

Spanish Cardiac Catheterization and Coronary Intervention Registry. 18th Official Report of the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology (1990-2008)

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Introduction and objectives. Each year the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology reports on the data contained in a national registry of procedures performed. The present report is for the year 2008. It contains information on the scope of interventional cardiology in Spain and provides data for use in comparisons with other countries.

Methods. Hospitals provided data voluntarily. The information was analyzed by the steering committee of the Working Group.

Results. Data were submitted by 131 hospitals (74 public and 57 private) that performed relevant procedures, mainly in adults. In total, 136 458 diagnostic procedures were carried out, of which 123 031 involved coronary angiography. Numbers were little changed from the previous year, with an overall rate of 2658 coronary angiograms per million population. The number of percutaneous coronary interventions increased by 2.2% to 61 810, with a rate of 1334 per million inhabitants. In addition, 101 753 stents were implanted, of which 58.2% were drug-eluting. The number of procedures carried out for acute myocardial infarction was 12 079, which makes up 20.6% of all percutaneous coronary interventions and is an increase of 6.7% relative to 2007. The most common intervention in adults with congenital heart disease was closure of an atrial septal defect, which was performed in 305 cases. The most common valve procedure was mitral valvuloplasty, which was performed in 371 cases with a success rate of 96%. Further, 151 aortic percutaneous valves were implanted.

Conclusions. The most significant increases in activity were in procedures for ST-segment elevation myocardial infarction and percutaneous valve implantation. The rates of all other diagnostic and therapeutic procedures changed only slightly.

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

Registro Español de Hemodinámica y Cardiología Intervencionista. XVIII Informe Oficial de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología (1990-2008)

Introducción y objetivos. La Sección de Hemodinámica y Cardiología Intervencionista presenta un informe anual con los datos del registro de actividad estatal. El actual corresponde al año 2008. Esta información permite saber la distribución nacional del intervencionismo cardiaco y ofrece datos para compararlo con el de otros países.

Métodos. Los centros proporcionan sus datos de forma voluntaria. La información es analizada por la Junta directiva de la Sección de Hemodinámica.

Resultados. Enviaron sus datos 131 hospitales (74 centros públicos y 57 privados) que realizan su actividad predominantemente en adultos. Se realizaron 136.458 estudios diagnósticos, con 123.031 coronariografías, sin apenas cambios respecto al año anterior, con una tasa de 2.658 coronariografías por millón de habitantes. Los procedimientos intervencionistas coronarios aumentaron un 2,2% y llegaron a los 61.810, con una tasa de 1.334 intervenciones por millón de habitantes. Se implantaron 101.753 *stents*, de los cuales el 58,2% eran farmacocativos. Se llevaron a cabo 12.079 procedimientos en el infarto agudo de miocardio, lo que supone un incremento del 6,7% respecto a 2007 y representa el 20,6% del total de intervenciones coronarias percutáneas. El intervencionismo más frecuente en las cardiopatías congénitas del adulto es el cierre de la comunicación interauricular (305 procedimientos). La valvuloplastia mitral (con 371 casos tratados y éxito en el 96%) es el procedimiento valvular más realizado. Se han implantado 151 válvulas aórticas percutáneas.

Conclusiones. El aumento más importante en la actividad ha tenido lugar en relación con el infarto agudo de miocardio con elevación del segmento ST y el implante percutáneo de válvulas; los demás procedimientos tanto diagnósticos como terapéuticos aumentaron ligeramente.

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

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ABBREVIATIONS

AMI: acute myocardial infarction
DES: drug-eluting stent
PCI: percutaneous coronary intervention

INTRODUCTION

Since 1990, the main aim of the Working Group on Cardiac Catheterization and Interventional Cardiology has been to collect and analyze data from the Spanish hospitals which perform relevant procedures, with steady improvements taking place in data acquisition.¹⁻¹⁷ Data collection and their analysis indicate the interest the interventional cardiology community places on continuous improvement. Data for 2008 were presented to the members of the Section at its annual meeting which took place June 19-21, 2009, in Palma de Mallorca, Spain, and were also presented on its official website (<http://www.hemodinamica.com>).

The level of information obtained represents, on the one hand, the actual situation in Spain and allows comparisons with other countries and, on the other, facilitates the assessment and comparison of interventional cardiology in the different autonomous communities of Spain. The free availability of these data facilitates knowing how the resources are distributed and assessing the different trends in the use of diagnostic and therapeutic procedures.

This work presents the 18th report on interventional cardiology in Spain, and represents the activities of all the public hospitals and most of the private ones.

METHODS

Data were collected on diagnostic procedures and interventional cardiology in most of the Spanish hospitals. Data were provided on a voluntary basis and were not audited. Only anomalous data or those with values outside the trend for a given hospital in recent years were requested from each researcher for reanalysis. Collection was performed using a standard questionnaire (Appendix 1), delivered to all the Spanish cardiac catheterization laboratories in 2 formats: electronically through the website of the Working Group on Cardiac Catheterization and Interventional Cardiology of the Spanish Society of Cardiology (<http://www.hemodinamica.com>), to be filled in online; and more traditionally, the same questionnaire was distributed on paper. The

Izasa company was in charge of distribution and collection. The information obtained was analyzed by the steering committee of the Working Group and is presented in this article.

The population was estimated at both the national level and at the level of each autonomous community with population estimations provided by the Instituto Nacional de Estadística (National Institute of Statistics) for January 1, 2008 (available from: <http://www.ine.es>). The Spanish population was estimated at 46 157 822 inhabitants.

Similar to previous registries, hospitals were defined as public when, regardless of their source of funding, they served a specific area within the public health system, and were considered private otherwise.

RESULTS

Infrastructure and Resources

A total of 131 hospitals performing relevant procedures in adults, including 9 that also performed pediatric procedures, participated in the present registry (Appendix 2). All 74 public hospitals and 57 private hospitals submitted their data, which represents almost all the hospitals performing relevant procedures in Spain. A total of 174 cardiac catheterization laboratories were available, of which 112 (64%) were in public hospitals. After adjusting for the population, there were 2.8 hospitals and 3.8 catheterization laboratories per million population, with no change in these figures in the last 2 years. Of the public hospitals, 71% have a 24-hour emergency response team and 69% have a cardiac surgery unit.

Regarding staff, 458 physicians performed interventions in 120 hospitals during 2008, an increase of 12% compared to 2007, with 3.5 specialists per hospital and 10 specialists per million population. Public hospitals had 4.3 specialists per hospital and 2.9 per laboratory, and private hospitals had 2.4 specialists per hospital and 2 per laboratory. Regarding nursing staff, 126 hospitals reported 550 registered nurses (DUE, from the Spanish *diplomados universitarios en enfermería*) and 100 radiology technicians (ATR from the Spanish *técnicos de radiodiagnóstico*), with a mean of 5 DUE or ATR per hospital and 3.8 per laboratory.

Diagnostic Procedures

In 2008, 136 458 diagnostic procedures were performed in Spain, with little increase compared to the previous year, probably because the number of hospitals had not increased and neither had the

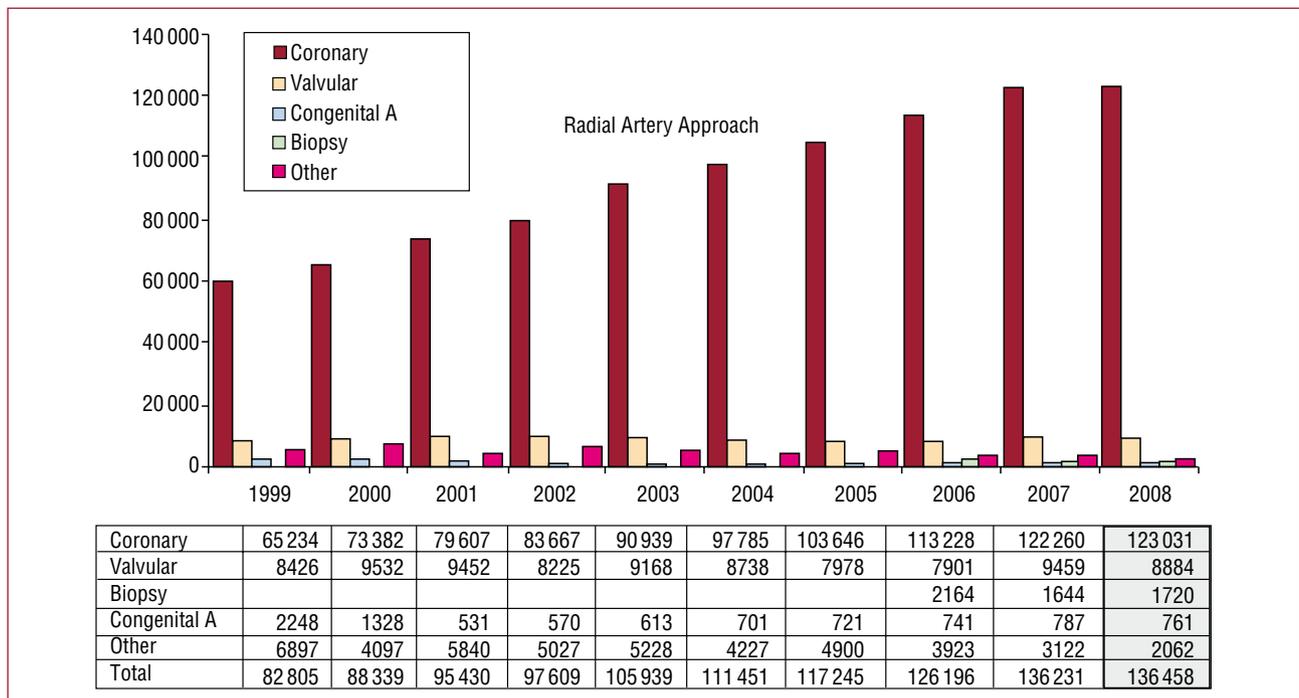


Figure 1. Change in the number and type of diagnostic procedures conducted between 1998 and 2008.

