data corresponding to procedures in 2007 were presented to members of the Working Party in their annual meeting, which took place on June 19-21, 2008 in Sancti-Petri, Cadiz, Spain (available from: http://www.hemodinamica.com).

The level of information obtained provides, on the one hand, knowledge of the actual situation in Spain and how it relates to international experience and, on the other, allows assessment of the development of interventional cardiology in the different autonomous regions of Spain. Open access to these data favors knowledge of the distribution of resources and evaluation of the different trends in usage and the frequency of diagnostic and therapeutic procedures.

This article is the 17th report of catheterization procedures in Spain and covers the activity of all public and most private hospitals.

METHODS

Data collection was done using a common questionnaire (Appendix 1), which was distributed to all catheterization laboratories in Spain by 2 routes. The first route was by means of the website of the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology (http://www.hemodinamica.com) with an online form. In the other route, data were obtained by the "traditional" method using the same form in hardcopy; the company Izasa was responsible for distributing and collecting them. The analysis of the information obtained was done by the management board of the working group and is made public in this article.

The population calculations, both for the country as a whole and for each autonomous region, were done based on the population estimations of the Spanish National Institute of Statistics for January 31, 2007, and published on their website (http://www.ine.es). Spain was estimated to have a population of 44 873 567 inhabitants.

As in previous registries, public hospitals were taken to be those which, regardless of where they obtained funding from, consistently attended a certain section of the population within the public health system. The remaining hospitals were considered as private.

RESULTS

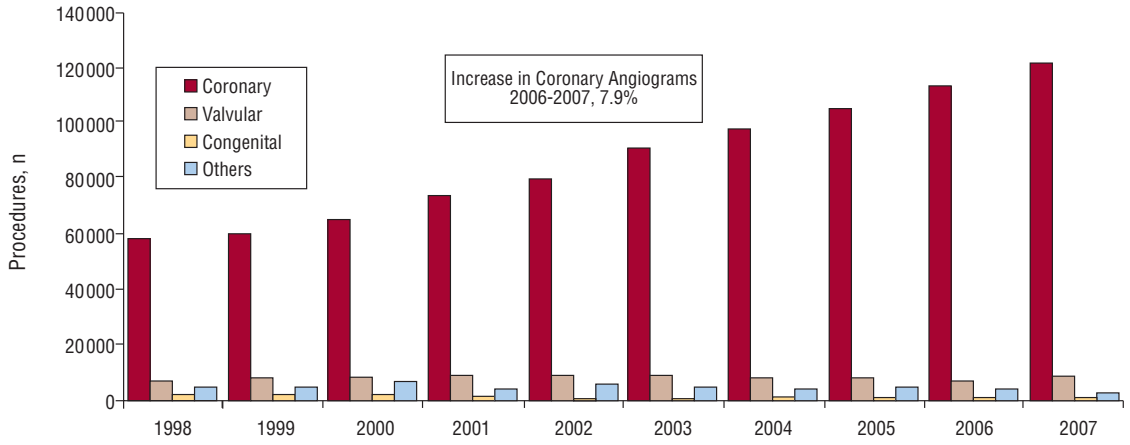
Infrastructure and Resources

One hundred and twenty-nine hospitals (Appendix 2) carrying out catheterization procedures participated in the registry. Of these, 14 centers also admitted pediatric patients. Of the all the hospitals that submitted data, 74 are public (100% of all such hospitals with catheterization facilities) and 55 are private. These hospitals account for 99% of the hospitals that perform catheterization in Spain; 173 catheterization laboratories are available, of which 116 (67%) are located in public hospitals. The number of hospitals and laboratories worked out at 2.8 and 3.82, respectively, per million inhabitants, with no changes with respect to 2006. An emergency team is available 24 hours a day in 63% of the centers. Heart surgery is available in 69% of the centers (66% of the public hospitals and 80% of the private ones).

With regard to hospital staff, 125 centers reported the presence of 409 doctors who performed catheterization procedures during 2007 (3.27/center; 9.1 specialists/ 1 000 000 inhabitants). The public hospitals had 3.9 physicians per center and 2.5 per laboratory. In the private sector, those figures were 2 per hospital and 2 per laboratory. As for staff other than qualified doctors, of the 124 hospitals that reported data, 492 qualified nurses (DUE) and 100 radiodiagnostic technicians (ATR) were present, corresponding to an average of 4.8 nurses and/or radiodiagnostic technicians per hospital and 3.4 per laboratory.

Diagnostic Activity

During 2007, 136 231 diagnostic procedures were undertaken in Spain, a figure that represents an increase



Coronary	59 3321	65 234	73 382	79 607	83 667	90 939	97 785	103 646	113 228	122 260
Valvular	8084	8426	9532	9452	8225	9168	8738	7978	7901	9459
Congenital	2094	2248	1328	531	570	613	701	721	741	787
Others	4865	6897	4097	5840	5027	5228	4227	4900	3923	3122
Total	74 364	82 805	88 339	95 430	97 609	105 939	111 451	117 245	126 196	136 231

Figure 1. Change in the number and type of diagnostic procedures done between 1998 and 2007.

of 7.9% with respect to 2006. Of these procedures, 122 260 were coronary angiograms. Twenty-seven percent were done in women and 24% in patients aged over 75 years, corresponding to an increase of 5.3% and 4.9% with respect to the previous year. With these data, a national average of coronary angiograms of 2725 procedures/1 000 000 population can be calculated. The most recent data published by the European registry refer to 2005 and put the figure at 4030 angiograms/1 000 000 population among the countries that participated in the registry.[17]

Figure 1 shows the distribution of all diagnostic procedures. The progressive increase in the number of coronary angiograms can be seen over the last 10 years; the number of studies done in patients with congenital heart diseases remains constant and catheterization studies of heart valves increased by 20% after the decrease observed in preceding years.

During 2007, public hospitals were responsible for 89% of diagnostic activity; 51 centers performed more than 1000 coronary angiograms and 14 more than 2000, which represents 41% and 11%, respectively, of the total centers with data available (Figure 2). A mean of 1056 diagnostic procedures were performed per center and 787 per laboratory—this does not represent any substantial changes with respect to the 2 previous registries.[14-16] With regard to public centers, 1626 (925) diagnostic procedures per hospital were done.

The national average for coronary angiograms was 2725 (330) procedures/1 000 000 population. Figure 3 shows the data by Spanish autonomous region. A greater tendency towards a more even distribution among autonomous regions can be discerned, with a range of 757 procedures if we exclude the 2 most outlying values.

With regard to the intracoronary diagnostic techniques, intravascular ultrasound is the most widely used technique, followed by pressure wires. Of note is the increase in the use of both compared to the previous year. This increase is 31% (4910 procedures) in the case of ultrasound and 37% in the case of pressure wires (1804 procedures in total). The use of intracoronary Doppler ultrasound changed the trend of previous years, and its use increased from 35 procedures in 2006 to 83 in 2007. Of the other diagnostic techniques, of note is optical coherence tomography, with 142 procedures last year; other procedures with a small number of cases are endothelial function studies, thermography, and intracardiac ultrasound. Figure 4 shows the changes in the usage of the different intracoronary diagnostic techniques in recent years.

The femoral artery is still the preferred approach route for Spanish catheterization specialists, but the increase in the use of the radial artery seen in previous years continued and in 2007, 41.4% of the diagnostic procedures used this approach compared to 38.1% the preceding year.

Percutaneous Coronary Intervention

During 2007, 60 457 percutaneous coronary interventions (PCI) were performed, an increase of 6% with respect to the previous year. This increase was less

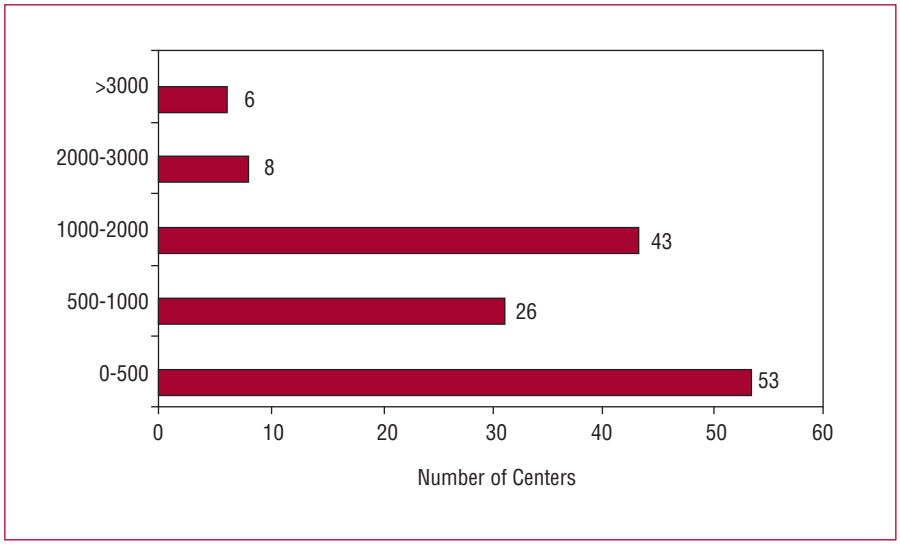


Figure 2. Distribution of hospitals according to the number of coronary angiograms performed.

