

## Spanish Cardiac Catheterization and Coronary Intervention Registry. 14th Official Report of the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology (1990-2004)

Ramón López-Palop, José Moreu, Felipe Fernández-Vázquez, and Rosana Hernández

Sección de Hemodinámica y Cardiología Intervencionista, Sociedad Española de Cardiología, Madrid, Spain.

This article presents the findings of the Spanish Society of Cardiology registry of cardiac catheterization and interventional cardiology in the year 2004. Data were obtained from 121 centers, which comprise almost all cardiac catheterization laboratories in Spain. Of these, 110 performed catheterization mainly in adults, and 11 carried out procedures in only pediatric patients. In 2005, 111 451 diagnostic catheterization procedures were performed, including 97 785 coronary angiograms. This was 6.6% higher than in 2003. The population-adjusted rate was 2263 coronary angiograms per million inhabitants. A total of 45 469 coronary interventions were performed, 12% more than in 2003. The population-adjusted rate was 1052 per million inhabitants. Coronary stents were used in 91.4% of procedures; 68 892 stents were implanted, which was 12% more than in 2003. Of these, 25 148 (36.5%) were drug-eluting stents. Some 7326 percutaneous coronary interventions were carried out in patients with acute myocardial infarction, 20.5% more than in 2003. These accounted for 16.1% of all percutaneous coronary interventions. Among non-coronary interventions, there was a decrease in the number of percutaneous mitral valvuloplasties (8%) and atrial septal defect closures (7%). In addition, there was a small increase in pediatric interventions (12%). Finally, it is important to note that the percentage of centers participating in the registry was high, what ensures that the data presented here are highly representative of the work carried out in cardiac catheterization laboratories in Spain.

**Key words:** *Health registries. Coronary angiography. Coronary angioplasty. Stent. Cardiac catheterization.*

### Registro Español de Hemodinámica y Cardiología Intervencionista. XIV Informe Oficial de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología (1990-2004)

Se presentan los resultados del Registro de Actividad de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología del año 2004. Se recogen datos de 121 centros, casi la totalidad de los laboratorios del país. De ellos, 110 realizaron su actividad sobre todo en pacientes adultos y 11 exclusivamente en pacientes pediátricos.

Se realizaron 111.451 estudios diagnósticos con 97.785 coronariografías, lo que representa un aumento del 6,6% respecto al año 2003 y una tasa de 2.263 coronariografías por millón de habitantes. Se efectuaron 45.469 procedimientos de intervencionismo coronario, con un incremento del 12% respecto al año anterior y una tasa de 1.052 intervenciones por millón de habitantes. Se empleó *stent* intracoronario en el 91,4% de los procedimientos, con 68.892 unidades utilizadas (incremento del 12%), de las cuales 25.148 fueron *stents* liberadores de fármacos antiproliferativos (36,5%). Se llevaron a cabo 7.326 procedimientos de intervencionismo en el infarto agudo de miocardio, lo que supone un 20,5% más respecto al año 2003 y el 16,1% del total de las intervenciones coronarias percutáneas.

En el intervencionismo no coronario se observó una disminución del número de valvuloplastias mitrales (8%) y de cierres percutáneos de comunicación interauricular en pacientes adultos (7%), y un ligero incremento de los procedimientos intervencionistas en pacientes en edad pediátrica (12%). Finalmente, destacamos el alto grado de participación de centros en el registro, lo que hace que los datos aquí presentados sean representativos de la actividad hemodinámica en nuestro país.

**Palabras clave:** *Registros sanitarios. Angiografía coronaria. Angioplastia coronaria. Stent. Cateterismo cardíaco.*

Results and reference material available at: [www.hemodinamica.com](http://www.hemodinamica.com)

Correspondence: Dr. R. López-Palop.  
Ricardo Gil, 20, 3.º dcha. 30002 Murcia, España.  
E-mail: [mlopezs@meditex.es](mailto:mlopezs@meditex.es)

## ABBREVIATIONS

PCI: percutaneous coronary intervention.  
AMI: acute myocardial infarction.

## INTRODUCTION

Since 1992, the *Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología* (Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology) has undertaken the creation of a registry of interventional activity in Spain, in both the public and private domains, as one of its most important undertakings. This registry is considered to be one of those most closely reflecting the state of coronary intervention in a European country, involving only a 1-year delay in production.

Health registries are an invaluable source of information regarding actual medical practice. They make it possible to compare regions, study temporal evolution and, based on this, assess performance in various health fields. The findings provide guidelines to help improve health care in its various aspects of research, prevention, treatment, and distribution of resources.

As in previous years,<sup>1-13</sup> the 14th report published in the current *REVISTA ESPAÑOLA DE CARDIOLOGÍA* brings together data from almost all Spanish hospitals and can be considered fully representative of the activities carried out in Spain.

## METHODS

Data collection for the Registry was done via a questionnaire (Appendix 1) sent to all the cardiac catheterization laboratories in Spain. This questionnaire was somewhat modified compared to previous ones and could be completed on paper, computer disk, or via the Working Group's website ([www.hemodinamica.com](http://www.hemodinamica.com)). The participating laboratories were encouraged to use the latter method this year, as it is considered to be the ideal way to complete these types of registries. In contrast to the minimal use of the website in previous years, 50 centers (45% of the participants) used the Internet to complete the data (for 2004) and even greater use is expected in future years. As in previous years, the company Izasa collaborated both in the distribution and collection of the questionnaires, and the Working Group Governing Board was in charge of data analysis and responsible for the present publication.

The population data used for the different calculations of population-adjusted rates per million

inhabitants, both at the national and regional level, were obtained from the estimation made for 2004 by the Spanish National Institute of Statistics ([www.ine.es](http://www.ine.es)). Spain was estimated to have a population of 43 197 684 in 2004.

## RESULTS

### Infrastructure and Resources

One hundred and twenty-one hospitals (Appendix 2) carrying out catheterization procedures in 2004 participated in the Registry, comprising 100% of the public centers (67 centers) and 88% of the private ones (43 of 49) performing such activities. Of the 121 centers, 110 carried out procedures mainly in adult patients, 19 of these included pediatric patients, and 11 centers treated pediatric patients only.

#### *Hospitals for Adults*

The 110 centers for adults have a total of 146 catheterization laboratories, of which 139 (95%) are fully computerized. The population-adjusted number of centers and laboratories is 2.55 and 3.38, respectively, per million inhabitants. Two or more catheterization laboratories are available in 35 centers. A system for the automatic quantification of coronary parameters is available in 91% of the centers. A total of 43 centers are private (39%) and the remaining 67 belong to the public health-care network (61%). Diagnostic and catheterization procedures are carried out in 99% of the hospitals. An emergency team is available 24 h a day in 67% of the centers (72% of the public centers and 59% of the private ones). Heart surgery is available in 76% of the centers (n=79). In a total of 31 centers non-surgical coronary interventions are carried out in the same hospital. Regarding staff, 347 physicians were working in 2004 (3.21/center; 8.01 specialists/10<sup>6</sup> inhabitants). The figure for 2004 matches the one for 1995 in Europe of 8 specialists/10<sup>6</sup> inhabitants.<sup>14</sup> Although dated this is the last known figure for Europe. There were 409 nursing staff and 91 radiology/imaging technicians, with an average of 4.5 nursing staff or radiology technicians per center and 3.5 per laboratory (an average of 3.8 nursing staff or radiology technicians per laboratory in the public sector).

#### *Pediatric Hospitals*

A total of 11 centers treat pediatric patients only in 12 laboratories (9 computerized). All of them carry out coronary intervention and 6 (54%) are on 24-h standby. Staff comprise 24 physicians (2.2 per center) and 30 nursing staff (2.7 per center).