number of laboratories in public hospitals, which is where most of the procedures are conducted. Of these procedures, 123 031 involved coronary angiogram procedures (a 0.6% increase compared to 2007). In total, 24% were performed in women and 22% in patients more than 75 years of age (similar to 2007). Taken together, the data indicate a national average of 2658 coronary angiogram procedures per million population, fewer than in 2007, since the increase of total population was far greater than that of the number of procedures; this is different from the most recent European data published for 2005, which reported 4030 coronary angiogram procedures per million population in the countries participating in this registry.¹⁸

Figure 1 shows the distribution of all the diagnostic procedures and the changes mentioned, as well as fluctuations among the different patient groups, which are probably related to the data collection methodology.

During 2008, the public hospitals performed 85% of diagnostic procedures; 57 hospitals performed more than 1000 coronary angiogram procedures and 14 hospitals performed more than 2000, representing 43% and 11%, respectively, of all hospitals (Figure 2). A mean of 1041 diagnostic procedures were performed per hospital and 784 per laboratory (without important variations compared to the last 2 registries¹⁴⁻¹⁷). There were 1578 (884) diagnostic procedures per public hospital, which

was a slightly lower figure than that of the previous year.

The national average of coronary angiogram procedures was 2658 (438) per million population. Figure 3 shows the distribution of these procedures per autonomous community. Two communities present values at the highest and lowest extremes of the range, whereas the others are similar, ranging around 650 procedures.

Regarding intracoronary diagnostic techniques, intravascular ultrasound (IVUS) was the most widely used, followed by pressure guidewire. The use of IVUS continued its increasing trend, although to a lesser extent (31% in 2007 and 17% in 2008); the use of pressure guidewire decreased by 14% (in 2007 it had increased by 37%). Optical coherence tomography continued to slowly increase, reaching 196 procedures; Doppler flow wire followed the same trend, increasing from 83 procedures in 2007 to 103 in 2008. Other diagnostic procedures, although few, included endothelial function studies, thermography, and intracardiac ultrasound procedures. Figure 4 shows how the use of the different diagnostic intracoronary techniques has changed in recent years.

Regarding the access route, the use of the radial artery continues to increase, as observed in previous years, and is almost equal to use of the femoral artery; in 2008 the radial artery was used in 48% (41.4% in 2007 and 38.1% in 2006).

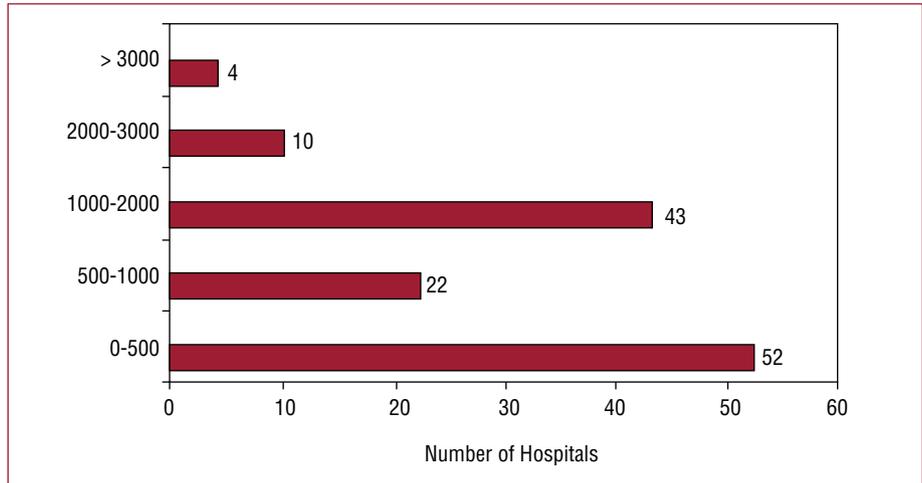


Figure 2. Distribution of hospitals according to the number of coronary angiogram procedures performed.

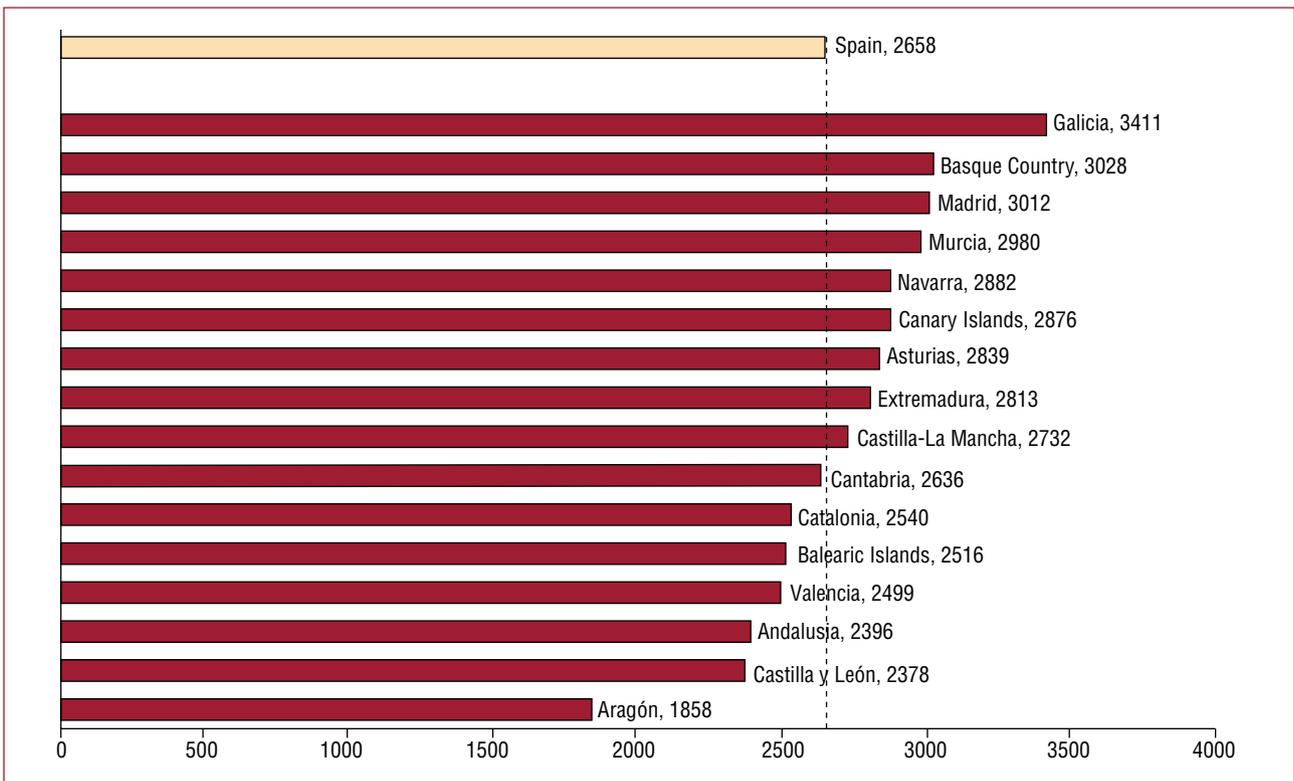


Figure 3. Distribution of coronary angiogram procedures per million population by autonomous community.

Percutaneous Coronary Intervention Procedures

During 2008, 61 810 percutaneous coronary intervention procedures (PCI) were performed, an increase of 2.2% compared to the previous year, and was the smallest increase during the last 4 years. The recent change in PCI procedures in Spain is presented in Figure 5. The number of PCI per million population was 1334 (231) throughout the country, somewhat less than the most recently published European data, which reported a figure

of 1601 PCI per million inhabitants in 2005.¹⁸ The mean number of interventional procedures was 471 per hospital and 355 per laboratory, and the average number of interventions per year per operator was 135, a decrease compared to the previous year, since the number of physicians had increased by 12% compared to 2007. Public hospitals performed 90% of PCI procedures, with a mean of 751 PCI procedures per hospital and 476 per laboratory. Regarding procedures per operator, these continued to decrease compared to the previous year for the reasons described above, with 167 procedures.