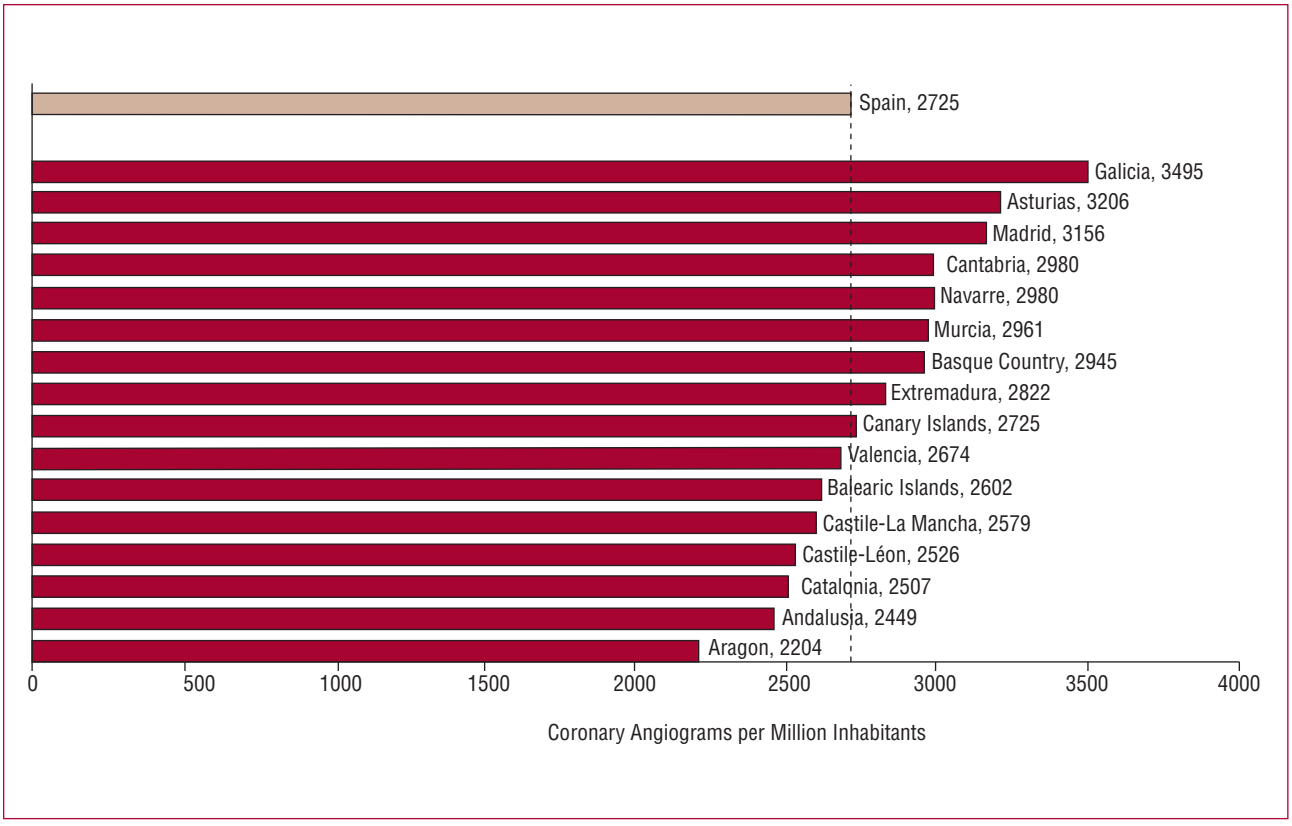


Figure 3. Distribution of coronary angiograms per million inhabitants by autonomous region.

than the 7.8% increase in 2006 and the 13.1% increase in 2005. The changes over time in PCI in Spain in the last 10 years are presented in Figure 5. The number of PCI/million inhabitants was 1347 (171) in all of Spain, that is, less than the latest European figures of 1601 PCI/million inhabitants in 2005.[17] The mean number of PCI procedures undertaken was 487 per center and 349 per laboratory. The mean annual number of PCI procedures per operator was 150. Public sector hospitals performed 90% of coronary interventions, and the mean

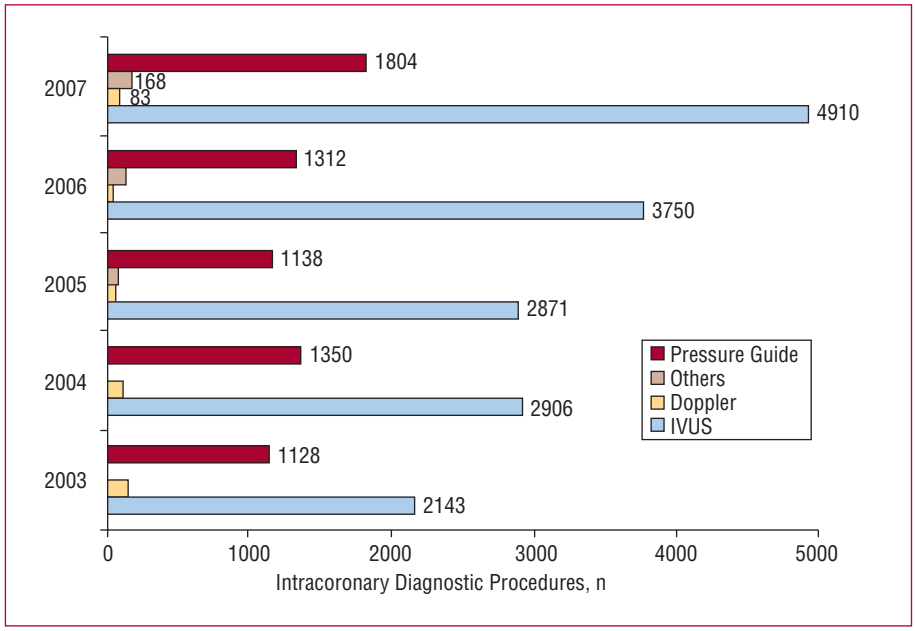


Figure 4. Change in the different intracoronary diagnostic techniques.

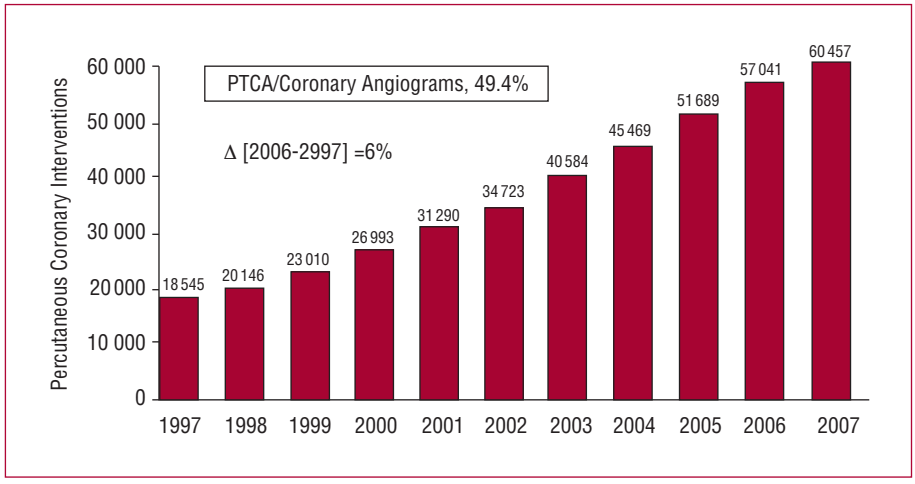


Figure 5. Change in the number of percutaneous coronary interventions between 1996 and 2007. PTCA indicates per percutaneous coronary angioplasty.

number of PCI per hospital was 735 procedures (469 procedures per laboratory). With regard to the number of procedures per operator, these decreased 9.5% compared to 2006, when that number was 189.