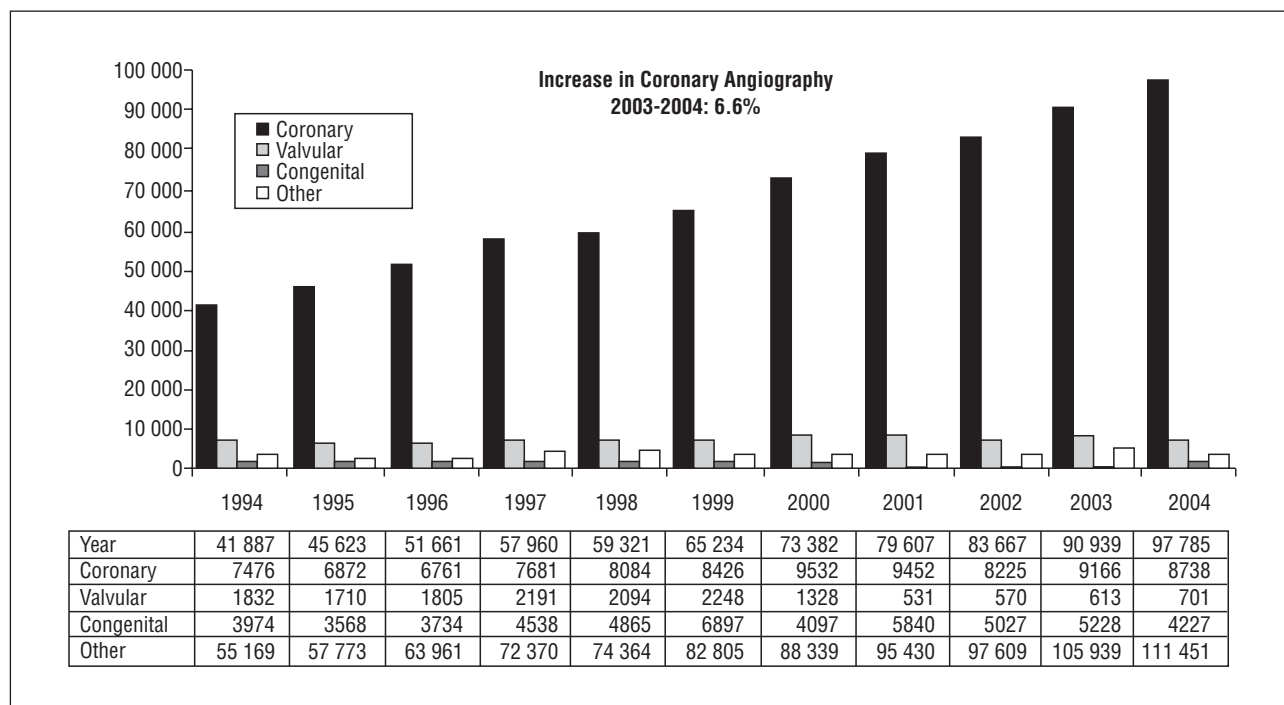


Figure 1. Evolution of the number and type of diagnostic procedure done between 1994 and 2004.

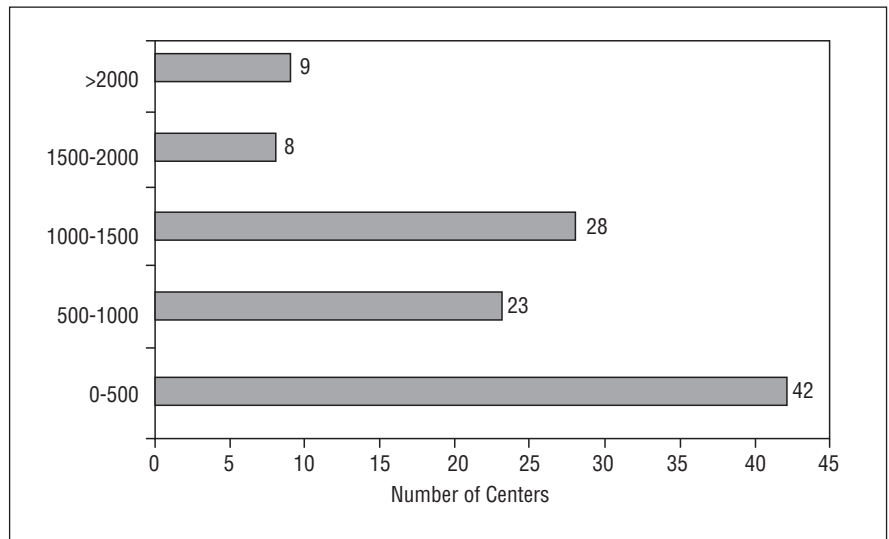
### Diagnostic Procedures

In 2004, 111 451 diagnostic procedures were carried out in Spain, involving a 5.2% increase compared to 2003; 97 785 of these procedures were coronary angiograms, representing a 6.6% increase. Some 2263 coronary angiograms/10<sup>6</sup> inhabitants were performed. This figure continues to be similar to that of European countries such as Greece, Portugal, or Hungary according to the European Registry last published in 2001,<sup>15</sup> whereas there continues to be a difference with figures from countries such as Germany (7462/10<sup>6</sup>), Austria (4800/10<sup>6</sup>), or France (3935/10<sup>6</sup>).<sup>15</sup> Figure 1 presents the distribution of diagnostic procedures in 2004 and its evolution since 1993. It should be emphasized that, although the increase in the number of coronary angiograms has been maintained as in previous registries, this increase has been less than in previous years, which suggests a leveling-out effect. A slight reduction has also been observed in the number of diagnostic procedures in valvular heart disease patients compared to 2003.

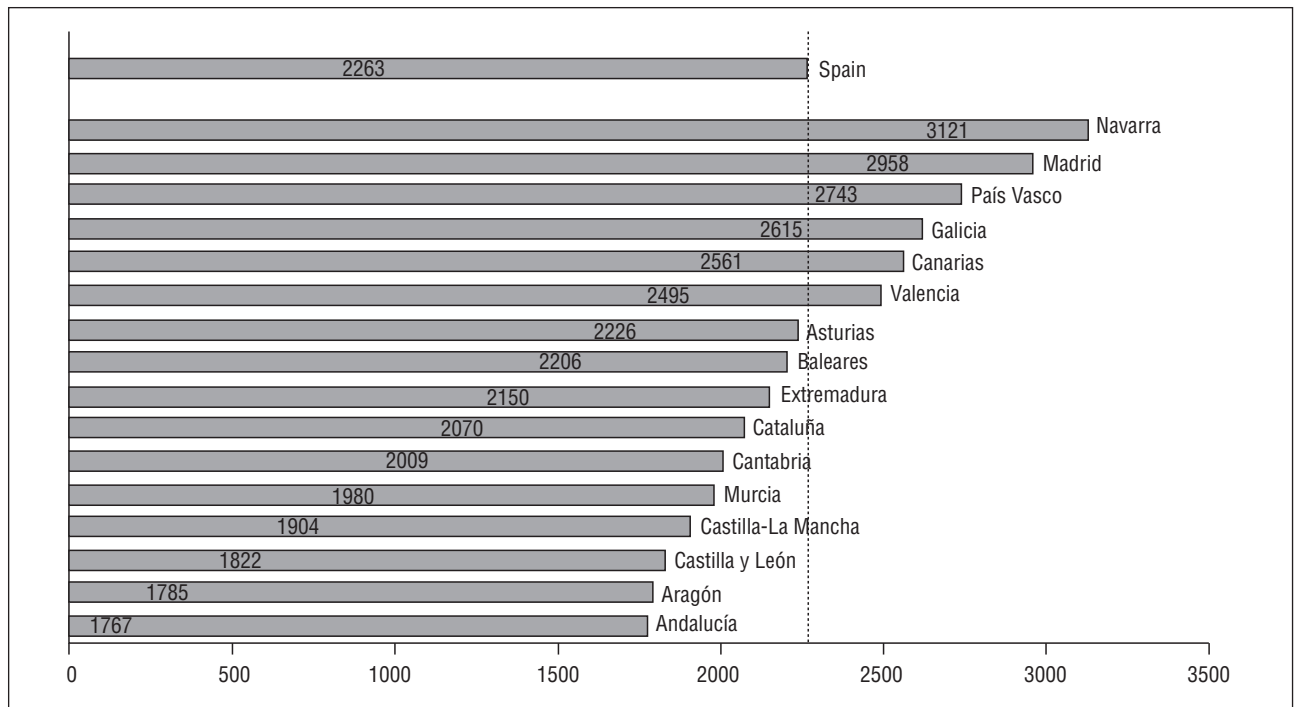
The number of procedures using the radial approach practically doubled compared to 2003. This approach was used in 20 244 procedures (20.7%), with a 95.4% increase compared to the previous year. Transcatheter closure devices (including diagnostic and therapeutic procedures) were used in 27 220 cases (a 32.4% increase compared to 2003), 17 977 (66%) with collagen, and 7349 (27%) with suture.

More than 1000 coronary angiograms/year were done in 45 centers (40.9%), 9 of which (8.2%) carried out more than 2000 coronary angiograms/year. On the other hand, 42 centers (38.2%) performed fewer than 500 coronary angiograms/year (Figure 2), only 8 of which were in the public sector (11.9%). There were 1013 diagnostic procedures per center and 719 per laboratory, which was practically identical to 2003. The average number of diagnostic procedures per room continues to be below the European average for 2001, with 1019 procedures per laboratory.<sup>15</sup> In the public sector, 911 diagnostic procedures were carried out per laboratory. The number of coronary angiograms per center (902) was 4% higher than in 2003<sup>13</sup> but remains lower than the already dated figure for 1997 in most western European countries.<sup>16,17</sup> It is also less than the 934 coronary angiograms/center recorded by the European Registry for 1999.<sup>17</sup> It must be emphasized that, whereas private sector centers carried out 360 coronary angiograms/center, there were an average of 1234 coronary angiograms/center in the public sector.

In 2004, the increase in the number of diagnostic procedures was basically due to the number of coronary angiograms. The number of congenital heart disease procedures also increased notably (14%; 701 procedures), whereas the number of procedures in valvular heart disease patients and other diagnostic procedures decreased.