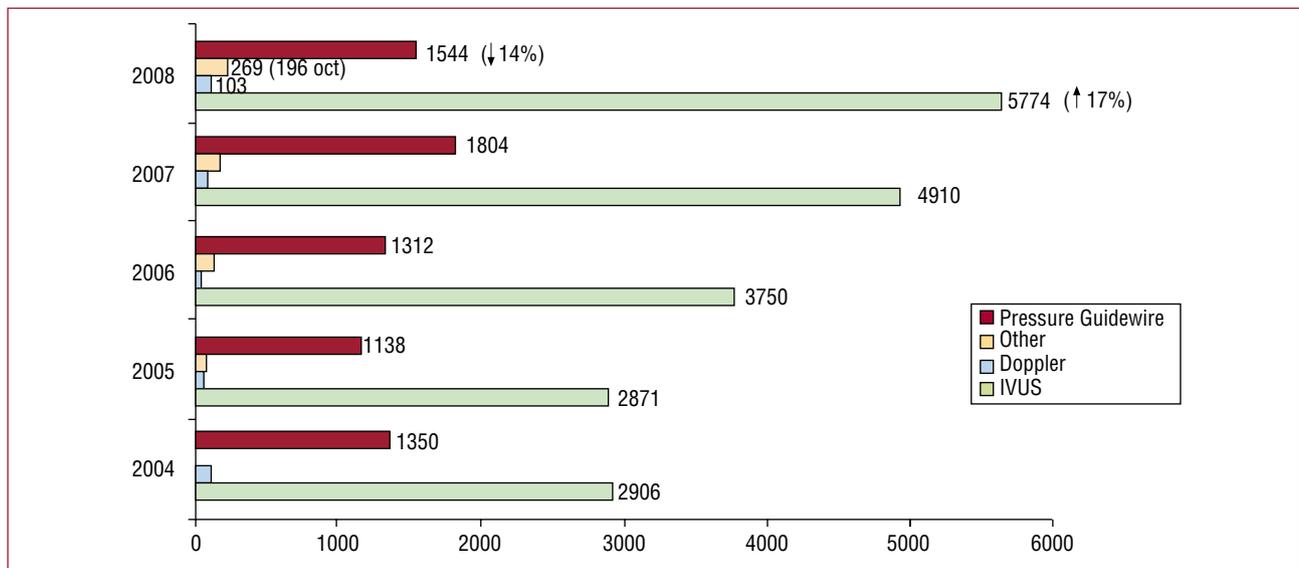


Figure 4. Change in the different intracoronary diagnostic methods.

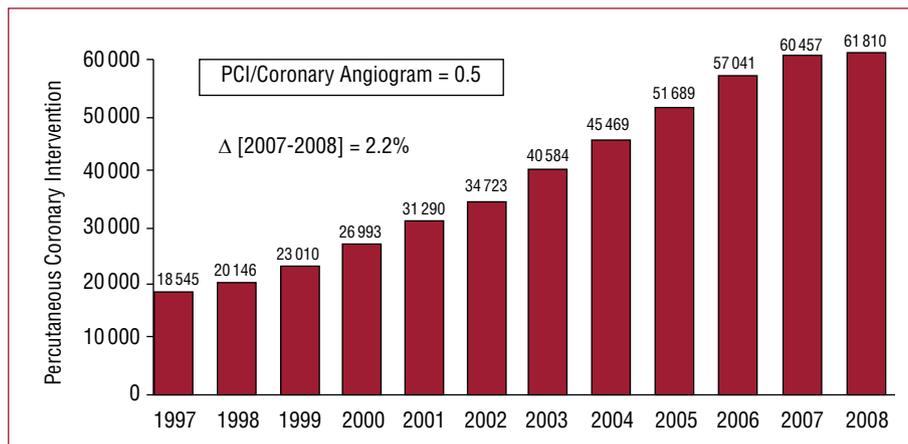


Figure 5. Change in the number of percutaneous coronary intervention (PCI) procedures between 1996 and 2008.

The ratio of PCI/coronary angiogram procedures in 2008 was 0.50 (slightly higher than in 2007) and indicates the strong increase in the number of PCI compared to coronary angiogram procedures. The number of procedures for multivessel disease did not change compared to the previous year, and constituted 27% of the total number of PCI procedures; neither was there a change in the number of procedures performed ad hoc during diagnosis (47 355; 77%).

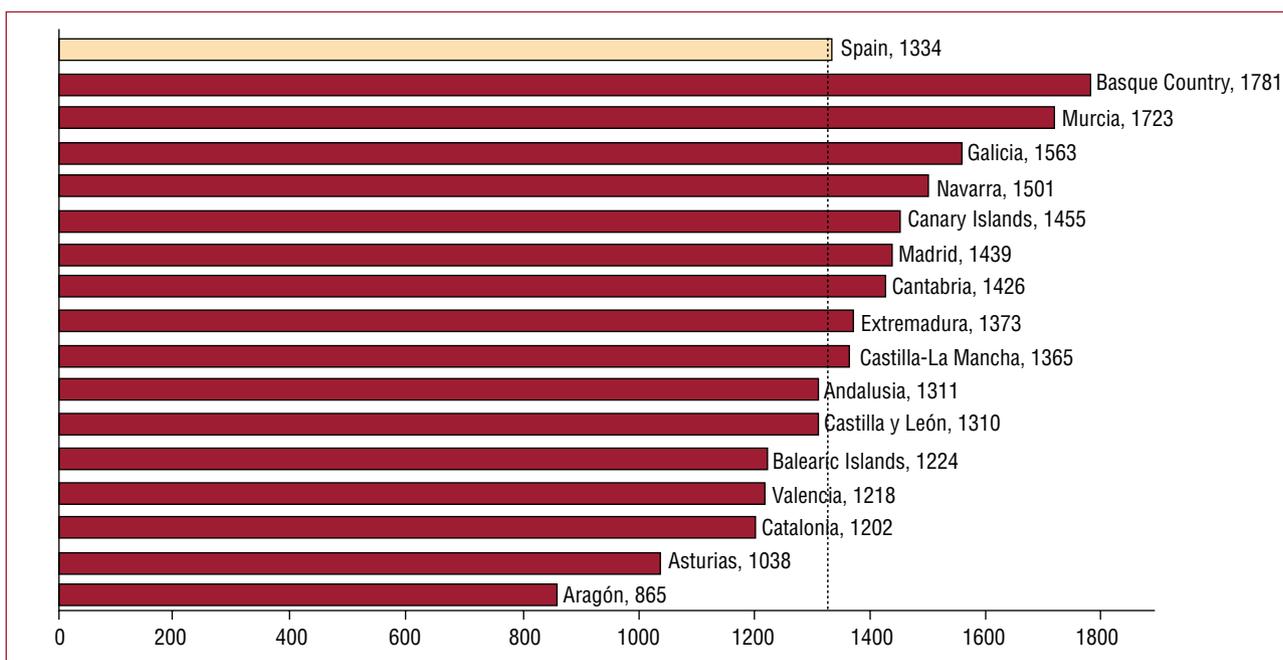
The percentages by sex and age group fell compared to 2007 (in women, 18.9% vs 24.7% during the previous year, and in those older than 75 years, 20% vs 26.3% during 2007). In 5.2% of patients, PCI was performed on 1 or more restenotic lesions (5.5% in 2007 and 5.3% in 2006). Table 1 shows that the percentage of PCI for restenotic lesions was slightly lower than during the previous year, which could be explained by the fact

that the use of drug-eluting stents (DES) remained stable. Intervention on the left main coronary artery (LMCA) remained constant in Spanish hospitals; there were 2356 procedures in 2008, of which 70% (1656) were unprotected LMCA interventions, representing 3.8% of all PCI. A total of 1780 procedures for chronic occlusion were recorded, representing 2.9% of all PCI. Grafting procedures made up 2% of the total; the saphena vein was used in 1007 procedures (81%); the mammary artery was used in 233 procedures.