The rate of PCI/coronary angiography in 2007 was 49.4%, that is, 1% less than in 2006, which reflects the larger increase in the number of coronary angiograms than the number of PCI. The number of procedures for multivessel disease remained unchanged compared to the previous year and accounted for 28% of all PCI. The number of PCI performed at the same time as the diagnostic procedure—49 669 (82%) in 2007—continued to increase.

In 24.7% of the procedures, the patients were women and in 26.3%, they were over 75 years of age. In 5.5% of the cases, the PCI procedures were done on 1 or more restenotic lesions (5.3% in 2006). Table 1 shows how the percentage of PCI on restenotic lesions has broken the downward trend of previous years, something that could be explained in part by a decrease in use of drug-eluting stents (DES). The number of procedures involving the left main coronary artery continued to increase in Spanish hospitals; in 2007, 2231 procedures were performed, and the artery was unprotected in 76% of these (n=1690), corresponding to 3.7% of all PCI procedures. Graft treatments accounted for 2.4% of the total; the saphenous vein being the most used (1173 procedures, 81% of all such procedures) followed by the mammary artery (274 procedures).

Glycoprotein IIb/III inhibitors were used as coadjuvant pharmacological treatment in 15 184 procedures (25.1%),

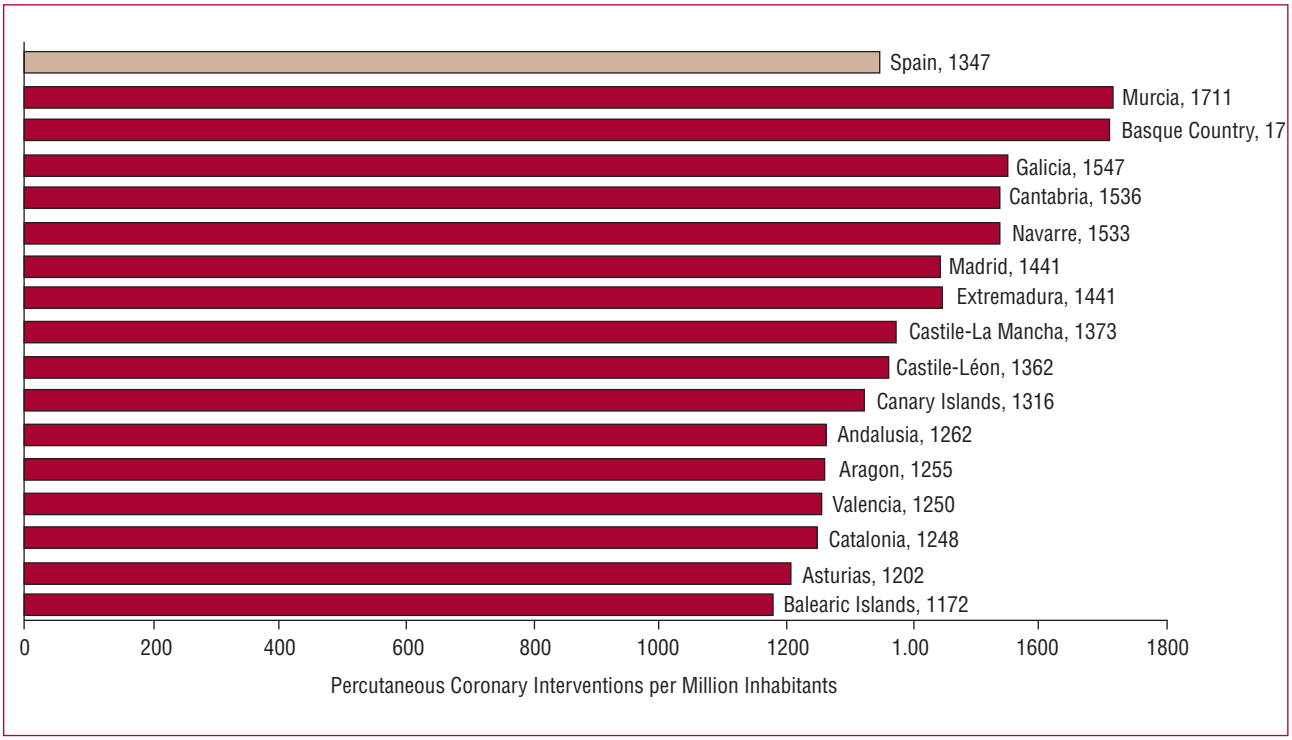


Figure 6. Distribution of percutaneous coronary interventions per million inhabitants by autonomous region.

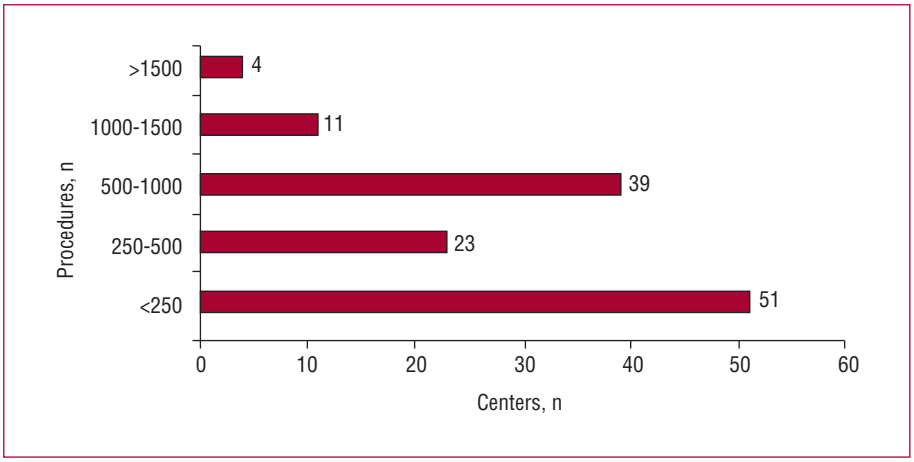


Figure 7. Distribution of centers according to the number of percutaneous coronary interventions done in 2007.

TABLE 1. **Change in Percentage of Percutaneous Coronary Interventions (PCI) in de Novo Lesions and in Restenotic Lesions (1998-2007)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
PCI in de novo lesions	21 436	25 131	31 464	28 855	32 334	38 175	42 586	48 869	54 193	57 180
PCI for restenosis	2094	2344	2893	2435	2309	2409	2883	2820	2848	3277
PCI for restenosis, %	9.8	9.3	9.2	8.4	7.1	6.3	6.8	5.8	5.3	5.5

PCI indicates percutaneous coronary intervention.

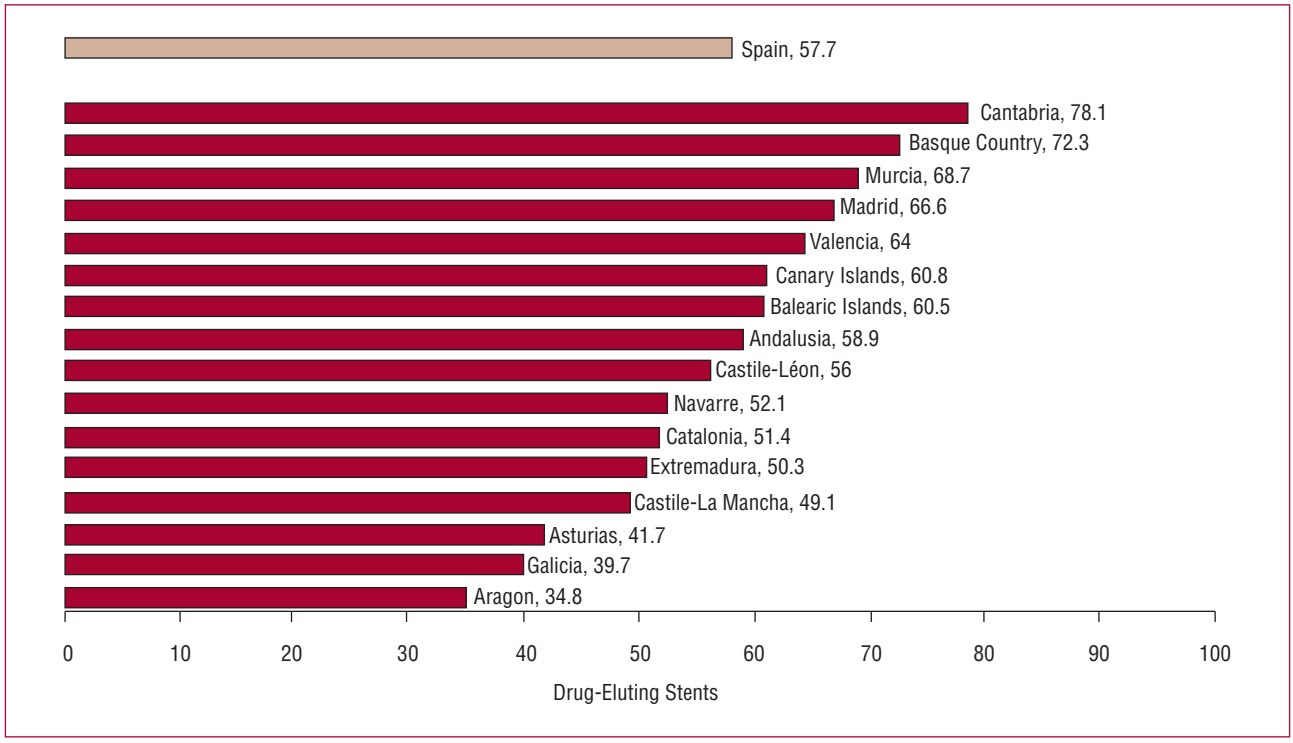


Figure 8. Distribution of the percentage of drug-eluting stents compared to the total number of stenting procedures by autonomous region.