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



**Figure 3.** Distribution of coronary angiograms per million inhabitants and regions.

In 2004, the notable difference in the number of coronary angiograms per million inhabitants was maintained among the different regions in Spain. Figure 3 shows the data for the regions. The statistical range was 1354 coronary angiograms per million inhabitants between regions.

Among the intracoronary diagnostic techniques, intracoronary ultrasound imaging underwent a 35% increase compared to 2003, with 2143 procedures. The use of intracoronary pressure guidewires underwent a 20% increase compared to 2003, with 1350 procedures.

Intracoronary Doppler flow guidewire was used in numbers similar to those in previous years (95 cases).

### Percutaneous Coronary Intervention

During 2004, 45 469 percutaneous coronary interventions (PCI) were done, involving a 12% increase compared to the previous year, with 1052 PCI per million inhabitants (Figure 4). This figure is higher than the one in the last European Registry for 2001 (990 coronary angioplasties/10<sup>6</sup> inhabitants), but is less than

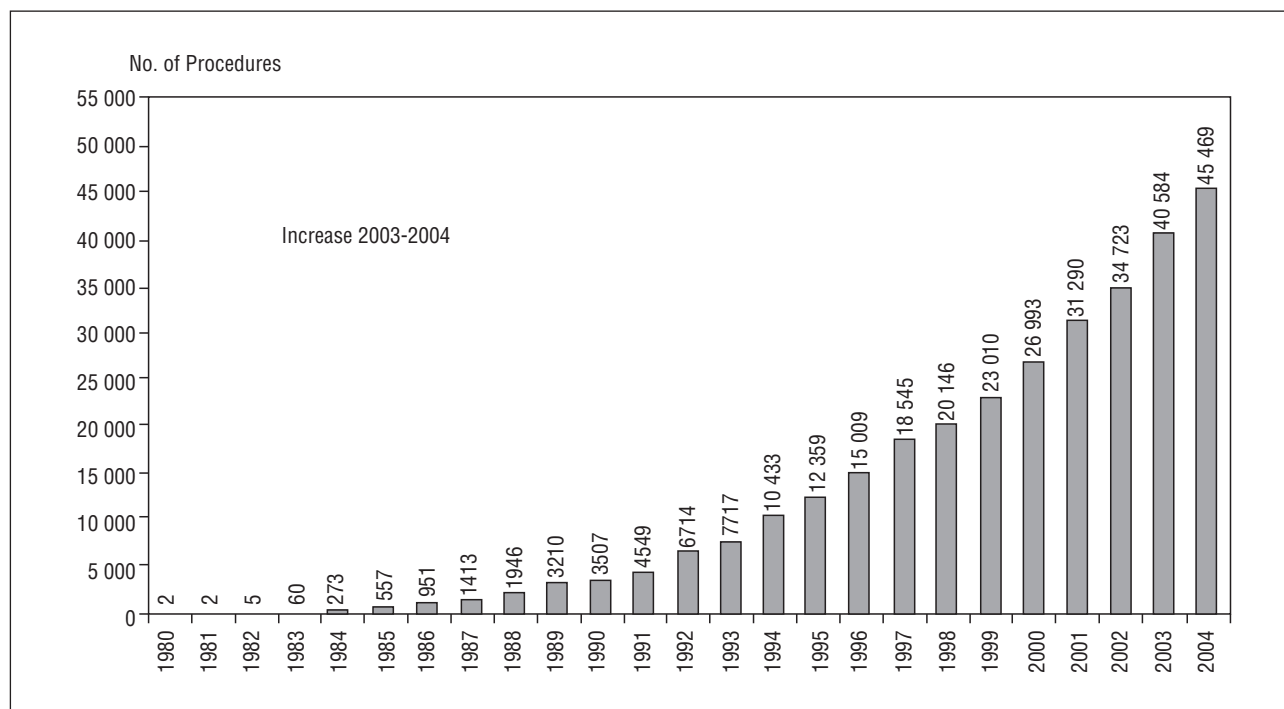


Figure 4. Evolution of the number of percutaneous coronary interventions between 1980 and 2004.

that of other leading countries in this context, such as (in descending order): Germany, Belgium, Austria, Switzerland, Iceland, France, and The Netherlands, which in 2001 reached or surpassed 1500 PCI per million inhabitants.<sup>15</sup> There was an average of 421 interventions per center performing catheterization procedures and 298 per laboratory. There were 129 interventions per interventionist. The European average for PCI per catheterization laboratory was 325 in 2001. There was an average of 149 PCI per center in the private sector and 594 in the public sector.

The percentage of PCI via coronary angiography in 2004 was 44.3% (44.6% in 2003), which was higher than the European average for 2001 (33%). At least 1 restenotic lesion was dealt with during the procedure in 6.3% of cases. In 2004, 13 050 multivessel procedures were carried out, representing 29% of total PCI, equal to 2003. Neither were there differences compared to 2003 regarding the percentage of procedures carried out during the same session as the diagnosis (78%; 35 496 procedures). The European average for PCI carried out in the same session as the diagnosis was 52% in 2001.<sup>15</sup>

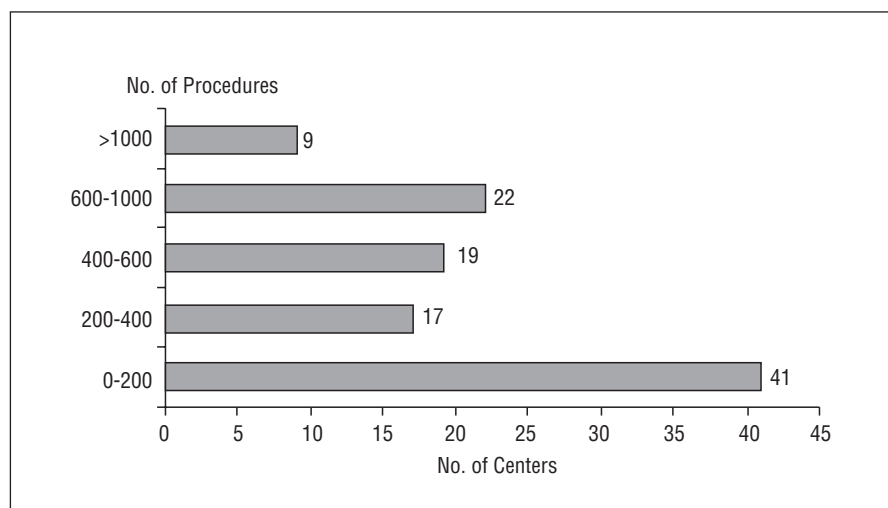
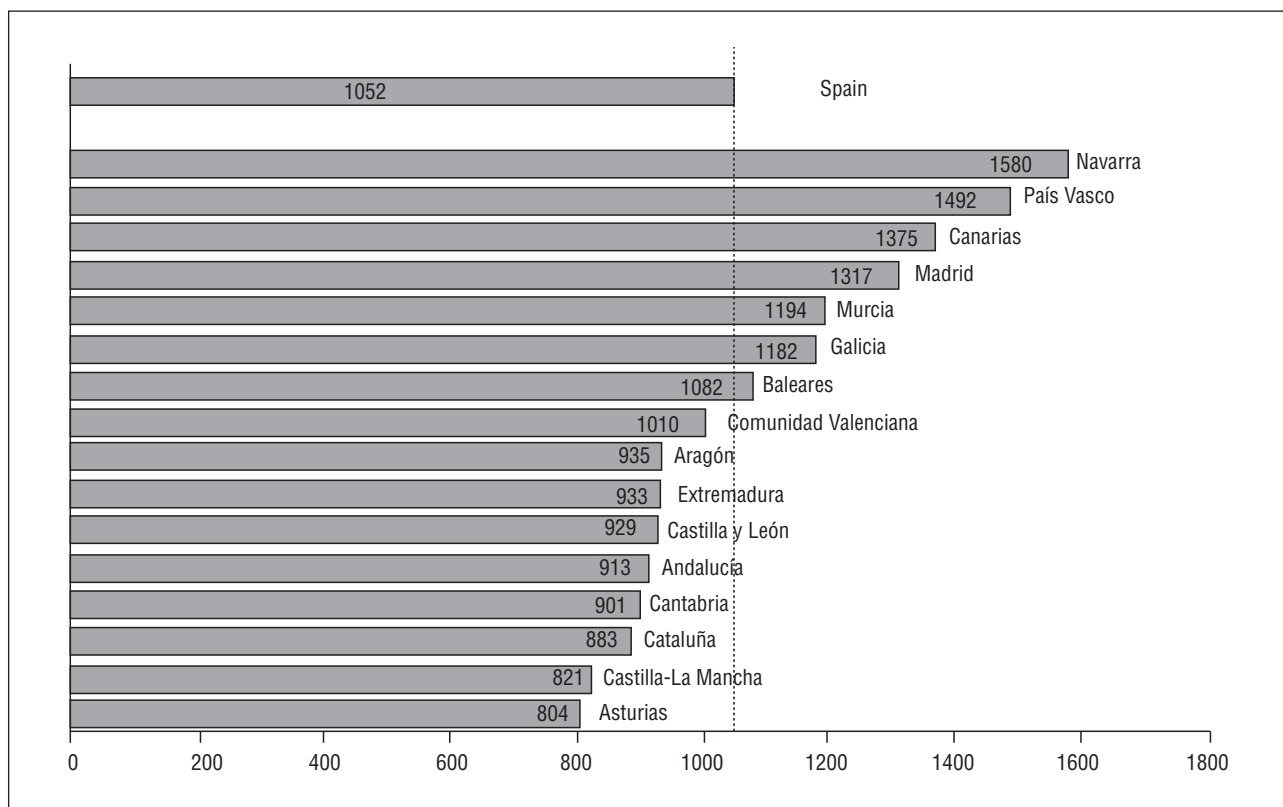


Figure 5. Distribution of centers according to the number of percutaneous coronary interventions carried out in 2004.