Glycoprotein IIb/IIIa inhibitors (anti-GPIIb/IIIa) and antithrombotic agents were used as adjunctive drug therapy in 13 766 procedures (22.3%), with a very similar distribution to that of the previous year: 62.3% using abciximab; 19.3% using tirofiban; 9.1% using eptifibatide; and 8.9% using bivalirudin, which presented the greatest increase (3.1% more than the previous year). These figures refer to the

TABLE 1. Change in the Percentage of Percutaneous Coronary Interventions (PCI) Performed on de Novo Lesions and Restenotic Lesions (1998-2008)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
PCI for de novo lesions	21 436	25 131	31 464	28 855	32 334	38 175	42 586	48 869	54 193	57 180	58 574
PCI for restenosis	2094	2344	2893	2435	2309	2409	2883	2820	2848	3277	3236
PCI for restenosis, %	9.8	9.3	9.2	8.4	7.1	6.3	6.8	5.8	5.3	5.7	5.5

**Figure 6.** Distribution of percutaneous coronary intervention procedures per million population by autonomous community.

total number of procedures in which anti-GPIIb/IIIa agents were used, although the time of drug administration cannot be specified since this variable was not included in the questionnaire. Intraaortic balloon counterpulsation was used on 1149 occasions (in 1.85% of PCI procedures vs 2.1% of those performed in 2007), whereas other cardiac assistance methods remained at their previous level, with just 27 cases (24 in 2007).

Figure 6 shows the distribution by autonomous community of the 1334 PCI procedures per million population. The range indicates an increasing trend in recent years: 743 in 2008, 543 in 2007, and 600 in 2006, if we exclude the community of Aragón, which could not fulfill its maximum capacity of interventions due to logistics problems; 9 regions were above the national mean, as in 2007. Regarding distribution per hospital (Figure 7), the number of those performing fewer than 500 PCI procedures per year remained the same, whereas there was an increase in number of hospitals performing

large numbers of procedures, with 15 hospitals performing more than 1000 PCI.

In relation to the overall outcome of PCI, the figures remained similar to previous years with 95% success, 4.6% failure without complications and 1.5% complications, as follows: 0.4% mortality during the procedure, 0.7% acute myocardial infarction (AMI), and 0.1% urgent surgery. Hospital mortality was 0.9%.

Intracoronary diagnostic techniques (IVUS and pressure guidewire) are basically used to make decisions on lesions of unknown severity and improve the result of intervention and, less frequently, in research protocols. As mentioned, the use of IVUS increased by 9.3% and pressure guidewire fell to 2.5% of all PCI.

The use of the radial artery as an access route continued to increase and reached 43.2% of PCI procedures versus 40.1% in 2007. The femoral route was used for 36 641 percutaneous closure devices, of which 65% were collagen based; 17.4%, suture-mediated; and 17.6% using other types of devices.

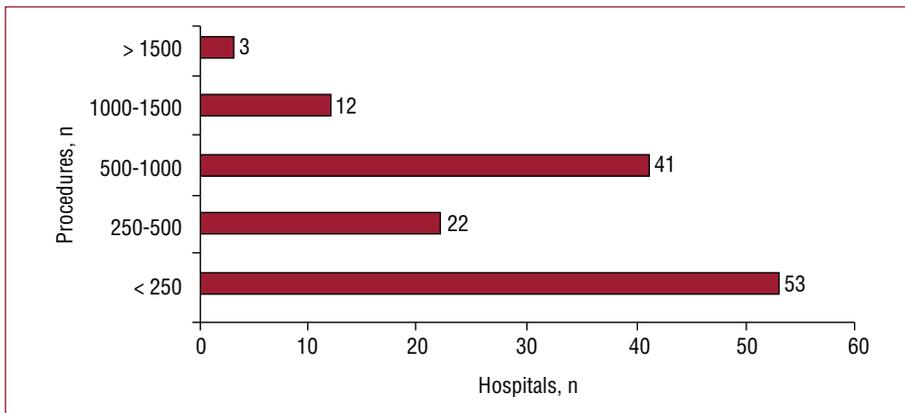


Figure 7. Distribution of hospitals according to the number of percutaneous coronary intervention procedures performed in 2008.

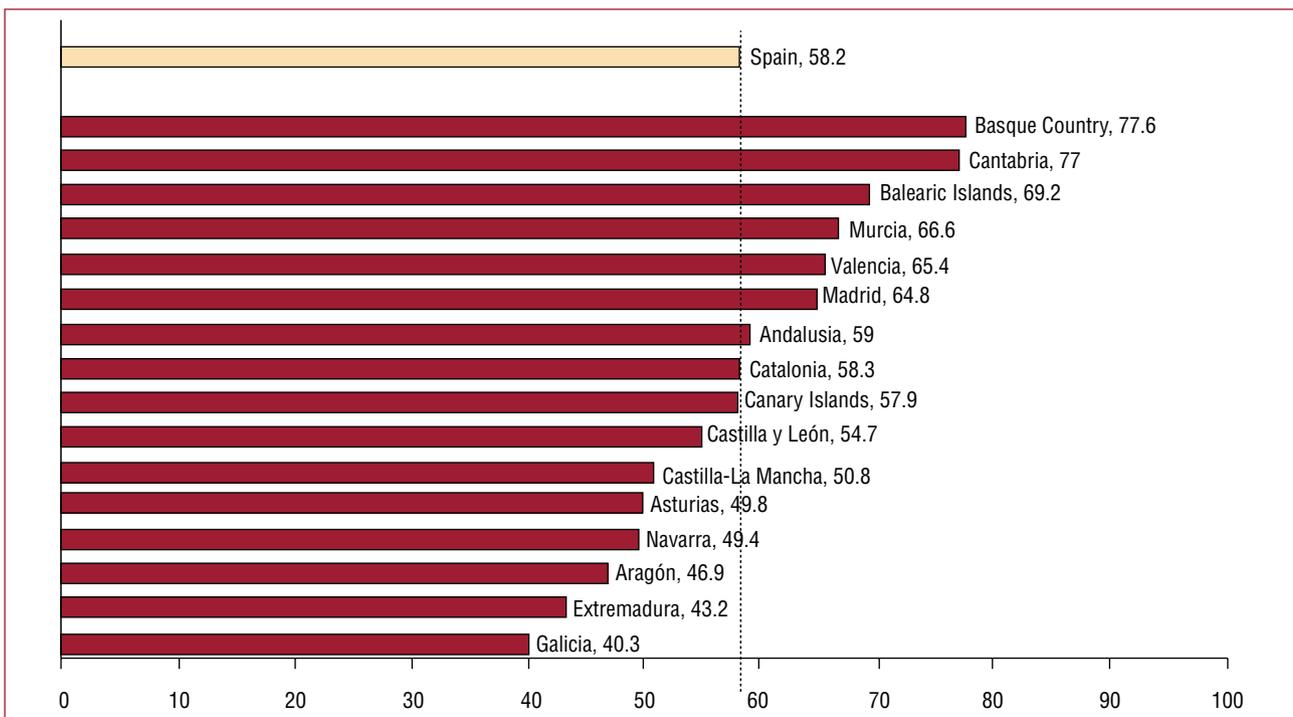


Figure 8. Distribution of the percentage of drug-eluting stents relative to the total number of stents implanted, by autonomous community.

Stents

A stent was implanted during 93.3% of all PCI procedures (a total of 57 683 PCI), with 101 753 units being implanted during 2008. The number of stents per procedure continued to increase, the current ratio being 1.76 (1.7 in 2007). The use of DES reached 58.2% (59 220 units), with a 0.5% increase compared to the previous year. The number of stents implanted increased by 6.7%; the relative increase was due to DES in 58% and to conventional stent in 42%. The type of stent used depended on the characteristics of both the patients and the lesions such that either one type or both types of stent were used in a large number of procedures; thus, in 2008, of a total of 40 297 procedures on which information was provided,

8% used both types of stent compared to 52% of procedures in which DES only was used.

The use of DES strongly differed between the autonomous communities (ranging between 77.6% and 40.3%; Figure 8), overall with similar figures to those of 2007.

Regarding the safety of stents, 449 cases of stent thrombosis (data submitted by 71 hospitals) were reported for the year. Their distribution was similar to that of the previous year, with 56% occurring in DES. In relation to the time of thrombosis, although there were no differences in early thrombosis, there were differences in late and very late thrombosis. Data for the last 3 years are shown in Table 2; 2008 data did not differ from 2007.

TABLE 2. Distribution of In-stent Thrombosis at the Time of Onset and Type of Stent in 2006, 2007 and 2008

	Early Thrombosis		Late Thrombosis		Very Late Thrombosis	
	CS	DES	CS	DES	CS	DES
2006 (n=354), n (%)	89 (25.1)	123 (28.8)	26 (7.3)	68 (19.2)	14 (3.9)	34 (9.6)
2007 (n=494), n (%)	94 (19)	125 (25.3)	81 (16.4)	94 (19)	52 (10.5)	48 (9.7)
2008 (n=449), n (%)	107 (23.8)	108 (24)	55 (12.2)	83 (18.5)	36 (8)	60 (13.3)

CS indicates conventional stent; DES, drug-eluting stent.

