Spanish Registry on Cardiac Catheterization Interventions. 11th Official Report of the Working Group on Cardiac Catheterization and Interventional Cardiology of the Spanish Society of Cardiology (years 1990-2001)

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The results of the Spanish Registry of the Working Group on cardiac catheterization and Interventional Cardiology of the Spanish Society of Cardiology (years 1990-2001) are presented. One-hundred-and-three centers contributed data, all the cardiac catheterization laboratories in Spain; 97 centers performed mainly adult catheterization and 6 carried out only pediatric procedures.

In 2001, 95,430 diagnostic catheterization procedures were performed, with 79,607 coronary angiograms, representing a total increase of 8.4% over 2000. The population-adjusted incidence was 1947 coronary angiograms per 10^6 inhabitants.

Coronary interventions increased by 15.4% compared with 2000, with a total of 31,290 procedures and an incidence of coronary interventions of 761 per 10^6 inhabitants. Coronary stents were the most frequently used devices with 39,356 implanted in 2001, and increase of 33.4% over 2000. Stenting accounted for 88.2% of procedures. Direct stenting was done in 11,280 procedures (40.9%). IIb-IIIa glycoprotein inhibitors were given in 7,012 procedures (22.4%). Multivessel percutaneous coronary interventions were performed in 8,445 cases (27%) and interventions were performed *ad hoc* during diagnostic study in 23,144 cases (74 %).

A total of 3,845 percutaneous coronary interventions were carried out in patients with acute myocardial infarction, an increase of 22.9% over 2000 and 12.3% of all interventional procedures.

Among non-coronary interventions, atrial septal defect closure was performed more often (161 cases, a 60% increase over 2000). Pediatric interventions increased by 15.4% (from 817 to 943 cases).

Lastly, we would like to underline the high rate of reporting by laboratories, which allowed the Registry to compile data that are highly representative of hemodynamic interventions in Spain.

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

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Registro Español de Hemodinámica y Cardiología Intervencionista. XI Informe Oficial de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología (años 1990-2001)

Se presentan los resultados del Registro Español de la Sección de Hemodinámica y Cardiología Intervencionista de la Sociedad Española de Cardiología (años 1990-2001). Se han recogido datos de 103 centros, la práctica totalidad de los laboratorios del país, de los que 97 realizaron su actividad fundamentalmente en pacientes adultos y seis en pacientes pediátricos de manera exclusiva.

Se realizaron 95.430 estudios diagnósticos, con una cifra de 79.607 coronariografías, con un incremento de éstas del 8,4% respecto al año 2000, y una tasa de 1.947 coronariografías por millón de habitantes.

Se efectuaron 31.290 procedimientos de intervencionismo coronario, con un incremento del 15,4% respecto al año anterior y una tasa de 761 intervenciones por millón de habitantes. El *stent* intracoronario fue el dispositivo más empleado, en el 88,1% de los procedimientos, con 39.356 unidades utilizadas (incremento del 33,4%). El *stent* con carácter directo, sin predilatación, fue utilizado en 11.280 procedimientos, el 40,9% de los casos. Los inhibidores de la glucoproteína IIb/IIIa fueron utilizados en 7.012 procedimientos (22,4%). En 8.445 casos (27%) se efectuó un procedimiento en multivaso, y en 23.144 casos (74%) la intervención coronaria percutánea se llevó a cabo en la misma sesión que la coronariografía diagnóstica.

Se efectuaron 3.845 procedimientos de angioplastia en el infarto agudo de miocardio, lo que supone un 22,9% más respecto al año 2000 y el 12,3% del total de las intervenciones coronarias percutáneas.

En el intervencionismo no coronario destaca el incremento del número de cierres de comunicación interauricular en adultos (161 casos con un incremento del 60% respecto al año 2000). El intervencionismo pediátrico aumentó un 15,4% (de 817 a 943 casos).

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.*

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ABBREVIATIONS

PCI: percutaneous coronary intervention

INTRODUCTION

In the present article are presented the results of the activity Registry of the Working Group of Hemodynamics and Interventional Cardiology for 2001. With this report, the Registry celebrates its eleventh consecutive year of publication in the REVISTA ESPAÑOLA DE CARDIOLOGÍA.[1-10] As in previous years, data were received from almost all the hospitals with activity, both public and private. Consequently, we view this data as representative of the activity carried out in Spain.