abciximab being the most frequently used of this class (64.9%) although 5.3% less than in 2006. Tirofiban was used in 22% of the PCI procedures and of note is the increase in use of eptifibatide from 3.7% to 9.1%. This year, information was requested on direct thrombin inhibitors, specifically bivalirudin, which was used in 3.1% of the procedures. This increase refers to the total number of procedures in which glycoprotein IIb/IIIa inhibitors were used. The timing of drug administration is not specified as this variable was not included in the data collection form for the registry. Counterpulsation intraaortic balloons were used 1267 times (a 22% increase compared to 2006), and use of other cardiac support methods was merely anecdotal, with only 24 cases being reported.

The distribution by autonomous region of the 1347 PCI/million inhabitants in Spain is shown in Figure 6. This distribution is a little more homogeneous than the ones in previous registries. The range is greater than in 2006 (539 compared to 600 procedures), although the number of regions above the national average was greater in 2007 than 2006 (9 vs 8, respectively). Examination of the distribution by centers (Figure 7) shows that the number of hospitals performing fewer than 500 PCI per year remained stable whereas the number of those that performed a high volume of procedures increased notably, with 15 hospitals performed more than to above 1000 angioplasties in the year.

The percentage of successful outcomes from PCI procedures remained similar to previous years. Overall, 94% were successful, 4.6% were failures without complications, and 1.5% were failures with complications. The complications were as follows: 0.4% mortality, 0.7% acute myocardial infarction (AMI), and 0.1% emergency surgery. In-hospital mortality was 0.9%.

The intracoronary diagnostic techniques (intravascular ultrasound [IVUS] and pressure guidewires) used essentially for guiding decisions to treat lesions of doubtful severity, improve the outcome of the intervention and, to a lesser extent, as part of investigational protocols, increased in 2007, and the rate of use of IVUS per PCI was 8.1% and pressure guidewire 3%.

Radial artery approach increased substantially to the extent that such procedures for diagnosis accounted for as many as 40.1% of the interventional procedures compared to 29% in 2006. Femoral access was used with 40 229 percutaneous closure devices, of which 59.5% were with collagen, 19.7% with suture, and 20.8% other types of device.

Stents

In total, during 2007, 94 916 stents were implanted during 55 722 procedures, yielding a ratio of stents/procedure of 1.7, slightly higher than the previous year (1.6). Of all the units implanted, 57.7% were DES,

TABLE 2. **Distribution of In-stent Thromboses According to Time of Onset and Type of Stent in 2006 and 2007**

	Early Thrombosis		Late Thrombosis		Very Late Thrombosis	
	BMS	DES	BMS	DES	BMS	DES
2006 (n=354)	25.1% (89)	28.8% (123)	7.3% (26)	19.2% (68)	3.9% (14)	9.6% (34)
2007 (n=494)	19% (94)	25.3% (125)	16.4% (81)	19% (94)	10.5% (52)	9.7% (48)

BMS indicates bare-metal stent; DES, drug-eluting stent.

that is, a decrease of 1.6% compared to the previous year with respect to bare-metal stents, as the total increase in implanted stents was 4.3% whereas the increase for DES was only 1.5%. This is the first time that the proportion decreased with respect to bare-metal stents since they have been available in Spain.

Use of DES shows large differences between the different autonomous regions—between 78% and 34.8%—as shown in Figure 8. These differences are slightly greater than in 2006 (range of 37.5% in 2007 compared to 36% in 2006).

As for stent safety, this year, 494 cases of stent thrombosis have been recorded (data from 61 centers). Compared to the previous year, it is worthwhile noting that the percentage of each type of stent has changed. Thus, the rate of thrombosis in bare-metal stents increased from 37% to 46% of the total, with the usual decrease in the case of DES. There are also changes in when thrombosis occurs, so while there are almost no differences in early thrombosis compared to 2006, there is a trend towards similar rates in late and very late thrombosis, probably because of the changes in the treatment regimens of double antiplatelet therapy and because of optimization of implantation after the controversy surrounding DES thrombosis. Data for both years are shown in Table 2.

Other Devices Used in Percutaneous Coronary Intervention

Rotational abrasion (rotablator) atherectomy procedures increased both in terms of the number of hospitals and in the total number of procedures: 57 hospitals (increase of 10%) and 770 procedures (increase of 20%). There were no reports of directional atherectomy or intracoronary brachytherapy. The use of other devices has also increased in 2007. Thus, cutting balloon usage increased by 14%, distal protection by 17%, and thrombus extractors by 53%.

Interventions During AMI

A total of 117 centers provided data on interventions during AMI. A total of 11 322 PCI procedures for AMI were carried out, representing an increase of 12.5% compared to 2006. In the European registry in 2005, PCI for AMI accounted for 17% of all PCI procedures, whereas in Spain, this procedure accounted for 18.7% in 2007.[17] Of the total number of procedures, 1913 (17%) were performed in women. In patients aged over 75 years, 2235 procedures were carried out (20%). Glycoprotein IIb/IIIa inhibitors were used in 58.8% of angioplasties for ST elevation AMI (STEMI) and thrombus extraction in 29% of the procedures.

Within the range of PCI procedures done during the acute phase of AMI, the distribution is similar to previous years: 7359 (65%) primary PCI, 2253 (19.9%) rescue PCI, and 15.1% of the PCI were facilitated (Figure 9). The growing number of interventional procedures in AMI is due to increased primary and facilitated PCI (24% in both cases), with a small increase in rescue PCI (9%). For an annual estimate of 45 000 admissions to Spanish hospitals for AMI,[18,19] primary PCI would be applied in only 16.3% of the cases of AMI. Forty-eight hospitals reported the time from door to balloon procedure. The mean time was 84.1 (42) minutes.

The national distribution of PCI in AMI showed large variations, with a mean of 254 PCI procedures/million inhabitants and a range of 283 procedures. This range is much more marked in the case of primary PCI with a difference of 314 procedures (Figures 10 and 11).

The mean PCI per hospital is similar to that of the previous year, with 97 procedures (100 in 2006) and the spread among hospitals is maintained, as 61% undertook fewer than 100 PCI for AMI/year as shown in Figure 12.

As in other procedures, radial approach was also used in PCI during AMI, in a total of 3657 procedures (32.3% of the total), corresponding to an increase of 6.5% with respect to the previous year.

There were 1012 PCI procedures in patients who were in cardiogenic shock in the acute phase of AMI. The procedure was successful in 51% of the cases and major complications were reported in 45%, with an in-hospital mortality of 30%.