Other Percutaneous Coronary Intervention Devices and Procedures

Rotational atherectomy (rotablator) was the intracoronary technique that underwent the greatest increase in the 2008 registry, both in the number of hospitals and total number of procedures: 66 hospitals (16% increase) and 1006 procedures (30.6% increase). No directional atherectomy or intracoronary brachytherapy procedure was documented. Other devices present figures similar to those of 2007, such as the cutting balloon (1373 cases) and distal protection devices (247 procedures); however, the use of thrombus aspiration devices increased by 32% and protrusion balloons by 50%. Regarding other techniques, 35 septal ablation procedures were performed (37 in 2007), which involved 16 fistula embolization procedures and 39 stem cell implantation procedures.

Percutaneous Coronary Intervention in Acute Myocardial Infarction

A total of 112 hospitals provided data on PCI for AMI. In total, 12 079 procedures were performed in this context, which represents 20.6% of all PCI procedures, with a 6.7% increase relative to 2007. The current figures are slightly higher than those of the European Registry of 2005 (17% of all PCI procedures for infarction¹⁸). Of all procedures, 2101 (17%) were performed in women. In patients older than 75 years, 2435 procedures were performed, forming 20% of the procedures (with no change in any of the patient subgroups compared to the previous year). Anti-GPIIb/IIIa agents were used in 51.8% of angioplasty procedures for ST-segment elevation AMI (STEMI) and thrombus aspiration devices in 30% of the procedures.

The distribution of PCI performed during acute phase of AMI was similar to that of previous years: 7837 (64%) primary PCI; 1945 (16%) rescue PCI; and 1822 (15.1%) facilitated PCI (Figure 9). The growing number of AMI procedures is due to the increase of primary PCI and facilitated PCI (6.5% in both cases), whereas rescue PCI decreased by

13.7%. No data are available on the incidence of STEMI in Spain, but if we assume that the annual estimation is 45 000 AMI patients admitted to Spanish hospitals,^{19,20} then primary PCI would be used in just 17.4%. A total of 51 hospitals reported a median door-to-balloon time of 74 min and a mean door-to-balloon time of 80 (46) min.

The national distribution of PCI for AMI was more dispersed than that of 2007, with a mean of 261 PCI for AMI per million population, with a range of 312 procedures (377 procedures in the case of PCI); the communities that have an established program of continuous care for AMI patients present the highest values (Figure 10 and Figure 11).

There was a mean of 106 PCI procedures per hospital (more than 2007, with 95 procedures) and the distribution between hospitals remained the same, since 58% performed fewer than 100 PCI procedures for AMI/y (Figure 12).

As in the other procedures, the radial artery was also used as the PCI access route for AMI, with a total of 4145 procedures, representing 34.3% of the total, with little change compared to the previous year.

A total of 1009 PCI procedures were counted in patients who presented cardiogenic shock in the acute phase of AMI. The procedure was successful in 57% of the patients and hospital mortality was 25%.

Non-Coronary Percutaneous Intervention in Adults

The number of valvuloplasty procedures increased by almost 10% in 2008, due to doubling the number of aortic valvuloplasty procedures, whereas the number of mitral valvuloplasty procedures has remained very similar for 8 years. There were 71 mitral valvuloplasty procedures (83%), 5 aortic valvuloplasty procedures (37 in 2007), and 16 pulmonary valvuloplasty procedures (Figure 13). The results of mitral valvuloplasty were better than during previous year and were successful in 96% of all cases; major complications occurred in 2.1% of the procedures. The most frequent complication was severe mitral regurgitation after valvuloplasty

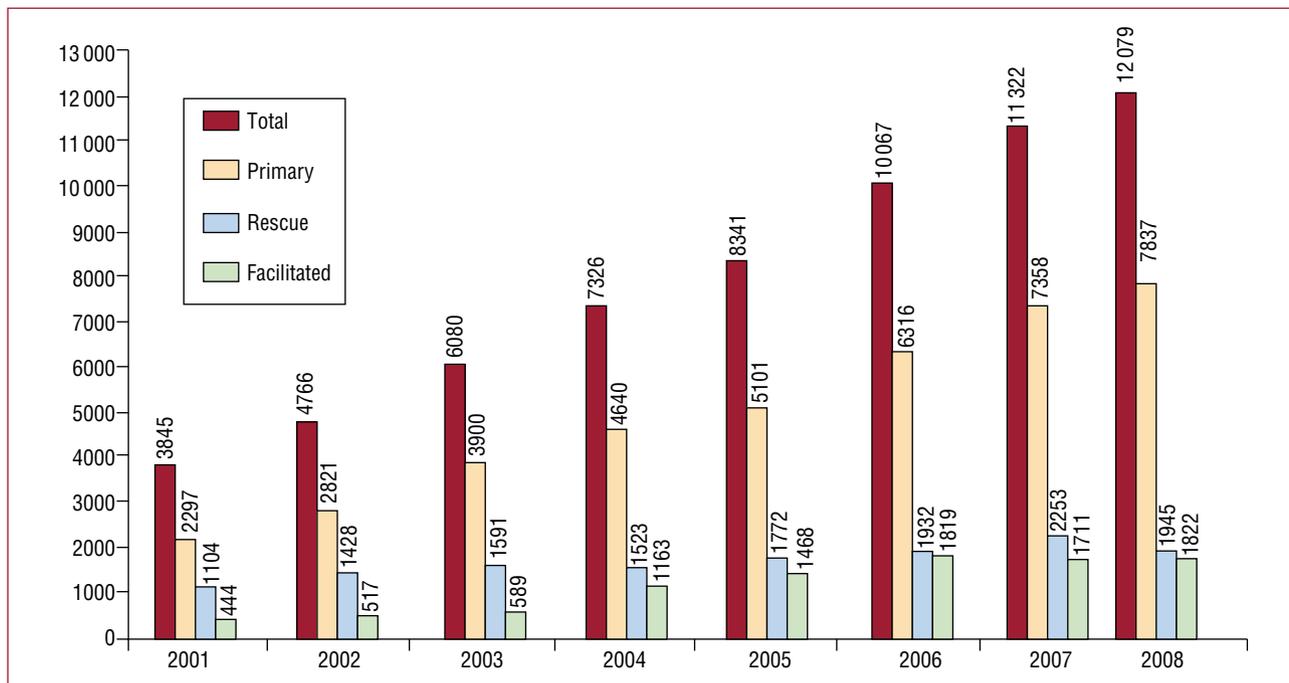


Figure 9. Change in the types of percutaneous coronary intervention (PCI) for acute myocardial infarction (AMI).

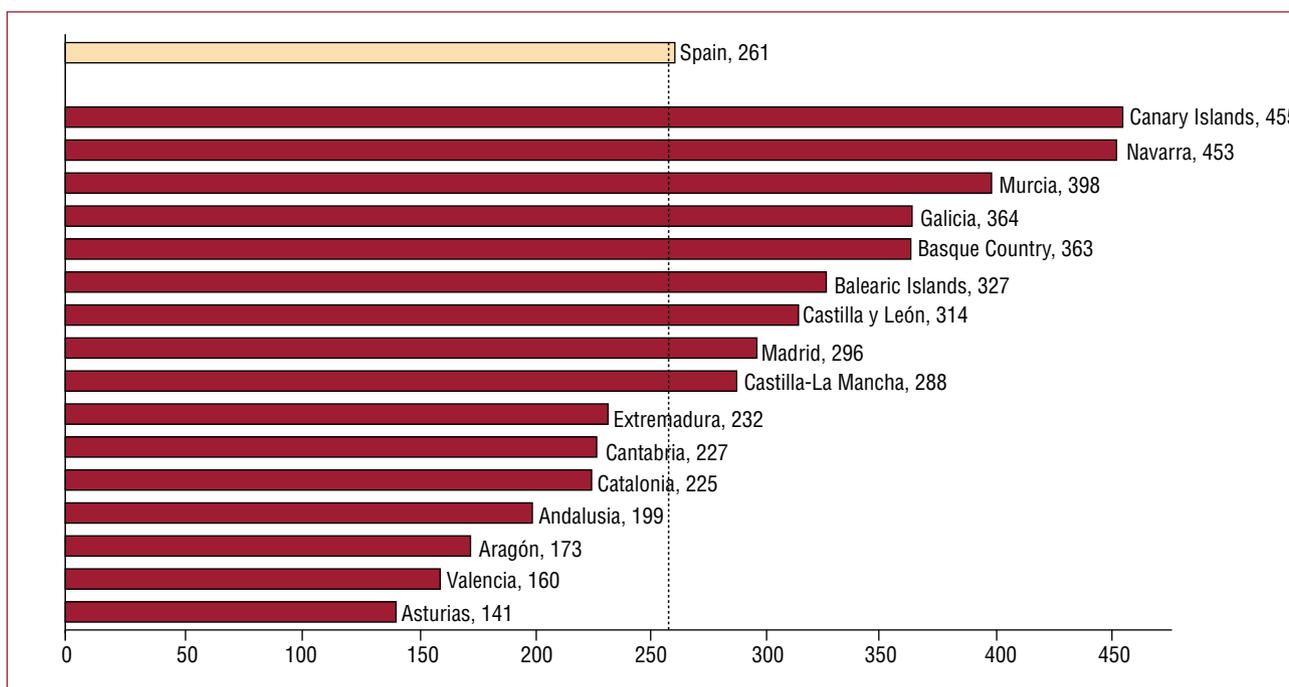


Figure 10. Distribution of percutaneous coronary interventions for acute myocardial infarction per million population and autonomous community.