**Figure 6.** Distribution of percutaneous coronary interventions per million inhabitants and regions.

The radial approach in PCI was used in 7407 cases (16.3%), 39% more than in 2003. There were 1215 PCI in vein grafts, 86.0% in saphenous veins and the remainder (14.0%) in mammary arteries. Some 1247 PCI were carried out in the left main coronary artery which was protected in 32.6% of cases.

Figure 5 shows the distribution of centers according to the number of PCI. As in previous years, the high number of centers carrying out less than 400 PCI per year (53%), or even less than 200 PCI/year (37%), remained steady. Nine centers carried out more than 1000 PCI in 2004. Figure 6 shows the number of PCI per million inhabitants in the different regions; the differences already indicated regarding diagnostic procedures was maintained. It is important to point out that, as in the case of coronary angiograms, in specific regions the high percentage of PCI is due to the fact that patients from other neighboring regions are treated in their centers.

Glycoprotein IIb/IIIa inhibitors were used as adjuvant drug therapy in 13 231 procedures, representing a 6% decrease compared to 2003. Their use ranged from 0% to 97% in the different centers. Intraaortic balloon counterpulsation was used in 902 cases and percutaneous heart-lung bypass in 6 cases.

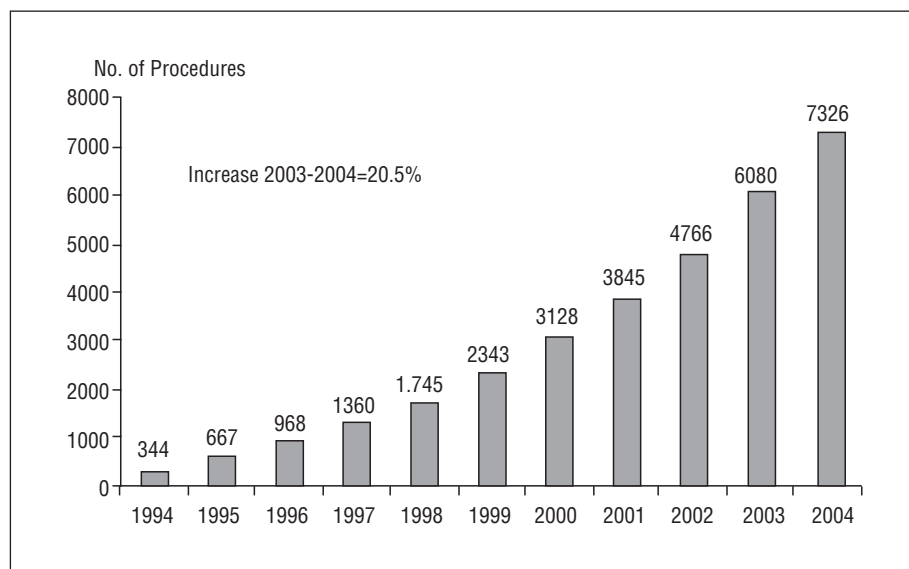
Regarding the total outcomes for PCI, figures similar to those of previous years were maintained;

94.8% successful, 3.5% failure without complications, and 1.7% failure with complications, broken down into 1.0% mortality, 1.1% acute myocardial infarction (AMI) and 0.1% emergency surgery.

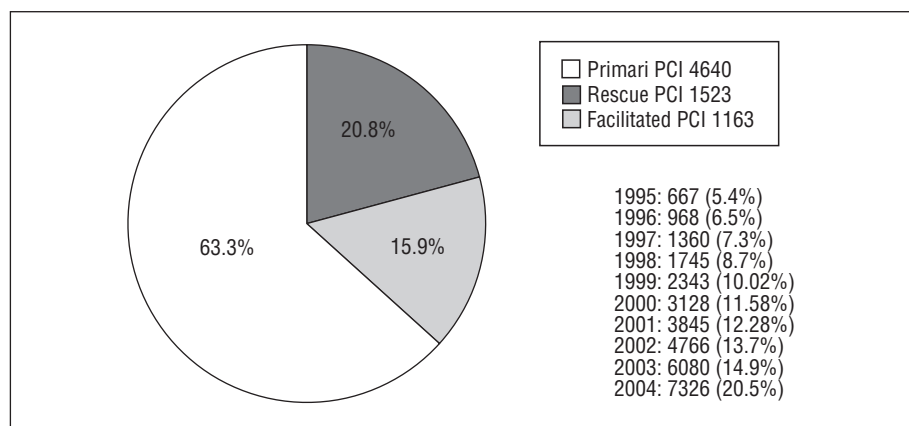
#### *Percutaneous Coronary Intervention in Acute Myocardial Infarction*

Some 7326 PCI procedures in AMI were carried out, representing a 20.5% increase compared to 2003 and 16.1% of the total intervention procedures (Figure 7). Some 63.0% of the cases involved primary PCI (64.1% in 2003), 20.8% rescue PCI (26.2% in 2003), and 15.9% facilitated PCI (9.7% in 2003) (Figure 8). Of the facilitated coronary angioplasties, 82% can be considered “delayed” having been carried out after the acute phase of the AMI. The 4640 primary coronary angioplasties carried out represent a 19% increase compared to 2003. Although there are few data on the number of AMI meeting criteria for reperfusion therapy, the number of PCI for AMI continues to be low compared to the estimated >40 000 AMI patients admitted annually in Spain.<sup>18,19</sup> A total of 91 centers carried out PCI for AMI. Although these centers performed an average of 79 interventions, the spread was considerable (Figure 9): 26 centers performed

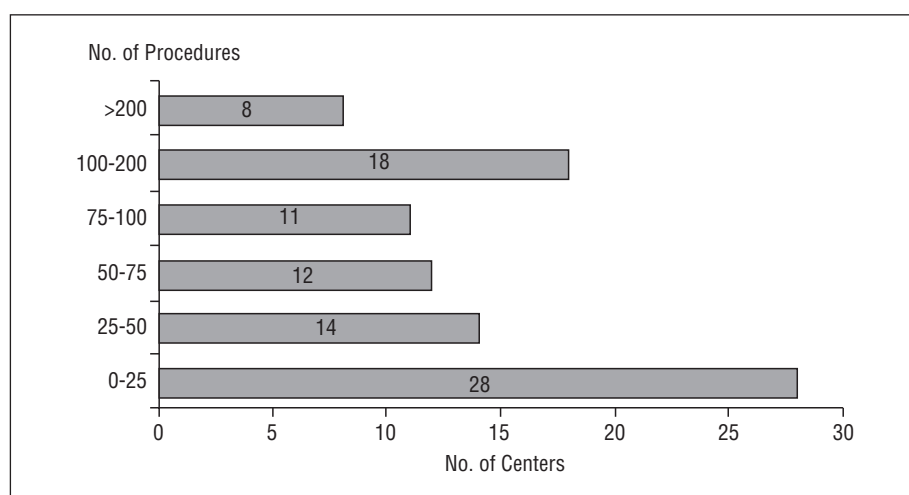




**Figure 7.** Percutaneous coronary interventions carried out in acute myocardial infarction. Evolution 1994-2004.



**Figure 8.** Percutaneous coronary interventions in acute myocardial infarction. Distribution of the type of intervention carried out and changes in percentages in total coronary interventions between 1995 and 2004.



**Figure 9.** Distribution of centers according to the number of percutaneous coronary interventions in acute myocardial infarction.

more than 100 PCI in the acute phase of the infarction and 38% performed less than 50. Figure 10 shows the number of PCI for AMI per million

inhabitants in the different Spanish regions. Some 846 PCI were done in cardiogenic shock patients, representing 11.5% of the cases in AMI.