Noncoronary Interventions in Adults

Valvuloplasties leveled off in terms of the number of procedures; in total there were 441 during 2007, a similar figure to 2006. There were 367 procedures (83%) performed on the mitral valve, 37 on the aortic valve, and as many again on the pulmonary valve (Figure 13). Mitral valvuloplasty was successful 90.7% of the time,

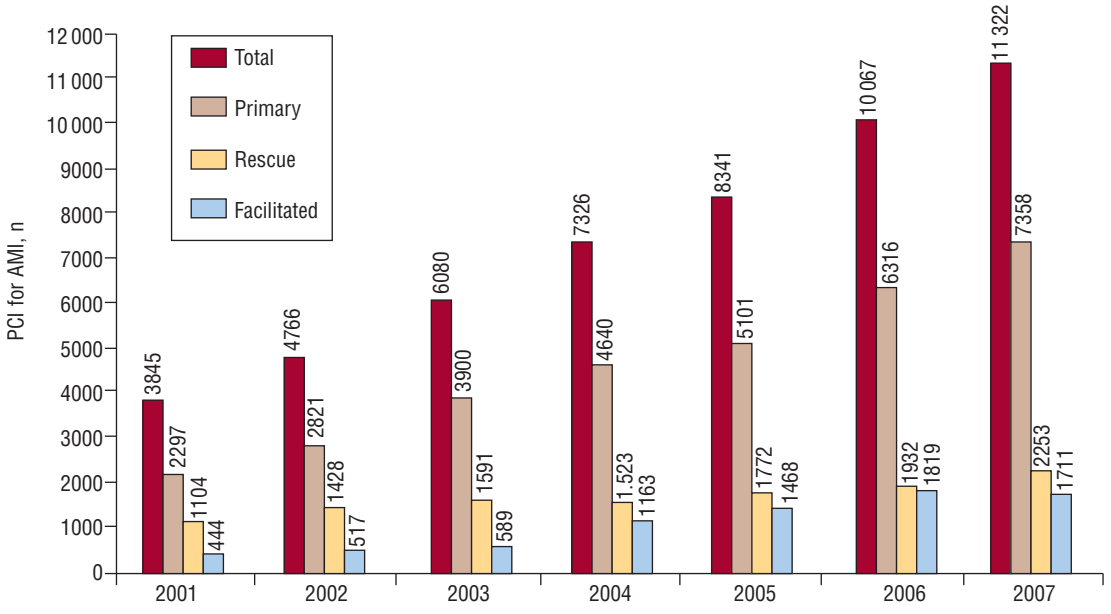


Figure 9. Distribution of percutaneous coronary interventions (PCI) during acute myocardial infarction (AMI).

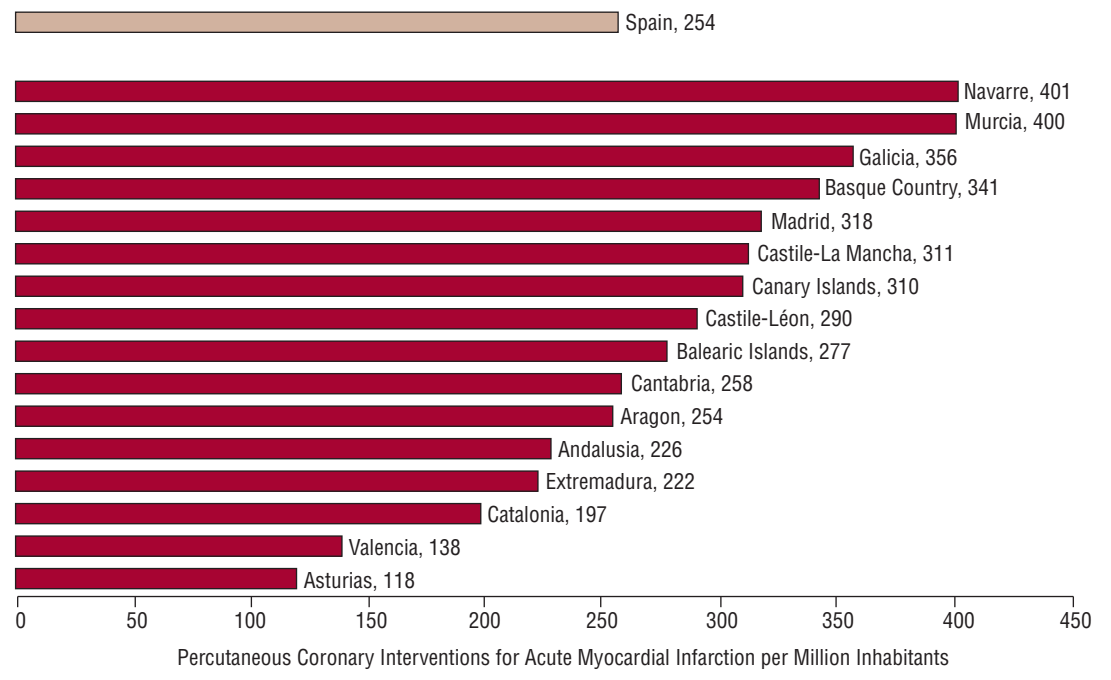


Figure 10. Distribution of percutaneous coronary interventions for acute myocardial infarction per million inhabitants by autonomous region.

with complications reported in 5.7% of the procedures. The most common complication was severe mitral valve regurgitation after valvuloplasty (2.4%), followed by tamponade (2.1%), and death and stroke (0.6% between the two). Eighteen percutaneous valve implantations were reported, 6 in the pulmonary valve, all successful, 12 in the aortic valve. Of these 3 were with self-expanding and 6 non-self-expanding devices.

Treatment of congenital heart disease in adults is the most common noncoronary interventional procedure in

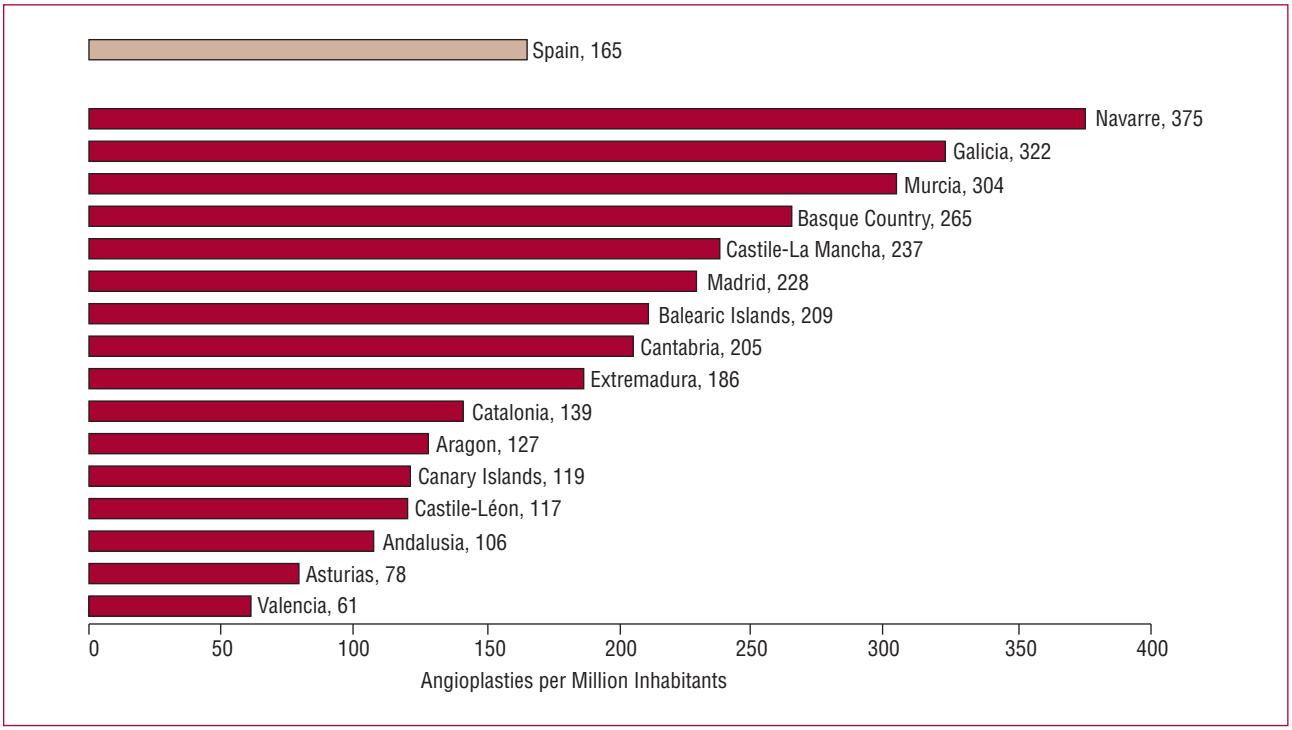


Figure 11. Distribution of primary angioplasty per million inhabitants and autonomous region.