(1.6%), followed by tamponade (0.2%), and stroke (0.6%). Of 161 total percutaneous valve implantations, 10 involved the pulmonary valve and were successful in 90%, with only 1 death. The number of aortic valve implantations has already increased, with a total of 151 prosthetic valves, of which 56% were premounted on balloons and 44% were self-expanding. Self-expanding ones were

successfully implanted in 91% of cases, with 8% in-hospital mortality of 8%, whereas balloon-mounted ones were successful in 88% with 12% in-hospital mortality.

The treatment of congenital heart disease remained the most frequent non-coronary percutaneous intervention in the registry. A total of 635 procedures were performed: the most frequent was closure of

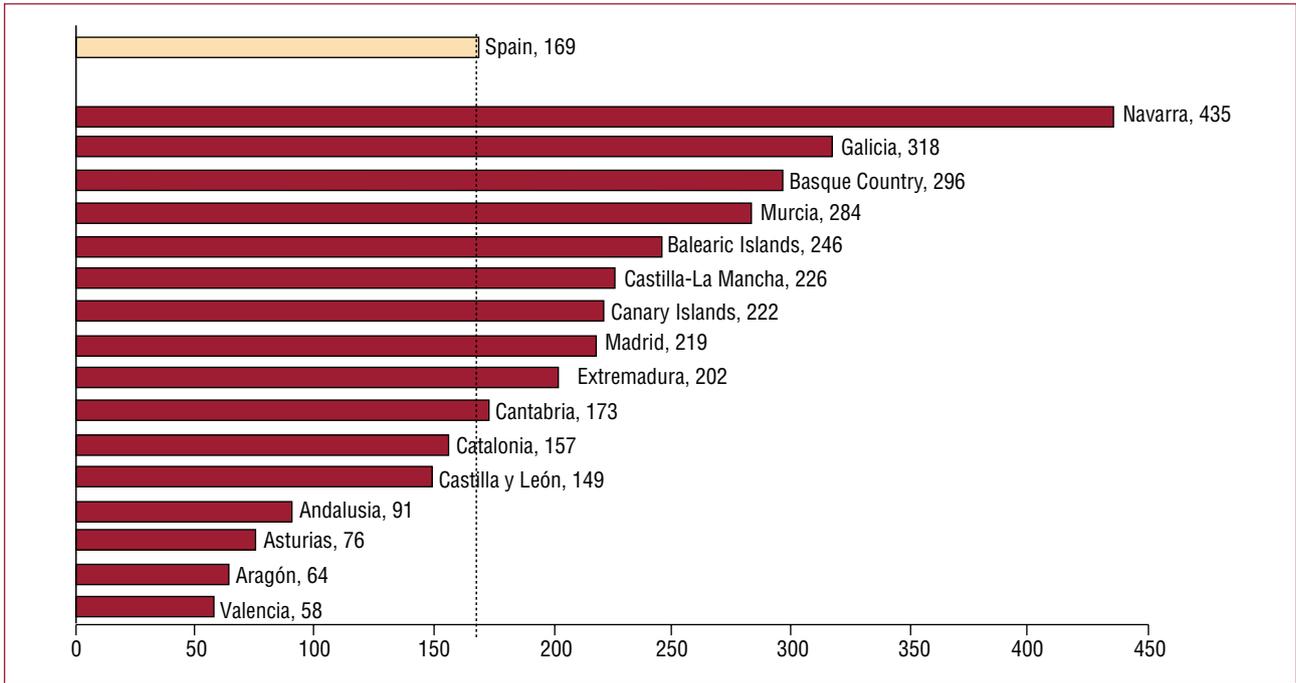


Figure 11. Distribution of the primary angioplasty per million population and autonomous community.

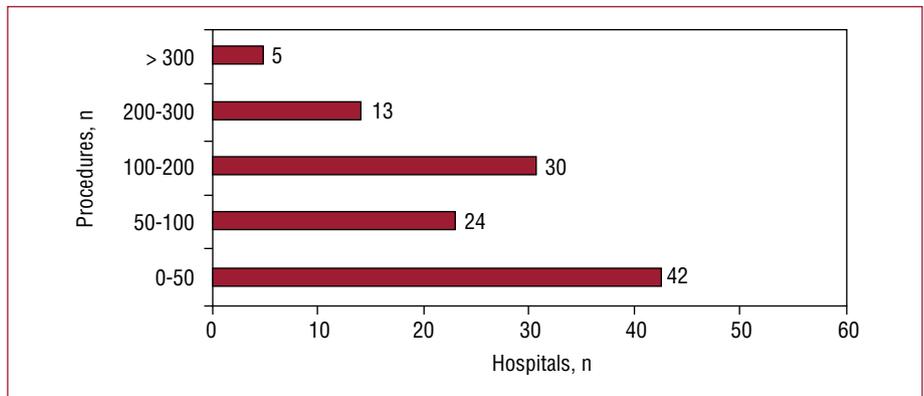


Figure 12. Distribution of hospitals according to the number of percutaneous coronary intervention procedures for acute myocardial infarction.

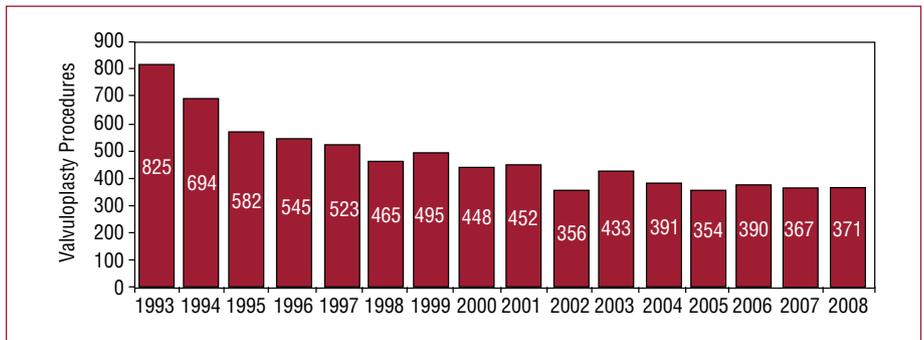


Figure 13. Change in the number of mitral valvuloplasty procedures in Spain.

atria septal defect (ASD), with 305 total cases, of which 96% were successful. There were complications in 1.9% involving device embolization or tamponade. Procedural mortality was zero, as in 2006 and 2007. In total, 211 patent foramen ovale were closed, successfully in 99% of cases, and 23 coarctations

of the aorta were treated. The 96 remaining procedures included ductus closure, interventricular communication closure and fistula closure.

A total of 45 paravalvular leaks were treated, of which 32 were mitral and 13 aortic. There were 71 aortic endoprosthesis implantation procedures, 30

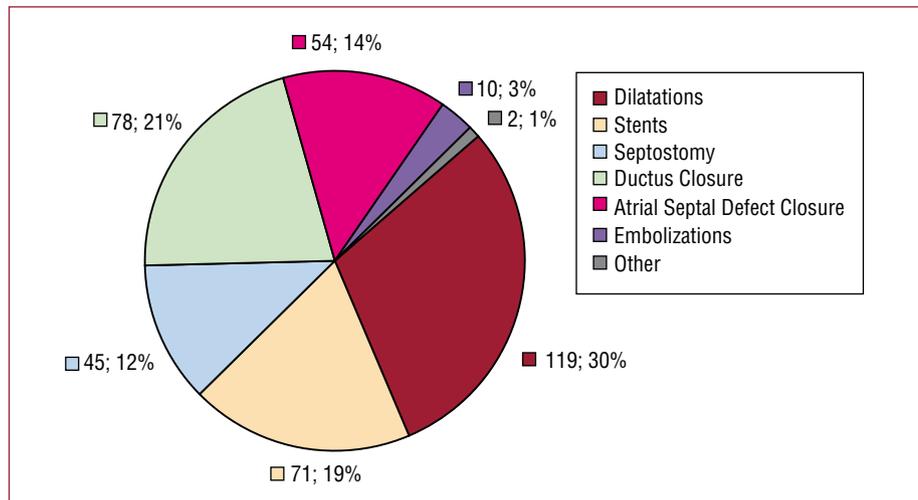


Figure 14. Distribution of pediatric interventional procedures performed in hospitals for adults without specific pediatric activity. ASD indicates atrial septal defect.

of which were in the abdominal aorta and 41 in the thoracic aorta.