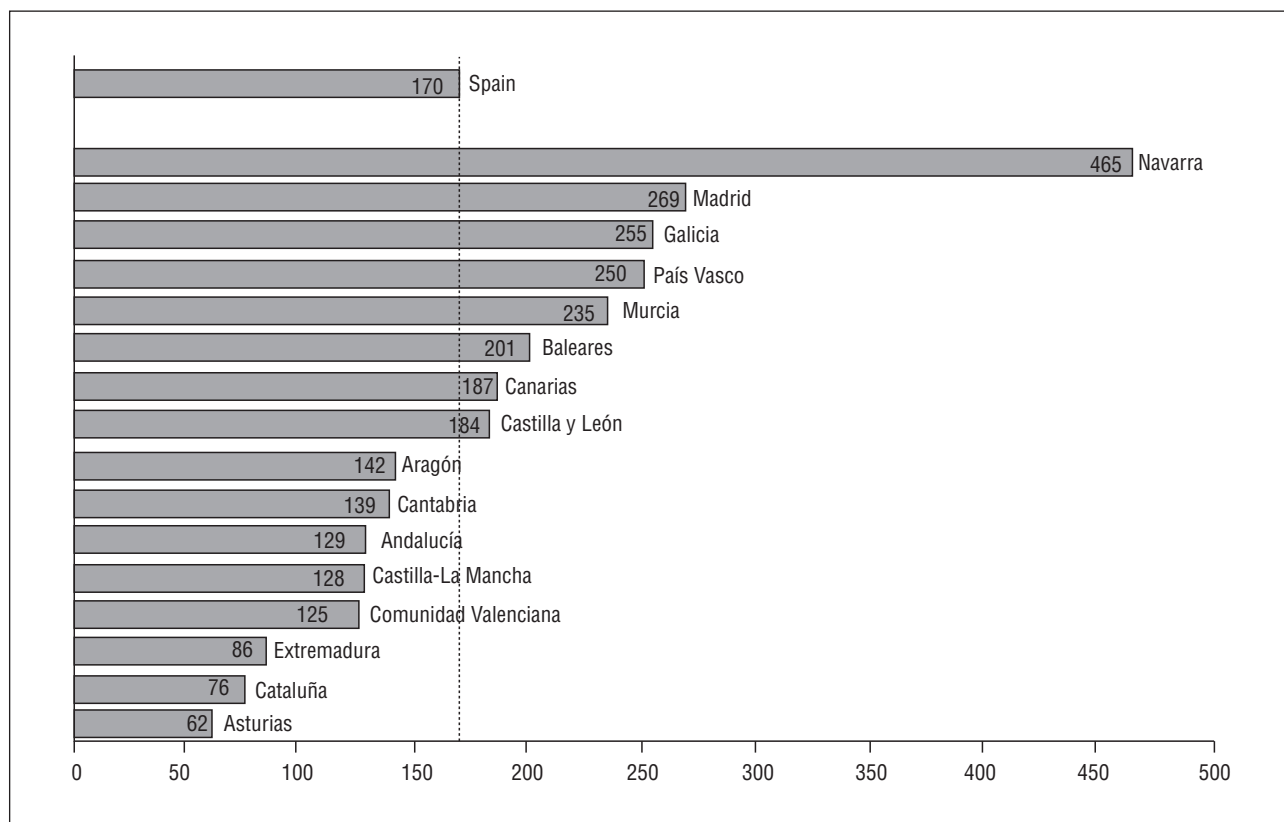


Figure 10. Distribution of percutaneous coronary interventions in acute myocardial infarction per million inhabitants and regions.

## Stents

In 2004, as in previous years, stents were used in most procedures (41 581; 91.4%). The stent/procedure ratio was 1.51 (1.53 in 2003) with 68 892 stents being implanted. Some 25 148 drug-eluting stents were implanted representing 36.5% of the total number of implanted stents. Figure 11 shows the great difference in the use of this type of stent, ranging between 55.9% and 23.1% by region.

Finally, 27 018 stents were implanted directly, without predilatation with balloon, representing 39.2% of implanted stents. Some 32.9% of the stenting

procedures were done without predilatation. Table 1 shows how stenting has evolved in recent years.

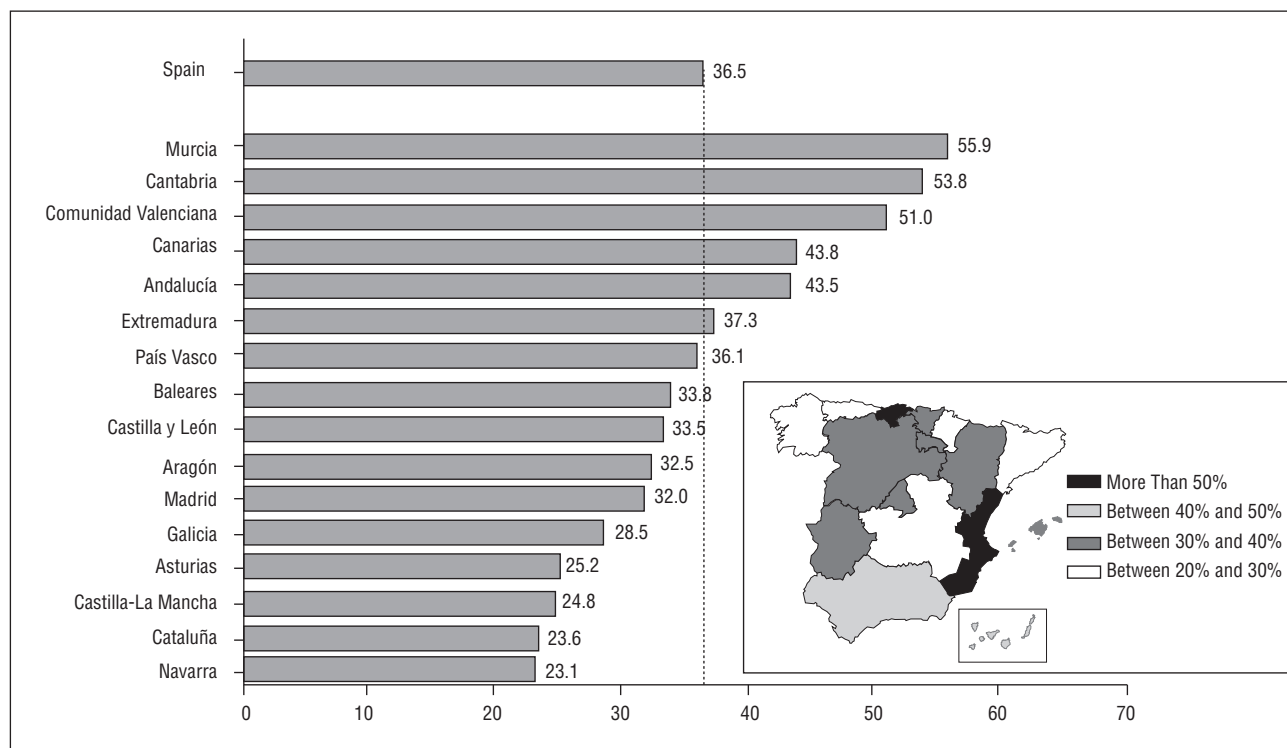
## Other Percutaneous Coronary Intervention Devices

Directional atherectomy was used in 3 procedures in 2 centers, exactly the same as in 2003, indicating the sparse use of this technique. Rotational atherectomy was used in 450 procedures in 33 centers, representing a 29% increase in use compared to 2003 (Table 2). The use of rotational atherectomy

TABLE 1. Evolution of Coronary Stenting Procedures (1997-2004)

	1997	1998	1999	2000	2001	2002	2003	2004
Centers, n	69	70	80	87	94	93	102	100
Procedures, n	7104	14 497	17 783	22 580	27 586	31 871	37 559	41 581
Stents implanted, n	14 170	19 378	22 946	29 504	39 356	47 249	57 778	68 892
Stents/procedure, n	1.24	1.34	1.3	1.3	1.43	1.48	1.53	1.53
Patients with stents/total PCI, n	47.3	61.5	71.9	77.3	88.1	91.7	92.5	
Drug-eluting stents, n	–	–	–	–	–	1906	11 699	25 148
Drug-eluting stents, %	–	–	–	–	–	4.1	20.2	36.5
Direct stenting procedures, n	–	–	–	8 778	11 280	13 768	11 577	27 018
Direct stenting procedures, %	–	–	–	38.9	40.9	43.2	30.8	32.9