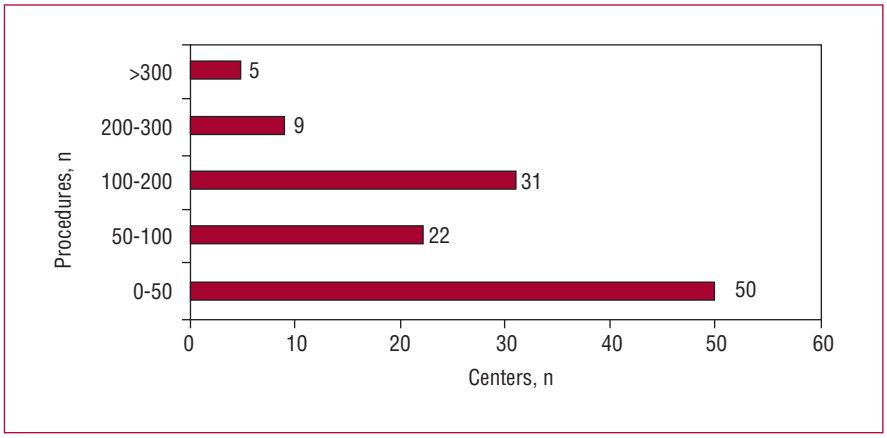


Figure 12. Distribution of hospitals according to the number of percutaneous coronary interventions during acute myocardial infarction.

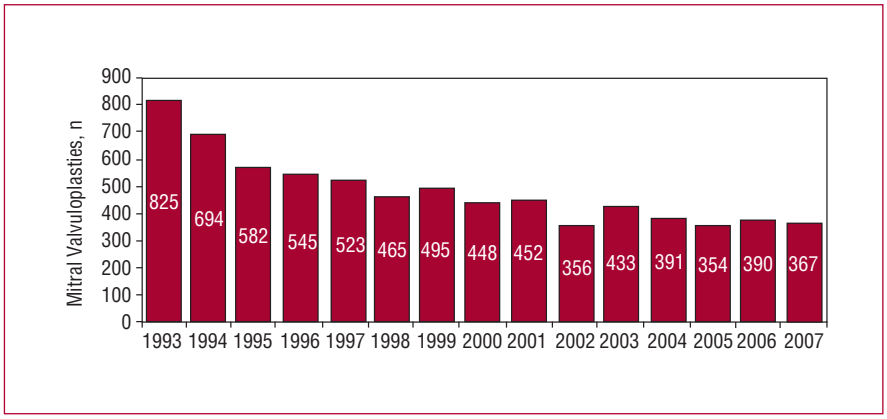


Figure 13. Change in number of mitral valvuloplasties in Spain.

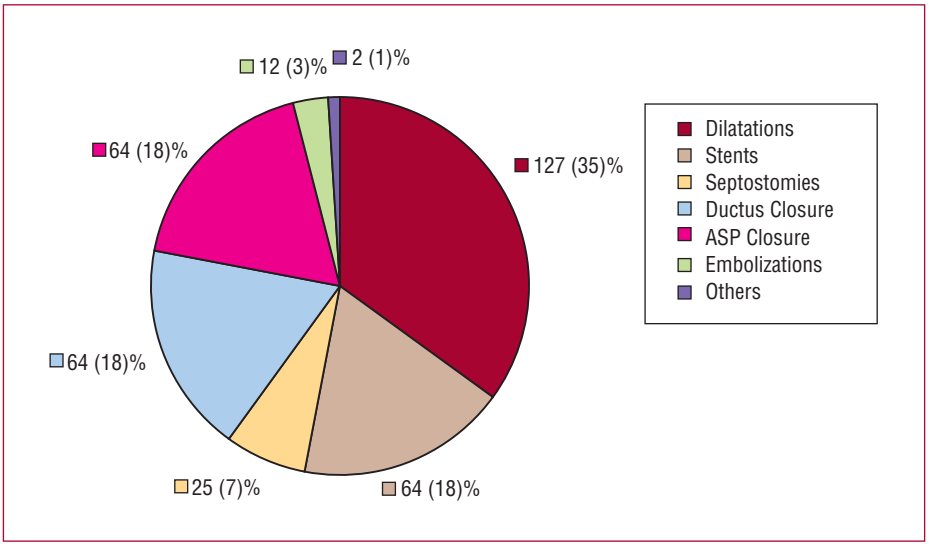


Figure 14. Distribution of pediatric interventions performed in adult hospitals without specific pediatric activity. ASP indicates atrial septal defect.

the current registry. A total of 622 procedures were performed, and the most frequent was closure of atrial septal defect (ASD), with 334 cases in total, of which 95.5% were performed with success. Complications were reported in 0.8%, and these consisted of device embolization. No mortality was associated with the procedure, as was the case in 2006. A total of 196 patent foramen ovales were closed, with success in 89% of the procedures. Aortic coarctations were treated in 34 patients. The remaining 41 procedures were closure of ductus, ventricular septal defects, and fistulas.

Forty-six paravalvular leaks were treated, 35 of which were mitral and 11 aortic. Seventy-nine procedures were done with implantation of aortic endoprosthesis, 40 of which were placed in the abdominal aorta, and 39 in the thoracic aorta.

In 57 cases, stem cells were implanted, and 37 septal ablations were performed in patients with obstructive hypertrophic cardiomyopathy.

Interventional Procedures in Pediatric Patients

A total of 14 centers provided data on catheterization procedures in pediatric patients (up to age 16 years), reporting 318 procedures in 2007. The most common procedures were dilatations, both vascular and valvular, accounting for a total of 127 procedures. Closure of ASD and persistent ductus arteriosus accounted for 36% of the total, with 64 cases each. Pediatric procedures are presented in detail in Figure 14.

CONCLUSIONS

In 2007, the activity of the Spanish hospitals that undertake PCI procedures followed the upward trends in the number of procedures that had been seen in previous years.

Diagnostic procedures increased due to increases in the number of coronary angiograms and the national distribution showed less variability than in previous years among different autonomous regions, probably due to better distribution of resources, with new laboratories being opened in a greater number of provinces. The total number of diagnostic procedures in patients with congenital heart disease and valve disease showed no increase. The most used intracoronary diagnostic techniques were intravascular ultrasound, which increased 30% with respect to the previous year.

The differences in coronary procedures among different regions of Spain were in general maintained.

It is likely that the clinical practice guidelines for management of AMI have led to an increase in the number of interventional procedures through an increase in the number of primary PCI procedures. Nevertheless, there are marked differences between autonomous regions in favor of those with a specific patient protocol for ST-elevation AMI.

DES have decreased their share with respect to 2006, and the national average is 57.7%, with a wide variability between the different autonomous regions and a similar distribution to that of previous years. The use of rotational atherectomy has increased considerably both in terms of the number of hospitals and the number of procedures, probably as a result of the greater complexity of the lesions currently treated.

Radial approach accounted for more than 40% of approach routes for both diagnostic and interventional procedures and is increasingly used in AMI.

With regard to interventional procedures, the number of valvuloplasties and procedures to treat congenital heart disease in adults have leveled off compared to the last 2

years, thus ending the gradual decline in the number of such procedures performed, and percutaneous valve placement has begun with 18 procedures.

Due to the lack of current data from other countries, we cannot make comparisons.

ACKNOWLEDGEMENTS

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APPENDIX I. **Working Group on Cardiac Catheterization and Interventional Cardiology. Form For Recording Procedures, 2007**

0. PERMISSION TO PUBLISH DATA
0.1. The publication in the webpage of the Working Group on Cardiac Catheterization of the data contained in the sections marked with an * is authorized (yes/No) (REQUIRED FIELD).

1. CENTRE INFORMATION
1.1 *Hospital
1.2 Address
1.3 Zip code
1.4 Province
1.5 Telephone
1.6 Extension
1.7 Fax
1.8 E-mail
1.9 Contact physician
1.10 Head of laboratory
1.11 Name of interventional cardiologists who work in the laboratory
1.11.1 Name of cardiologist 1
1.11.1.1 Full time/part time
1.11.2 Name of cardiologist 2
1.11.2.1 Full time/part time
1.11.3 Name of cardiologist 3
1.11.3.1 Full time/part time
1.11.4 Name of cardiologist 4
1.11.4.1 Full time/part time
1.11.5 Name of cardiologist 5
1.11.5.1 Full time/part time
1.11.6 Name of cardiologist 6
1.11.6.1 Full time/part time
1.11.7 Name of cardiologist 7
1.11.7.1 Full time/part time
1.11.8 Name of cardiologist 8
1.11.8.1 Full time/part time

2. LABORATORY INFORMATION
2.1 *Number of laboratories
2.1.1 Conventional
2.1.2 Computerized
2.2 Number of staff physicians
2.3 Number of staff physicians who do PCI
2.4 Number of registered nurses
2.5 Number of x-ray technicians
2.6 24-h emergency service
2.7 Cardiovascular surgery available at the center[a]
2.8 Procedures database available[a]

3. DIAGNOSTIC ACTIVITY
3.1 Total number of diagnostic procedures[a]
3.1.1 Number of coronary angiograms[a]
3.1.1.1 Number of coronary angiograms in women[b]
3.1.1.2. Number of coronary angiograms in patients aged 75 years or more[b]
3.1.2 Number of studies in patients with valve disease
3.1.3 Number of endomyocardial biopsies
3.1.4 Number of adults with congenital heart disease
3.1.5 Number of pediatric patients (<16 years old)
3.1.6 Other
3.2 Number of procedures with radial approach

[a]The combination of left and right cardiac catheterization is considered as a single procedure regardless of whether it is accompanied by a coronary angiogram. A complete study in a patient with valve disease who also has a coronary angiogram is considered a single study in a patient with valve disease. A solitary coronary angiogram in a patient with valve disease is to be counted as a coronary angiogram. A biopsy in a patient with a coronary angiogram is a single procedure and should be counted as a biopsy so as not to interfere with the ratio of coronary angiograms to PCI. The sum of values in Sections 3.1.1 to 3.1.6 should equal the figure in Section 3.1 (Total number of diagnostic procedures).
[b]If the information is not available, leave the box blank, do not give an estimate.