Percutaneous Coronary Intervention in Pediatric Patients

A total of 9 hospitals provided data on the pediatric age group (16 years or less), reporting 379 procedures in 2008. The most frequent procedures were dilatations, both vascular and valvular, with a total of 119 procedures. Atrial septal defect and persistent ductus arteriosus were treated in 132 patients (35% of the total). A total of 45 procedures were performed on the aorta, of which 27 were coarctations, 16 in the valve, and 2 for subaortic stenosis. Furthermore, 16 pulmonary valvuloplasty procedures were performed. The remaining procedures are shown in Figure 14.

CONCLUSIONS

The upward trend in the number of procedures performed in previous years slowed down in 2008. The only increase was in unscheduled procedures, such as angioplasty in STEMI, although this increase was less than in 2007. There was no increase in the number of public hospitals or in the number of laboratories available in them. On the other hand, the increase in the general population, which has been very large in certain communities, has led to great differences in the data on procedures per autonomous community.

Overall, diagnostic procedures were very similar to those of the previous year and only the use of intravascular ultrasound has increased, whereas the use of pressure guidewire decreased.

In general, the differences between the various Spanish autonomous communities in the use of PCI remained the same.

The clinical practice guidelines on the management of AMI have led to an increase in the number of interventional procedures due to the increase in primary PCI; even so, there are very marked differences between the autonomous communities, benefiting those which have developed a specific STEMI care plan.

The use of DES increased by 0.5% compared to 2007 (national mean, 58.2%), and was widespread among the autonomous communities with a distribution similar to that of previous years. The use of rotational atherectomy increased considerably, both in hospitals and in the number of procedures, probably due to the greater complexity of the lesions currently treated.

Use of the radial artery access route was close to 50% both for diagnosis and intervention, and was increasingly used during the acute phase of infarction.

Outside the context of PCI, there were 161 percutaneous valve implantation procedures, of which 151 were aortic valves. These figures were attained little more than 1 year after the technique was approved in Spain and this shows the willingness of Spanish interventional cardiologists to implement the latest techniques throughout the country.

Making comparisons remains problematic due to the lack of current data on the procedures performed in the countries surrounding Spain. The lack of data within Spain on the incidence of heart disease makes it difficult to assess whether the use of the different techniques matches the standards of the scientific societies.

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APPENDIX 1. Working Group on Cardiac Catheterization and Interventional Cardiology. Data Collection Questionnaire for the Registry for 2008

0. DATA PUBLICATION AUTHORIZATION

- 0.1. We authorize publication on the Working Group on Cardiac Catheterization Website of data contained in the boxes marked with a * (YES/NO) (OBLIGATORY)

1. HOSPITAL IDENTIFICATION

- 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 interventional cardiologist 1
 1.11.1.1 Type of employment: full time/part time
 1.11.2 Name of interventional cardiologist 2
 1.11.2.1 Type of Employment: Full time/part time
 1.11.3 Name of interventional cardiologist 3
 1.11.3.1 Type of employment: full time/part time
 1.11.4 Name of interventional cardiologist 4
 1.11.4.1 Type of employment: full time/part time
 1.11.5 Name of interventional cardiologist 5
 1.11.5.1 Type of employment: full time/part time
 1.11.6 Name of interventional cardiologist 6
 1.11.6.1 Type of employment: full time/part time
 1.11.7 Name of interventional cardiologist 7
 1.11.7.1 Type of employment: full time/part time
 1.11.8 Name of interventional cardiologist 8
 1.11.8.1 Type of employment: 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 perform PCI
 2.4 Number of radiology technicians/registered nurses
 2.5 Number of radiology technicians
 2.6 24-hour emergency service
 2.7 *Cardiovascular surgery available at the hospital
 2.8 *Procedural activity database available

3. DIAGNOSTIC ACTIVITY

- 3.1 *Total number of diagnostic procedures
 3.1.1 *Number of coronary angiogram procedures
 **3.1.1.1 Number of coronary angiogram procedures in women
 **3.1.1.2. Number of coronary angiogram procedures in patients aged 75 years or more
 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)
 3.1.6 Other
 3.2 Number of procedures using the radial artery approach

*The combination of right and left cardiac catheterization is considered a single diagnostic procedure, regardless of whether it is accompanied by a coronary angiogram. A complete study of a patient with valve disease who also has a coronary angiogram is counted as a single study in a patient with valve disease. A single coronary angiogram in a patient with valve disease is 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 in order to not interfere with the coronary angiogram/PCI ratio. The sum of the values in sections 3.1.1 to 3.1.6 should be equal to the value in section 3.1 (total number of procedures).

**If the information is unavailable, the box should be left blank, do not provide an estimation.

4. OTHER DIAGNOSTIC CORONARY STUDIES

- 4.1 Quantitative angiogram
 4.2 Number of intracoronary ultrasound studies
 4.3 Number of studies using pressure guidewire
 4.4 Number of studies using Doppler flow wire
 4.5 Number of other studies using an 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 using a pressure guidewire only counts as a coronary angiogram (3.1.1) and, logically, a single diagnostic procedure (3.1) would also count as a pressure guidewire study (4.3). A PCI with IVUS is a single interventional procedure (5.1) and a study using intracoronary ultrasound (4.2).

5. INTERVENTIONAL CORONARY PROCEDURES

- 5.1 Total number of procedures*
 5.2 Number of multivessel procedures
 5.3 Number of procedures during the same session as diagnostic procedures
 5.4 Number of procedures for restenosis**
 5.5 Number of procedures used to treat at least one lesion in the saphena vein
 5.6 Number of procedures used to treat at least one lesion in the mammary artery
 5.7 Number of procedures in the left main coronary artery
 5.7.1 Protected
 5.7.2 Unprotected
 5.8 Number of procedures using balloon only
 5.9 Number of procedures using the radial artery approach
 5.10 Number of procedures using antithrombotic agents
 5.10.1 Abciximab
 5.10.2 Eptifibatide
 5.10.3 Tirofiban
 5.10.4 Bivalirudin
 5.11 Number of procedures using ionic contrast media
 5.12 Number of procedures using non-ionic contrast media
 5.13 Number of vessels treated***
 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 Urgent surgery (24 h)
 5.15.3.3 Death secondary to the procedure performed
 5.15.4 Hospital death
 5.15.5 Stent thrombosis††

- 5.15.5.1 Early stent thrombosis in conventional stent (0-30 days)
- 5.15.5.2 Early stent thrombosis in drug-eluting stent (0-30 days)
- 5.15.5.3 Late stent thrombosis in conventional stent (31-365 days)
- 5.15.5.4 Late thrombosis in drug-eluting stent (31-365 days)
- 5.15.5.5 Very late stent thrombosis in conventional stent (>365 days)
- 5.15.5.6 Very late stent thrombosis in drug-eluting stent (>365 days)

- 5.16 Number of coronary interventional procedures in women
- 5.17 Number of coronary interventional procedures in patients aged 75 years or more

*A therapeutic coronary procedure is defined as the 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.

**At least one of the lesions treated in a session is restenotic.

***According to convention, the following vessels are considered: left main coronary artery, anterior descending artery, circumflex artery, right coronary artery and each arterial graft (a patient with native arteries can only be treated in 4 vessels).

†If the information is unavailable, leave the box blank.

††We consider stent thrombosis to be definite thrombosis, that is, confirmed by angiographic or anatomic and pathological studies.

6. SUPPORT METHODS FOR INTERVENTIONAL PROCEDURES

- 6.1 Number of procedures using intraaortic balloon counterpulsation
- 6.2 Number of procedures using percutaneous cardiopulmonary bypass

7. PERCUTANEOUS CORONARY INTERVENTION FOR ACUTE MYOCARDIAL INFARCTION

- 7.1 *Total number procedures for AMI
 - 7.1.1 Primary PCI*
 - 7.1.2 Rescue PCI**
 - 7.1.3 Facilitated PCI
 - 7.1.3.1 Immediate facilitated PTCA***
 - 7.1.3.2 Delayed facilitated PTCA****
 - 7.1.4 Approximate percentage of primary PCI relative to total AMI
 - 7.1.5 Door-to-balloon time
- 7.2 Outcomes of PCI for AMI (overall, including cardiogenic shock)
 - 7.2.1 Success without complications
 - 7.2.2 Failure without major complications
 - 7.2.3 Procedures with major complications
 - 7.2.4 Hospital death
- 7.3 Number of stent procedures
- 7.4 Number of procedures using balloon only
- 7.5 Number of procedures using GPIIb/IIIa inhibitors
- 7.6 Number of procedures using thrombus aspiration devices
- 7.7 Number of procedures with distal embolization protection
- 7.8 Number of patients in cardiogenic shock within the first 24 h 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 Procedures with major complications
 - 7.9.4 Hospital death
- 7.10 Number of procedures using the radial artery approach
- 7.11 Number of procedures for AMI in women
- 7.12 Number of procedures for AMI in patients aged 75 years or more

*PTCA performed during the acute phase of AMI (first 12 h) without prior thrombolytic therapy.