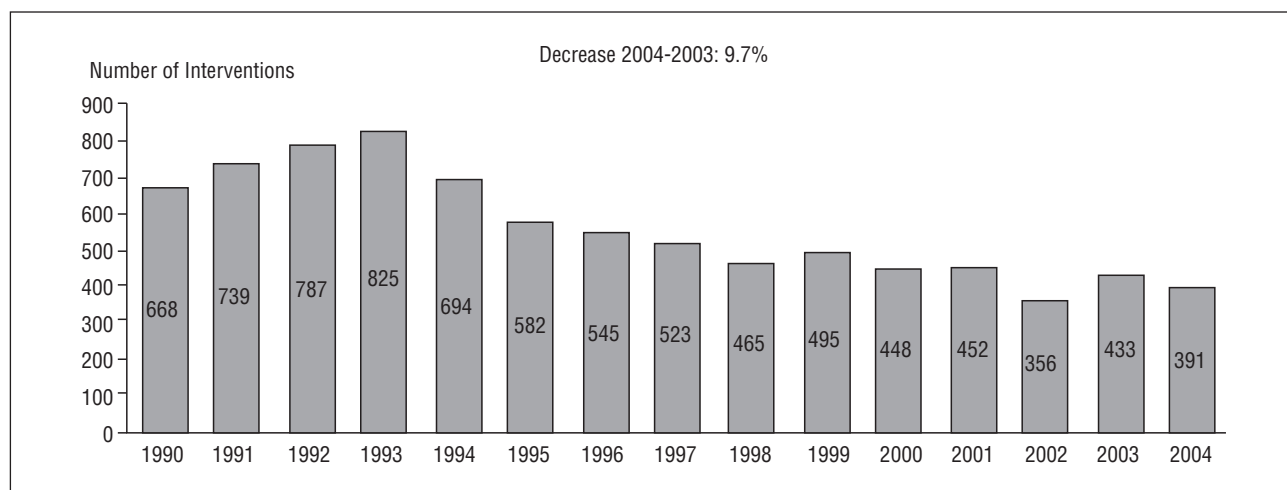




**Figure 11.** Distribution of the percentage of drug-eluting stents compared to the total number of stents implanted according to region.

has returned to the same level as in 2000. Regarding other PCI devices, it should be noted that cutting balloon was used in 1344 cases, an increase of 25%, and devices to extract thrombotic material in 1215 procedures (a 63% increase). The increase in thrombus extraction devices has been much higher than the increase in PCI for AMI; this implies not only a greater number of procedures in AMI, but also greater use of these devices in these types of procedures. The

use of distal embolic protection devices has remained close to 200 procedures (n=216), as in the 2 previous years. Ethanol ablation of the septal branch was carried out in 39 cases and fistula embolization in 16. Finally, the steady decrease in the use of brachytherapy in Spain compared to previous years should be highlighted. The 120 cases treated in 2002 dropped to 71 in 2003 and then to 55 in 2004. Some 58 restenotic lesions, but no de novo lesions, were



**Figure 12.** Evolution of the number of mitral valvuloplasty procedures between 1990 and 2004.

**TABLA 2. Evolution of Use of Rotational Atherectomy, Directional Atherectomy, Cutting Balloon, Thrombectomy, and Distal Protection (1995-2004)**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Rotational atherectomy										
Procedures	330	367	554	549	473	461	445	426	349	450
Centers	23	18	33	36	32	28	33	27	26	33
Directional atherectomy										
Procedures	186	96	92	81	52	57	114	19	3	3
Centers	23	12	8	6	5	4	9	4	3	2
Cutting balloon	–	–	–	71	93	176	423	638	1079	1344
Thrombectomy	–	–	6	10	4	108	329	499	743	1215
Distal protection	–	–	–	–	–	10	43	200	200	216

treated successfully without complications in 100% of cases.

### Non-Coronary Percutaneous Interventions in Adults

In 2004, 427 valvuloplasties were carried out in adults in 57 centers, representing an 8% decrease compared to 2003. This occurred due to the number of mitral valvuloplasties decreasing from 433 to 391, some 9.7% (Figure 12). In addition, 7 aortic valvuloplasties and 29 lung valvuloplasties were carried out.

Atrial septal defect closure was performed in 247 cases, representing a 7% decrease compared to the previous year. Success was achieved in 92.9% of cases, failure without complications in 6.7%, and failure with complications in 0.4%. There were 131 patent foramen ovale closures and another 36 procedures in adult patients with congenital defects. Some 60 renal artery dilatations were carried out plus 11 interventions for aortic coarctation, 6 for aneurysms of the abdominal aorta, 19 for aneurysms of the thoracic aorta, and 48 percutaneous myocardial stem-cell implantations.

### Percutaneous Intervention in Pediatric Patients

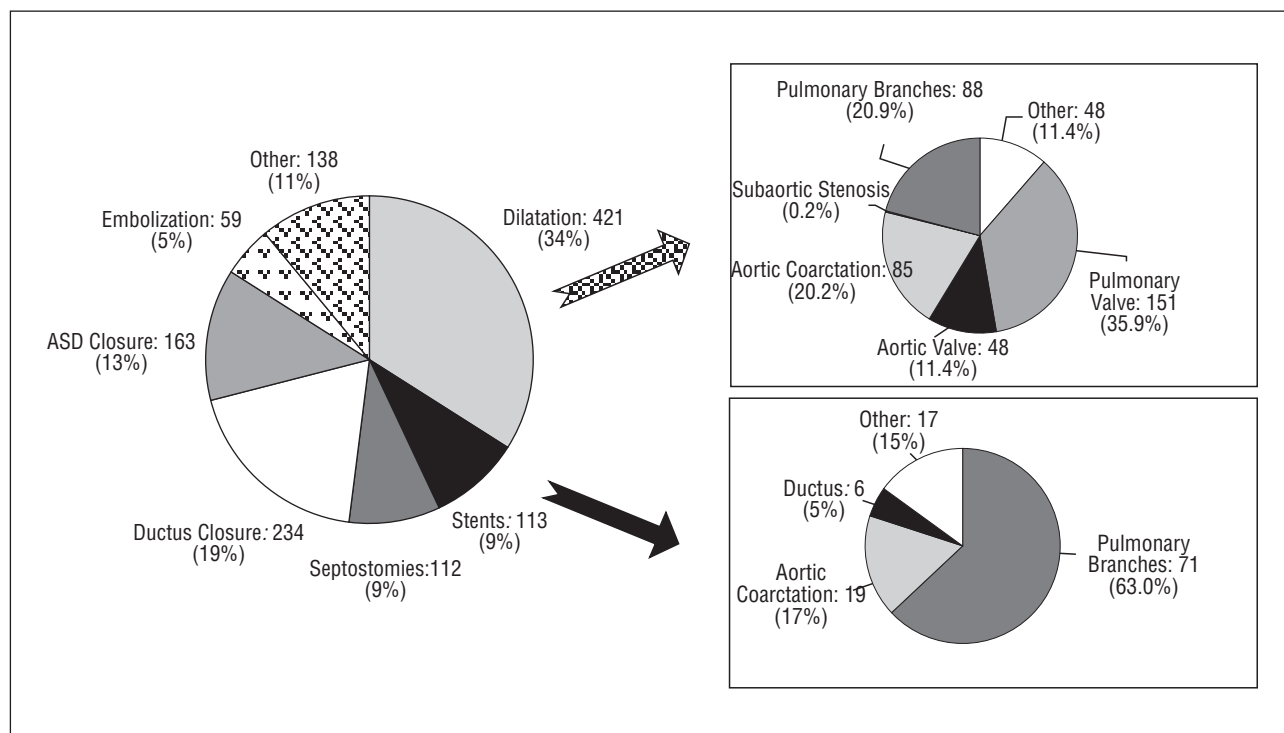
There were 1108 procedures in the pediatric age group in 21 centers, representing an 11.9% increase compared to 2003; these included dilatations (421 cases), atrial septal defect closure (n=163) and ductus closure (n=234). The most frequently used techniques are summarized in Figure 13.

## CONCLUSIONS

The preparation and presentation of the Annual Cardiac Catheterization and Coronary Intervention Registry is one of the most important tasks of the Spanish Society of Cardiology Working Group on Cardiac Catheterization and Interventional Cardiology.

The Working Group, both its board and members, consider the data presented in this registry to be of vital importance to professionals, health authorities, and the general public. These data allow a realistic approach to an important aspect of cardiovascular disease, as well as helping to improve the distribution of health resources in this field. In 2004, as in previous years, there have been increases in figures for diagnostic and therapeutic procedures in infarction, although these increases were lower than in previous years. In addition, a very large increase was observed in the percentage of procedures where the radial approach was used, especially in the case of diagnostic procedures. Despite these increases, most diagnostic and interventionist resource indexes continue to be clearly lower than those of the most developed European countries, especially if we take into account that the comparisons are based on outdated European references (2001), given the delay in publishing the information in these registries. Together with the disparity with certain European countries, there are still great differences between the various Spanish regions regarding diagnostic procedures and the different treatment methods. Up to the present, it has proved impossible to eliminate the differences in the rates of coronary angiography, cardiac catheterization, and cardiac catheterization procedures in AMI, and some regions have values strikingly below the national average.

Drug-eluting stents have been used in 36% of cases. This means that the replacement of conventional stents is far from complete, but indicates a strong increase in use during the second year of their introduction. Their use ranged between 56% and 23% among the different regions. There has been an increase in the use of atherectomy techniques due to rotational atherectomy. The use of directional atherectomy is so low in Spain that the figures contribute very little. For the third consecutive year, there has been a strong increase in the use of thrombectomy, with a percentage decrease in the use of distal embolization protection devices.