4. OTHER DIAGNOSTIC CORONARY STUDIES
4.1 Quantitative coronary angiogram
4.2 Number of intracoronary ultrasound studies
4.3 Number of studies with pressure wire
4.4 Number of studies with Doppler flow wire
4.5 Number of other studies with invasive coronary diagnostic procedure
4.5.1 Specify:

These intracoronary studies are not counted separately within the total number of diagnostic or interventional procedures. For example, a diagnostic coronary angiogram accompanied by a study with a pressure wire only counts as a coronary angiogram (3.1.1) and, logically, a single diagnostic procedure (3.1) would also count as a pressure wire study (4.3). A PCI with IVUS is a single interventional procedure (5.1) and a study with intracoronary ultrasound (4.2).

5. INTERVENTIONAL CORONARY PROCEDURES
5.1 Total number of procedures[c]
5.2 Number of multivessel procedures
5.3 Number of procedures at the same time as diagnostic procedures
5.4 Number of procedures for restenosis[d]
5.5 Number of procedures using at least 1 saphenous vein graft
5.6 Number of procedures using at least 1 mammary artery graft
5.7 Number of procedures in the left main coronary artery
5.7.1 Protected
5.7.2 Unprotected
5.8 Number of procedures with balloon intervention only
5.9 Number of procedures with radial approach
5.10 Number of procedures with antiplatelet agents
5.10.1 Aciximab
5.10.2 Eptifibatide
5.10.3 Tirofiban
5.10.4 Bivalirudin
5.11 Number of procedures with ionic contrast
5.12 Number of procedures with nonionic contrast
5.13 Number of vessels treated[e]
5.14 Number of lesions treated
5.15 Outcomes of interventional coronary procedures
5.15.1 Total number of successful procedures
5.15.2 Total number of failed procedures without complications
5.15.3 Total number of procedures with major complications
5.15.3.1 Nonfatal AMI
5.15.3.2 Emergency surgery (24 h)
5.15.3.3 Death resulting from the procedure performed
5.15.4 In-hospital death
5.15.5 Stent Thrombosis[f]
5.15.5.1 Early thrombosis in bare-metal stent (0-30 days)

5.15.5.2 Early thrombosis in drug-eluting stent (0-30 days)
5.15.5.3 Late thrombosis in bare-metal stent (31-365 days)
5.15.5.4 Late thrombosis in drug-eluting stent (31-365 days)
5.15.5.5 Very late thrombosis in bare-metal stent (>365 days)
5.15.5.6 Very late thrombosis in drug-eluting stent (>365 days)
5.16 Number of coronary interventional procedures in women[g]
5.17 Number of coronary angiograms in patients aged 75 years or more[g]

[e]A therapeutic coronary procedure is defined as an attempt to treat one or more coronary lesions, provided an attempt is made to introduce a guidewire into a coronary artery. Regardless of how many devices are used in the same procedure (stent, IVUS, atherectomy, etc), it will only count as a single procedure.
[d]At least 1 of the treated lesions in a session is restenotic.
[e]By convention, the following vessels are considered: left main coronary artery, left anterior descending artery, circumflex artery, right coronary artery, and each arterial graft. (A patient with native arteries can only be treated in 4 vessels.)
[f]Stent thrombosis is considered as definitive thrombosis when there is angiographic or histopathological confirmation that it is present.
[g]If the information is not available, leave the box blank.

6. SUPPORT METHODS FOR INTERVENTIONAL PROCEDURES
6.1 Number of procedures with intraaortic balloon counterpulsation
6.2 Number of procedures with percutaneous extracorporeal circulation

7. PERCUTANEOUS CORONARY INTERVENTION FOR ACUTE MYOCARDIAL INFARCTION
7.1 Total number of diagnostic procedures during AMI[h]
7.1.1 Primary PCI[h]
7.1.2 Rescue PCI[i]
7.1.3 Facilitated PCI
7.1.3.1 Immediate facilitated PTCA[j]
7.1.3.2 Delayed facilitated PTCA[k]
7.1.4 Approximate percentage of primary PCI with respect to total AMI
7.1.5 Time from door to balloon procedure
7.2 Outcomes of PCI during AMI (overall, including cardiogenic shock)
7.2.1 Success without complications
7.2.2 Failure without major complications
7.2.3 Total number of procedures with major complications
7.2.4 In-hospital death
7.3 Number of stent procedures
7.4 Number of procedures with balloon intervention only
7.5 Number of procedures with platelet glycoprotein IIb/IIIa inhibitors
7.6 Number of procedures with thrombus aspiration devices
7.7 Number of procedures with distal embolization protection
7.8 Number of patients in cardiogenic shock within 24 hours of onset of AMI
7.9 Outcomes of PCI in patients in cardiogenic shock
7.9.1 Success without complications
7.9.2 Failure without complications
7.9.3 Total number of procedures with major complications
7.9.4 In-hospital death
7.10 Number of procedures done with radial approach
7.11 Number of procedures for AMI in women[l]
7.12 Number of procedures for AMI in patients aged years or more[l]

[h]PTCA performed during acute phase of AMI (first 12 h) without any prior thrombolytic therapy.
[i]PTCA performed during acute phase of AMI after thrombolytic therapy due to clinical suspicion of reperfusion failure with thrombosis.
[j]PCI performed electively in the first 3 hours after administration of thrombolytic therapy and a platelet glycoprotein IIb/IIIa antagonist.
[k]PCI performed electively between 3 and 24 hours after successful administration of thrombolytic therapy and a platelet glycoprotein IIb/IIIa antagonist.
[l]If the information is not available, leave the box blank.

8. CORONARY STENTING
8.1 Total number of procedures[m]
8.2 Total number of stents implanted
8.3 Number of stents implanted without predilatation
8.4 Total number of procedures without predilatation[n]
8.5 Total number of drug-eluting stents (active coating)
8.6 Number of stent procedures only with drug-eluting stents
8.7 Number of stent procedures only with bare-metal stents

[m]The procedure is defined in the same way as the interventional procedure (5.1).
[n]All lesions treated without predilatation during 1 session.

9. OTHER DEVICES/PROCEDURES
9.1 Directional atherectomy
9.2 Rotational atherectomy
9.3 Other types of atherectomy
9.4 Coronary laser
9.5 Laser guidewire
9.6 Thrombus aspiration techniques
9.7 Distal embolization protection devices
9.8 Radiofrequency balloon
9.9 Ultrasound therapy
9.10 Cutting balloon
9.11 Other special balloons (with protrusions, guidewire)
9.12 Embolization of fistulas

These include procedures during AMI and when AMI is not present.