**PTCA performed during the acute phase of AMI, after administration of thrombolytic therapy due to clinical suspicion of reperfusion failure of thrombolytic therapy.

***PCI performed electively in the first 3 h after the administration of thrombolytic therapy and a platelet IIb/IIIa antagonist.

****PCI performed electively between 3 h and 24 h after successful administration of thrombolytic therapy and a platelet IIb/IIIa antagonist. †If the information is unavailable, leave the box blank.

8. CORONARY STENTING

- 8.1 Total number of procedures*
- 8.2 Total number of stents implanted
- 8.3 Number of stents implanted without predilatation
- 8.4 Total number of procedures without predilatation**
- 8.5 Number of drug-eluting stents (active coating)
- 8.6 Number of procedures using drug-eluting stent only
- 8.7 Total number of procedure using conventional stent only

*The procedure is defined in the same way as the interventional procedure (5.1).

**All lesions treated without predilatation during one 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 devices
- 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 for AMI and when AMI is not present.

10. OTHER NON-CORONARY 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 Dilatation of renal arteries
- 10.6 Closure of paravalvular leaks:
 - 10.6.1 Mitral
 - 10.6.2 Aortic

11. PERCUTANEOUS VASCULAR CLOSURE DEVICES

- 11.1 Number of percutaneous closure devices
 - 11.1.1 Using collagen
 - 11.1.2 Using suture
 - 11.1.3 Other

12. INTERVENTIONAL PROCEDURES IN ADULTS WITH VALVE DISEASE

- 12.1 Total number of mitral valvuloplasty procedures
- Outcomes
 - 12.1.1 Success
 - 12.1.2 Fracaso sin complicaciones

- 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
- Outcomes
 - 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
- Outcomes
 - 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 percutaneous valve implantation procedures
 - 12.4.1 Aortic position
 - 12.4.1.1 Self-expanding (total number)
 - 12.4.1.1.1. Number of successful procedures
 - 12.4.1.1.2. Hospital mortality
 - 12.4.1.2 Not self-expanding (total number)
 - 12.4.1.2.1. Number of successful procedures
 - 12.4.1.2.2. Hospital mortality
 - 12.4.2 Pulmonary position
 - 12.4.2.1 Number of successful procedures
 - 12.4.2.2 Hospital mortality

13. PROCEDURES IN ADULTS WITH CONGENITAL HEART DISEASE

- 13.1 Number of atrial septal defect closure procedures
 - 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
 - 13.1.3.4 Embolization of the device

- 13.2 Number of procedures for coarctation of the aorta
- 13.3 Number of patent foramen ovale closure procedures
 - 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
 - 13.1.3.4 Embolization of the device
- 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 or less)
- 14.1 Dilatations
 - 14.1.1 Pulmonary valve
 - 14.1.2 Aortic valve
 - 14.1.3 Coarctation of the aorta
 - 14.1.4 Subaortic stenosis
 - 14.1.5 Pulmonary branches
 - 14.1.6 Other dilatations
- 14.2 Stent implantations
 - 14.2.1 Pulmonary artery branches
 - 14.2.2 Coarctation of the aorta
 - 14.2.3 Ductus
 - 14.2.4 Other locations
- 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 COMMENTS

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APPENDIX 2. Registry of Activity of the Working Group on Cardiac Catheterization and Interventional Cardiology. Laboratories Participating in 2008

Andalucía	Almería	Complejo Hospitalario Torrecárdenas	Catalonia	Barcelona	Ciutat Sanitària i Universitària de Bellvitge						
		Hospital Virgen del Mar			Hospital Clínic i Provincial de Barcelona						
	Cádiz	Hospital Universitario Puerta del Mar			Hospital de la Santa Creu i Sant Pau						
		Hospital Universitario Puerto Real			Hospital General Universitari						
		Hospital de Jerez de la Frontera			Vall d'Hebron						
	Córdoba	Hospital Universitario Reina Sofía			Pujol	Girona	Tarragona	Hospital Universitari Germans Trias i			
		Granada						Hospital Universitario Virgen de las Nieves	Hospital del Mar		
	Huelva							Hospital Juan Ramón Jiménez	Hospital Parc Taulí		
	Jaén	Complejo Hospitalario Universitario de Jaén						Hospital General de Catalunya	Lleida	Centre Cardio-Vascular Sant Jordi	
		Málaga						Complejo Universitario Carlos Haya		Centro Médico Teknon	
								Hospital Clínico Universitario Virgen de la Victoria	Community of Madrid		Hospital Quirón
								Hospital Costa del Sol			Hospital de Barcelona-SCIAS
								Clínica Xanit Internacional de Benalmádena			Clínica Corachan
								Clínica Parque San Antonio			Hospital Universitari Sagrat Cor-ANGIOCOR
								USP Marbella			Mútua de Terrassa
Clínica El Ángel			Centro Médico Delfos								
Clínica Santa Elena			Hospital Universitari Dr. Josep Trueta								
Hospiten Estepona			Hospital Juan XXIII								
Seville			Hospital Universitario Virgen del Rocío	Hospital Universitari Arnau de Vilanova							
			Hospital Universitario Virgen Macarena	Hospital Puerta de Hierro							
			Hospital Universitario de Valme	Hospital Universitario 12 de Octubre							
Aragón			Zaragoza	Hospital Clínico Universitario Lozano Blesa	Hospitalario		Hospital Clínico San Carlos, Complejo				
				Hospital Universitario Miguel Server			Hospital Universitario de La Princesa				
Principado de Asturias				Hospital Central de Asturias	Marañón		Hospital General Universitario Gregorio				
				Centro Médico de Asturias			Hospital Universitario La Paz				
Balearic Islands	Mallorca	Hospital Son Dureta			Hospital Militar Gómez Ulla						
		Policlínica Miramar			Hospital Ramón y Cajal						
		Clínica Rotger			Hospital de Alcorcón						
		Clínica Palmaplanas			Cardioclinsa-Clínica						
		Clínica Juaneda			Ntra. Sra. de América						
Canary Islands	Ibiza	Policlínica Ntra. Sra. del Rosario			Clínica Moncloa						
		Las Palmas			Hospital de Gran Canaria Dr. Negrín	Clínica Montepíncipe					
	Hospital Universitario Insular de Gran Canaria				Clínica Ruber						
	Clínica San Roque				Hospital Ruber Internacional						
	Santa Cruz de Tenerife	Hospital Universitario de Canarias			Fundación Jiménez Díaz						
Complejo Hospitalario Ntra. Sra. de la Candelaria		Sanatorio La Milagrosa									
Cantabria		Hospiten Rambla			Centro Médico Zarzuela						
		Hospital Universitario Marqués de Valdecilla			Clínica La Luz						
		Hospital Clínico Universitario de Valladolid			Sanatorio el Rosario						
Castilla y León	Valladolid	Hospital Campo Grande (CEMIN)	Community of Alicante		Sanatorio San Francisco de Asís						
		Hospital Universitario de Salamanca			Hospital NISA Pardo de Aravaca						
	León	Hospital de León			Clínica La Moraleja						
		Burgos			Hospital General Yagüe	Clínica Quirón					
Castilla-La Mancha	Toledo	Hospital Virgen de la Salud			Hospital General Universitario						
		Albacete			Hospital General de Albacete Ibérica de Diagnóstico y Cirugía S.L.	Valenciana de Alicante					
	Hospital Universitario Guadalajara				Hospital Universitario San Juan						
	Hospital General de Ciudad Real				Hospital General Universitario de Elche						
								Clínica Medimar			
			Sanatorio Perpetuo Socorro								
			Clínica Benidorm								
					Clínica San Jaime de Torreveja						
					Hospital de Levante						
					Hospital de Torreveja						

	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			Sanatorio Quirúrgico Modelo Pontevedra Complejo Hospitalario Universitario de Vigo Hospital POVISA Orense Centro Médico El Carmen
			Autonomous Community of Navarre Basque Country	Álava Guipúzcoa Vizcaya	Hospital de Navarra Clínica Universitaria de Navarra Hospital Txagorritxu Policlínica Guipúzcoa Hospital de Basurto Hospital de Galdakao Clínica V. San Sebastián
Region of Murcia	Castellón	Hospital General de Castellón 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			Hospitals with different pediatric activity Barcelona Hospital Vall d'Hebron
	Cáceres	Hospital de Cáceres			Vizcaya Hospital de Cruces
Galicia	La Coruña	Complejo Hospitalario Universitario de A Coruña Complejo Hospitalario Universitario de Santiago Clínica USP Santa Teresa Instituto Médico Quirúrgico San Rafael			Granada Hospital Universitario Virgen de las Nieves Cádiz Hospital Universitario Puerta del Mar Córdoba Hospital Reina Sofía Canary Islands Hospital Universitario de Canarias Hospital Insular de Gran Canaria A Coruña Complejo Hospitalario Universitario de A Coruña Baleary Islands Hospital Universitario Son Dureta