**Figure 13.** Distribution of pediatric cardiac catheterization procedures.

Finally, a slight decrease was seen in the number of mitral valvuloplasties and atrial septal defect closures. In contrast, in 2004, there were 131 foramen ovale closures, which have become a new field in PCI. Cardiac catheterization procedures grew by 12% in pediatric patients.

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**APPENDIX 1. Questionnaire for the Working Group on Cardiac Catheterization and Interventional Cardiology Registry. Year 2004\***

**1. DEMOGRAPHIC DATA**

- 1.1. † Hospital: .....
- 1.2. Address: .....
- 1.3. Postal code: .....
- 1.4. Province: .....
- 1.5. Telephone: ..... Extension: .....
- 1.6. Fax: .....
- 1.7. E-mail: .....
- 1.8. Laboratory director: .....
- 1.9. Contact physician (in charge of the data): .....
- 1.10. Name of interventionists working in the laboratory
 

.....	Part time/full time
.....	Part time/full time
.....	Part time/full time
.....	Part time/full time
.....	Part time/full time
.....	Part time/full time
.....	Part time/full time
- 1.11. Do you authorize the publication of the data contained in the section marked with a † in the Cardiac Catheterization Working Group Website? YES: ..... NO: .....

**2. LABORATORY DATA**

- †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 nursing staff: .....
- 2.5. Number of radiology/imaging technicians: .....
- 2.6. 24-h standby: ..... YES NO
- †2.7. Availability of cardiovascular surgery in the center: ..... YES NO
- †2.8. Availability of database concerning procedures: ..... YES NO

**3. DIAGNOSTIC PROCEDURES:**

- † 3.1. Total number of diagnostic procedures: .....
  - † 3.1.1. Number of coronary angiograms: .....
  - 3.1.2. Number of procedures in valvular heart disease patients: .....
  - 3.1.3. Number of endomyocardial biopsies: .....
  - 3.1.4. Number of adults with congenital heart disease: .....
  - 3.1.5. Number of pediatric patients: .....
  - 3.1.6. Other: .....
- 3.2. Number of diagnostic procedures using the radial approach: .....

NOTE. The combination of right and left cardiac catheterization, whether or not accompanied by coronary angiography, is considered to be a single diagnostic procedure. A complete procedure in a valvular heart disease patient plus a coronary angiography is considered a single valvular heart disease procedure. An isolated coronary angiography in a valvular heart disease patient is recorded as a single coronary angiography. A biopsy plus a coronary angiography is a single procedure and should be recorded as a biopsy so as not to interfere with the coronary angiograms/PCI index. The total value of sections 3.1.1 to 3.1.6 should be the same as that of section 3.1 (total number of procedures).

*Continue next page*

**APPENDIX 1. Continuation**

4. OTHER CORONARY DIAGNOSTIC PROCEDURES
- 4.1. Quantitative angiography: . . . . . YES: NO:
  - 4.2. Number of intracoronary ultrasonography procedures: . . . . .
  - 4.3. Number of pressure guidewire procedures . . . . .
  - 4.4. Number of Doppler flow guidewire procedures . . . . .

These intracoronary procedures are not recorded separately within the total number of diagnostic or interventionist procedures. For example, a diagnostic coronary angiography accompanied by a pressure guidewire procedure only adds a single coronary angiography (3.1.1) and, logically, a single diagnostic procedure (3.1) will also add a single pressure guidewire procedure (4.3). A PCI with intravascular ultrasonography (IVUS) is a single catheterization procedure (5.1) and an intracoronary sonography procedure (4.2).

5. CORONARY CATHETERIZATION PROCEDURES
- †5.1. Total number of procedures<sup>a</sup>: . . . . .
  - 5.2. Number of multivessel procedures: . . . . .
  - 5.3. Number of procedures in the same session as diagnosis: . . . . .
  - 5.4. Number of restenosis procedures<sup>b</sup>: . . . . .
  - 5.5. Number of procedures treating at least one saphenous vein:
  - 5.6. Number procedures treating at least one mammary artery: . . . . .
  - 5.7. Number of procedures in left main coronary artery: . . . . .
    - 5.7.1 Protected: . . . . .
    - 5.7.2. Unprotected: . . . . .
  - 5.8. Number of procedures exclusively using balloon: . . . . .
  - 5.9. Number of catheterization procedures using the radial approach: . . . . .
  - 5.10. Number of procedures using glycoprotein IIb/IIIa inhibitors: . . . . .
    - 5.10.1. Abciximab: . . . . .
    - 5.10.2. Eptifibatide: . . . . .
    - 5.10.3. Tirofiban: . . . . .
  - 5.11. Number of procedures using ion contrast enhancement . . . . .
  - 5.12. Number of procedures using non-ion contrast enhancement: . . . . .
  - 5.13. Number of treated vessels<sup>c</sup>: . . . . .
  - 5.14. Number of lesions treated: . . . . .
  - 5.15. Results of coronary catheterization 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. Non-fatal AMI: . . . . .
      - 5.15.3.2. Emergency surgery (24 h): . . . . .
      - 5.15.3.3. Death secondary to the procedure: . . . . .
      - 5.15.4. Number of hospital deaths: . . . . .

<sup>a</sup>The attempt to treat one or more coronary lesions is recorded as a therapeutic coronary catheterization procedure whenever the introduction of a guidewire in a coronary artery is attempted. Whatever the number of devices used in the same procedure (stent, IVUS, atherectomy, etc) it will be recorded as a single procedure.

<sup>b</sup>At least 1 of the lesions treated in a session is restenotic.

<sup>c</sup>By convention the following are considered to be vessels: left main coronary artery, left anterior descending artery, circumflex artery, right coronary artery, and every arterial graft (a patient with native arteries can only be treated in 4 vessels).

6. SUPPORT METHODS FOR CARDIAC CATHETERIZATION
- 6.1. Number of procedures using intraaortic balloon counterpulsation: . . . . .
  - 6.2. Number of procedures using heart-lung bypass: . . . . .

*Continue next page*

**APPENDIX 1. Continuation**

**7. CARDIAC CATHETERIZATION IN ACUTE MYOCARDIAL INFARCTION**

- † 7.1. Total number of procedures in AMI (including patients in cardiogenic shock)<sup>a</sup>:
  - 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 in the total of AMI with criteria for reperfusion treatment.
- 7.2. Results of cardiac catheterization in AMI (total, 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 procedures using stent: .....
- 7.4. Number of procedures exclusively using balloon: .....
- 7.5. Number of procedures using glycoprotein IIb/IIIa inhibitors: .....
- 7.6. Number of procedures using thrombus extraction devices: .....
- 7.7. Number of protective distal embolization procedures: .....
- 7.8. Number of patients in cardiogenic shock within the first 24 h of AMI: .....
- 7.9. Results of cardiac catheterization 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: .....

<sup>a</sup>PTCA performed in the acute phase of AMI (first 12 h) without previous administration of thrombolytic agents.

<sup>b</sup>PTCA performed in the acute phase of AMI after administration of thrombolytic agents due to clinical suspicion of reperfusion failure with thrombolysis.

<sup>c</sup>Elective PCI performed in the first 3 h after thrombolysis and administration of a glycoprotein IIb/IIIa inhibitor.

<sup>d</sup>Elective PCI performed between the first 3 h and 24 h after successful thrombolysis and administration of a glycoprotein IIb/IIIa inhibitor.

**8. CORONARY STENT**

- 8.1. Total number of stenting procedures<sup>a</sup>: .....
- 8.2. Total number of stents implanted: .....
- 8.3. Total number of stents implanted without predilatation: .....
- 8.4. Total number of procedures without predilatation<sup>b</sup>: .....
- 8.5. Number of drug-eluting stents (active coating): .....

<sup>a</sup>The procedure is defined in the same way as the cardiac catheterization procedure (5.1).

<sup>b</sup>All lesions treated without predilatation in one session.

**9. OTHER CORONARY 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 extraction devices: .....
- 9.7. Distal embolization protection devices: .....
- 9.9. Radiofrequency balloon: .....
- 9.10. Ultrasound therapy: .....
- 9.11. Cutting balloon: .....
- 9.12. Other special balloons (with protrusions, guidewire): .....
- 9.13. Fistula embolization: .....

<sup>a</sup>All procedures are included whether within the AMI context or not.

**10. OTHER NON-CORONARY PROCEDURES/DEVICES.**

- 10.1. Transmyocardial laser: .....
- 10.2. Septal myocardial ablation: .....
- 10.3. Percutaneous perfusion of stem cells: .....
- 10.4. Stent implantation in aorta: .....
- 10.4.1. Abdominal: .....
- 10.4.2. Thoracic: .....
- 10.5. Dilatation of renal arteries: .....