10. OTHER NONCORONARY PROCEDURES/DEVICES
10.1 Transmyocardial laser
10.2 Septal branch ablation
10.3 Percutaneous transplantation of stem cells
10.4 Stenting of the aortic artery
10.4.1 Abdominal
10.4.2 Thoracic
10.5 Renal artery dilatation
10.6 Paravalvular leak closure
10.6.1 Mitral
10.6.2 Aortic

11. PERCUTANEOUS VASCULAR CLOSURE DEVICES
11.1 Number of percutaneous closure devices
11.1.1 With collagen
11.1.2 With suture
11.1.3 Other

12. INTERVENTIONS IN ADULT PATIENTS WITH VALVE DISEASE
12.1 Total number of mitral valvuloplasty procedures

Outcome
12.1.1 Success
12.1.2 Failure without complications
12.1.3 Complications
12.1.3.1 Cardiac tamponade
12.1.3.2 Severe mitral regurgitation
12.1.3.3 Stroke
12.1.3.4 Death
12.2 Total number of aortic valvuloplasty procedures
Outcome
12.2.1 Success
12.2.2 Failure without complications
12.2.3 Complications
12.2.3.1 Severe aortic regurgitation
12.2.3.2 Stroke
12.2.3.3 Death
12.3 Total number of pulmonary valvuloplasty procedures
Outcome
12.3.1 Success
12.3.2 Failure without complications
12.3.3 Complications
12.3.3.1 Cardiac tamponade
12.3.3.2 Death
12.4 Total number of procedures with percutaneous valve implantation
12.4.1 Aortic position
12.4.1.1 Self-expanding (total no.):
12.4.1.1.1. Number of successful procedures.
12.4.1.1.2. In-hospital mortality
12.4.1.2 Not self-expanding (total no.):
12.4.1.2.1. Number of successful procedures
12.4.1.2.2. In-hospital mortality
12.4.2 Pulmonary position:
12.4.2.1 Number of successful procedures.
12.4.2.2 In-hospital mortality

13. PROCEDURES IN ADULTS WITH CONGENITAL HEART DISEASE
13.1 Number of procedures to close atrial septal defect
13.1.1 Success
13.1.2 Failure without complications
13.1.3 Major complications
13.1.3.1 Death
13.1.3.2 Stroke
13.1.3.3 Tamponade
13.3.3.4 Device embolization
13.2 Number of procedures for aortic coarctation
13.3 Number of procedures to close patent foramen ovale
13.1.1 Success
13.1.2 Failure without complications
13.1.3 Major complications
13.1.3.1 Death
13.1.3.2 Stroke
13.1.3.3 Tamponade
13.3.3.4 Device embolization
13.4 Other procedures in adults with congenital heart disease (specify):
13.5 Specification of other procedures

14. THERAPEUTIC PROCEDURES IN PEDIATRIC PATIENTS (≤16 years)
14.1 Dilatations
14.1.1 Pulmonary valve
14.1.2 Aortic valve
14.1.3 Aortic coarctation
14.1.4 Subaortic stenosis
14.1.5 Pulmonary arteries
14.1.6 Other dilatations
14.2 Stenting
14.2.1 Pulmonary arteries
14.2.2 Aortic coarctation
14.2.3 Ductus
14.2.4 Other sites
14.3 Atrial septostomy
14.3.1 In the ICU
14.3.2 In the catheterization laboratory
14.4 Ductal closure
14.5 Atrial septal defect closure
14.6 Embolizations
14.7 Other

15. OBSERVATIONS AND REMARKS

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AMI indicates acute myocardial infarction; ASD, atrial septal defect; PCI, percutaneous coronary intervention; PTCA, percutaneous coronary angioplasty.

APPENDIX II. **Registry of Activity of the Working Group on Cardiac Catheterization and Interventional Cardiology. Laboratories Participating in 2007**

Andalusia
Almería
Complejo Hospitalario Torrecárdenas
Hospital Virgen del Mar
Cádiz
Hospital Universitario Puerta del Mar
Hospital Universitario Puerto Real
Hospital de Jerez de la Frontera
Clínica Nuestra Señora de la Salud
Córdoba
Hospital Universitario Reina Sofía
Granada
Hospital Universitario Virgen de las Nieves
Huelva
Hospital Juan Ramón Jiménez
Jaén
Complejo Hospitalario Universitario de Jaén
Málaga
Complejo Universitario Carlos Haya
Hospital Clínico Universitario Virgen de la Victoria

Hospital Costa del Sol
Clínica Xanit Internacional de Benalmádena
Clínica Parque San Antonio
USP Marbella
Clínica El Ángel
Clínica Santa Elena
Hospiten Estepona
Seville
Hospital Universitario Virgen del Rocío
Hospital Universitario Virgen Macarena
Hospital Universitario de Valme

Aragon

Zaragoza
Hospital Clínico Universitario Lozano Blesa
Hospital Universitario Miguel Servet

Asturias

Hospital Central de Asturias
Centro Médico de Asturias

Balearic Islands

Hospital Son Dureta
Policlínica Miramar
Clínica Rotger
Clínica Palmaplanas
Clínica Juaneda
Policlínica Nuestra Señora del Rosario (Ibiza)

Canary Islands

Las Palmas
Hospital de Gran Canaria Dr. Negrín
Hospital Universitario Insular de Gran Canaria
Clínica San Roque
Santa Cruz de Tenerife
Hospital Universitario de Canarias
Complejo Hospitalario Nuestra Señora de la Candelaria
Hospiten Rambla

Cantabria

Hospital Universitario Marqués de Valdecilla

Castille-Leon

Valladolid
Hospital Clínico Universitario de Valladolid
Hospital Campo Grande (CEMIN)
Salamanca
Hospital Universitario de Salamanca
León
Hospital de León
Burgos
Hospital General Yagüe

Castille-La Mancha

Toledo
Hospital Virgen de la Salud
Albacete
Hospital General de Albacete
Guadalajara
Hospital Universitario Guadalajara
Ciudad Real
Hospital General de Ciudad Real

Catalonia

Barcelona
Ciutat Sanitària i Universitària de Bellvitge
Hospital Clínic i Provincial de Barcelona
Hospital de la Santa Creu i Sant Pau
Hospital General Universitari Vall d'Hebron
Hospital Universitari Germans Trias i Pujol
Hospital del Mar
Hospital General de Catalunya
Centre CardioVascular Sant Jordi
Centro Médico Teknon
Clínica Quirón
Hospital de Barcelona-SCIAS
Clínica Corachan
Clínica La Alianza-ANGIOCOR
Mútua de Terrassa
Centro Médico Delfos
Gerona
Hospital Universitari Dr. Josep Trueta
Tarragona
Hospital Juan XXIII
Lérida
Hospital Universitari Arnau de Vilanova

Madrid

Hospital Puerta de Hierro
Hospital Universitario 12 de Octubre
Hospital Clínico San Carlos Complejo Hospitalario
Hospital Universitario de La Princesa
Hospital General Universitario Gregorio Marañón
Hospital Universitario La Paz
Hospital Militar Gómez Ulla
Hospital Ramón y Cajal
Hospital de Alcorcón
Cardioclinsa-Clínica Nuestra Señora de América
Clínica Moncloa
Clínica Montepríncipe
Clínica Ruber
Hospital Ruber Internacional
Fundación Jiménez Díaz
Sanatorio La Milagrosa
Centro Médico Zarzuela
Clínica La Luz
Sanatorio el Rosario
Sanatorio La Paloma
Clínica Alcorcón Sur
Clínica La Moraleja
Clínica Quirón

Valencia

Alicante
Hospital General Universitario de Alicante
Hospital Universitario San Juan
Hospital General Universitario de Elche
Clínica Medimar
Sanatorio Perpetuo Socorro
Clínica Benidorm
Clínica San Jaime de Torrevieja
Hospital de Levante
Hospital de Torrevieja
Valencia
Hospital Clínico Universitario
Hospital General Universitario de Valencia
Hospital Universitario La Fe
Hospital Dr. Peset
Hospital de la Ribera
Hospital 9 de Octubre
Clínica Virgen del Consuelo
Clínica Casa Salud
Castellón
Hospital General de Castellón

Murcia

Hospital Universitario Virgen de la Arrixaca

Hospital Santa María del Rosell
Clínica San Carlos
Clínica Virgen de la Vega

Extremadura

Badajoz
Hospital Universitario Infanta Cristina
Cáceres
Hospital de Cáceres

Galicia

La Coruña
Complexo Hospitalario Juan Canalejo
Complexo Hospitalario Universitario de Santiago
Clínica USP Santa Teresa
Instituto Médico Quirúrgico San Rafael
Sanatorio Quirúrgico Modelo
Pontevedra
Complexo Hospitalario Universitario de Vigo
Hospital POVISA
Orense
Centro Médico El Carmen

Navarre

Hospital de Navarra
Clínica Universitaria de Navarra

Basque Country

Álava
Hospital Txagorritxu
Guipúzcoa
Policlínica Guipúzcoa
Biscay
Hospital de Basurto
Hospital de Cruces
Hospital de Galdakao
Clínica V. San Sebastián

HOSPITALS WITH A LARGE NUMBER OF PROCEDURES IN PEDIATRIC PATIENTS

Barcelona
Hospital San Joan de Déu
Hospital Vall d'Hebron
Madrid
Hospital 12 de Octubre
Hospital La Paz
Hospital Ramón y Cajal
Hospital Gregorio Marañón
Seville
Hospital Universitario Virgen del Rocío
Valencia
Hospital Universitario La Fe
Zaragoza
Hospital Miguel Servet
Murcia
Hospital Universitario Virgen de la Arrixaca