*Continue next page*

**APPENDIX 1. Continuation**

**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. BRACHYTHERAPY**  
 12.1. Total number of procedures: .....  
     12.1.1. Beta: .....  
     12.1.2. Gamma: .....  
 12.2. Total number of treated lesions: .....  
     12.2.1. De novo: .....  
     12.2.2. Restenotic: .....  
 12.3. Initial results: .....  
     12.3.1. Total number of successful procedures: .....  
     12.3.2. Total number of failed procedures without complications: .....  
     12.3.3. Total number of major complications: .....  
         12.3.3.1. Death: .....  
         12.3.3.2. Non-fatal AMI: .....  
         12.3.3.3. Surgery: .....

**13. CARDIAC CATHETERIZATION IN ADULT VALVULAR HEART DISEASE PATIENTS**  
*Percutaneous mitral commissurotomy:* .....  
 13.1. Total number of procedures:  
 Results  
     13.1.1. Success:  
     13.1.2. Failure without complications  
     13.1.3. Complications:  
         13.1.3.1. Heart block:  
         13.1.3.2. Severe mitral regurgitation:  
         13.1.3.3. Ictus:  
         13.1.3.4. Death:  
*Aortic valvuloplasty:*  
 13.2. Total number of procedures: .....  
 Results  
     13.2.1. Success: .....  
     13.2.2. Failure without complications: .....  
     13.2.3. Complications: .....  
         13.2.3.1. Severe aortic valve failure: .....  
         13.2.3.2. Ictus: .....  
         13.2.3.3. Death: .....  
*Pulmonary valvuloplasty:*  
 13.3. Total number of procedures: .....  
     13.3.1. Success: .....  
     13.3.2. Failure without complications: .....  
     13.3.3. Complications:  
         13.3.3.1. Heart block:  
         13.3.3.2. Death:

**14. PROCEDURES IN ADULT CONGENITAL HEART DISEASE PATIENTS**  
*ASD closure:*  
 14.1. Number of ASD closures: .....  
     14.1.1. Success: .....  
     14.1.2. Failure without complication: .....  
     14.1.3. Complications: .....  
         14.1.3.1. Death: .....  
         14.1.3.2. Other: .....  
 14.2. Number of aortic coarctation procedures: .....  
 14.3. Number of permeable foramen ovale closure procedures: .....  
 14.4. Number of other procedures in adults with congenital heart disease (specify): .....

*Continue next page*



**APPENDIX 1. Continuation**

<b>15. PROCEDURES IN PEDIATRIC PATIENTS</b>	
15.1. Number of dilatations: .....	
15.1.1. Pulmonary valve: .....	
15.1.2. Aortic valve: .....	
15.1.3. Aortic coarctation: .....	
15.1.4. Subaortic stenosis: .....	
15.1.5. Pulmonary branches: .....	
15.1.6. Other dilatations: .....	
15.2. Number of stent implantations: .....	
15.2.1. Pulmonary artery branches: .....	
15.2.2. Aortic coarctation: .....	
15.2.3. Ductus: .....	
15.2.4. Other locations: .....	
15.3. Number of atrial septostomies: .....	
15.3.1. In ICU: .....	
15.3.2. In catheterization laboratory: .....	
15.4. Ductus closure: .....	
15.5. ASD closure: .....	
15.6. Embolizations: .....	
15.7. Other: .....	
<b>16. OBSERVATIONS AND COMMENTS:</b>	
.....	
.....	
	Signed:
	DATE:

\*PCI indicates percutaneous coronary intervention; AMI, acute myocardial infarction; PTCA, percutaneous transluminal coronary angioplasty; ASD, atrial septal defect; ICU, intensive care unit.

**APPENDIX 2. Registry of the Findings of the Working Group on Cardiac Catheterization and Interventional Cardiology. Laboratories Participating in 2004**

**ANDALUCÍA**

- Almería*  
Hospital Torrecárdenas de Almería
- Cádiz*  
Clínica ASISA Jerez  
Clínica Nuestra Señora de la Salud  
Hospital de Jerez de la Frontera  
Hospital Universitario de Puerto Real  
Hospital Universitario Puerta del Mar
- Córdoba*  
Hospital Universitario Reina Sofía y Cruz Roja
- Granada*  
Hospital Universitario Virgen de las Nieves
- Huelva*  
Hospital Juan Ramón Jiménez
- Jaén*  
Complejo Hospitalario Ciudad de Jaén
- Málaga*  
Clínica El Ángel  
Clínica Parque San Antonio  
Clínica Santa Elena  
Complejo Hospitalario Carlos Haya  
Hospital Clínico Universitario Virgen de la Victoria  
Hospital Costa del Sol Marbella
- Sevilla*  
Hospital de Valme  
Hospital Universitario Virgen del Rocío  
Hospital Universitario Virgen Macarena

**ARAGÓN**

- Zaragoza*  
Hospital Clínico Universitario Lozano Blesa  
Hospital Universitario Miguel Servet

**CANARIAS**

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

**CANTABRIA**

- Hospital Universitario Marqués de Valdecilla

**CASTILLA Y LEÓN**

- León*  
Hospital de León
- Salamanca*  
Hospital Universitario de Salamanca
- Valladolid*  
Hospital Campo Grande  
Hospital Clínico Universitario de Valladolid

**CASTILLA-LA MANCHA**

- Albacete*  
Hospital General de Albacete  
Ibérica de Diagnóstico y Cirugía
- Guadalajara*  
Hospital General de Guadalajara
- Toledo*  
Hospital Virgen de la Salud

## CATALUÑA

### *Barcelona*

Centre Cardiovascular Sant Jordi  
Centro Médico Teknon  
Ciutat Sanitaria i Universitaria de Bellvitge. L'Hospitalet de Llobregat  
Clínica La Alianza. ANGIOCOR  
Clínica Quirón  
Clínica Sagrada Familia. UCRISA  
Hospital Clínic y Provincial de Barcelona  
Hospital de Barcelona. SCIAS  
Hospital de la Santa Creu i Sant Pau  
Hospital del Mar  
Hospital General de Catalunya  
Hospital General Vall d'Hebron  
Hospital Universitario Germans Trias i Pujol. Badalona

### *Girona*

Hospital Dr. Josep Trueta

### *Tarragona*

Hospital Juan XXIII

## COMUNIDAD DE MADRID

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

## COMUNIDAD FORAL DE NAVARRA

Clínica Universitaria de Navarra  
Hospital de Navarra

## COMUNIDAD VALENCIANA

### *Alicante*

Hospital Clínica Benidorm  
Hospital General Universitario de Alicante  
Hospital General Universitario de Elche  
Hospital de San Jaime. Torrevieja  
Hospital de San Juan  
Sanatorio Perpetuo Socorro

### *Castellón*

Hospital General de Castellón

### *Valencia*

Hospital Clínico Universitario de Valencia  
Hospital de la Ribera. Alzira  
Hospital General Universitario de Valencia  
Hospital Nueve de Octubre. GESNOU S.A.  
Hospital Universitario Dr. Peset  
Hospital Universitario La Fe  
Hospital Virgen del Consuelo

## EXTREMADURA

### *Badajoz*

Hospital Universitario Infanta Cristina

### *Cáceres*

Clínica Virgen de Guadalupe

## GALICIA

### *La Coruña*

Complejo Hospitalario Juan Canalejo  
Complejo Hospitalario Universitario de Santiago de Compostela  
Instituto Médico-Quirúrgico San Rafael  
Sanatorio Quirúrgico Modelo

### *Pontevedra*

Hospital de Meixoeiro. MEDTEC. Vigo  
Hospital PQVISA

## ILLES BALEARS

Clínica Rotger  
Hospital Universitario Son Dureta  
Policlínica Miramar  
Clínica Palmaplanas

### *Ibiza*

Clínica el Rosario

## PAÍS VASCO

### *Álava*

Hospital Txagorritxu. Vitoria

### *Guipúzcoa*

Policlínica Guipúzcoa. San Sebastián

### *Vizcaya*

Clínica V. San Sebastián. Bilbao  
Hospital de Basurto. Bilbao  
Hospital de Cruces. Baracaldo  
Hospital de Galdakao. Galdakao

## PRINCIPADO DE ASTURIAS

Centro Médico de Asturias  
Hospital Central de Asturias

## REGIÓN DE MURCIA

Clínica Nuestra Señora de la Vega  
Hospital Universitario Virgen de la Arrixaca  
Sanatorio San Carlos

## CENTROS CON ACTIVIDAD PEDIÁTRICA DIFERENCIADA

### *Barcelona*

Hospital Sant Joan de Déu  
Hospital Vall d'Hebron Infantil

### *Madrid*

Hospital La Paz Infantil  
Hospital Ramón y Cajal  
Hospital 12 de Octubre  
Hospital Gregorio Marañón

### *Málaga*

Hospital Materno Infantil. Complejo Carlos Haya

### *Murcia*

Hospital Universitario Virgen de la Arrixaca

### *Sevilla*

Hospital Universitario Virgen del Rocío

### *Valencia*

Hospital Universitario La Fe

### *Zaragoza*

Hospital Universitario Miguel Servet