METHODS

The registry data were collected by means of a questionnaire (Annex 1) sent to all the hemodynamics laboratories in the country. This questionnaire had some modifications with respect to previous questionnaires and could be completed by hard copy, computer diskette, or online through the web page of the working group. The Izasa Company collaborated in the distribution and collection of questionnaires and the Board of Directors of the working group was responsible for data analysis.

RESULTS

Infrastructure and resources

One hundred and three hospitals participated in this registry (Annex 2). This represents an increase of 3% with respect to last year. A total of 97 centers carry out their activity in adult patients (12 in both adult and pediatric patients) and 6 centers are exclusively pediatric.

Adult hospitals

The 97 adult centers have a total of 134 hemodynamic units, of which 117 (87%) are digital. The number of centers and laboratories in relation to the population was 2.36 centers and 3.26 units per million inhabitants, slightly lower than the mean values reported in the European registry of 1995[11] (2.5 and 3.4, respectively). Twenty-seven centers have two or more hemodynamic units. Eighty-six percent of the centers have some system of automatic coronary quantification. A total of 40 centers are private (41%) and the other 57 belong to the national health system (59%).

Ninety-seven percent of the hospitals have diagnostic and interventional activity, and 3% have only diagnostic activity. Sixty-four percent of the centers have a team on call 24 hours. Seventy-nine percent (77/97) perform cardiac surgery. This percentage has decreased for two consecutive years due to the opening of new units without surgical facilities. In 17 centers, interventions without cardiac surgery are performed in the hospital.

With respect to staff, 273 physicians work in these laboratories (2.8/center; range, 1-7), an increase of 9.2% with respect to last year. There are 6.6 especialistas/10^6 inhabitants, which is lower than the mean of 8 specialists/10^6 inhabitants in the European registry of 1995.[11] The number of nurses/radiological technicians was 410 (332/78, respectively), with a mean of 4.2 per center (range, 1-14).

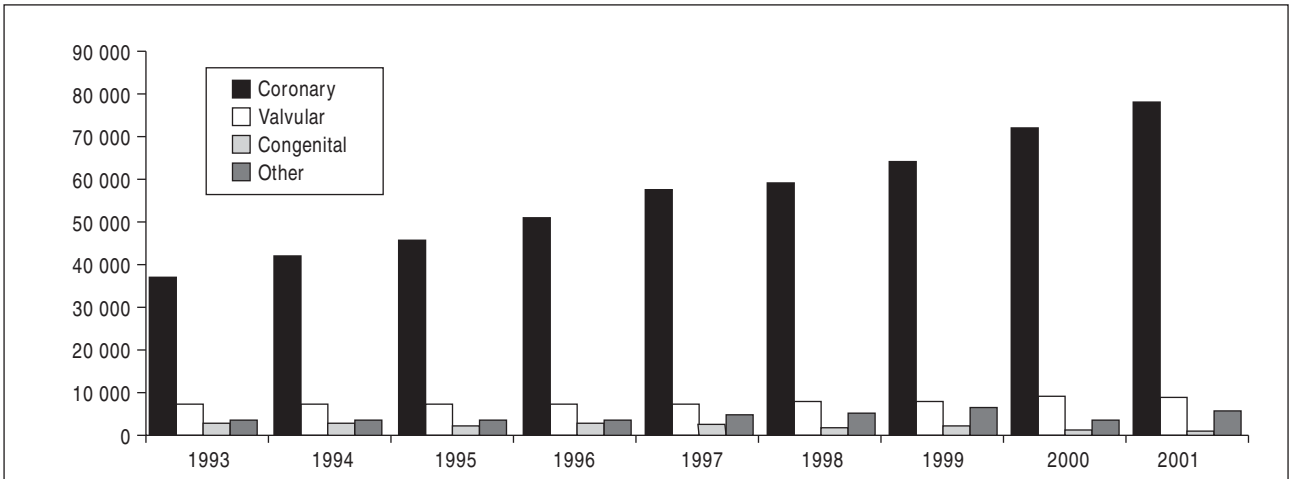
Pediatric hospitals

Six centers have only pediatric activity, with 7 units (all digital). All perform interventions and 5 of them (83%) have a team on call 24 hours. The total staff consists of 12 physicians (2/center, range, 1-3) and 10 nurses/radiological technicians (1.6/center; range, 1-3).

Diagnostic activity

In 2001, 95 430 diagnostic studies were performed in Spain, which is an increase of 8% with respect to 2000.[10] Of these procedures, 79 607 were coronariographies, which showed an increase of 8.4%. The frequency of coronariography was 1947/10^6 inhabitants. The distribution of diagnostic studies in 2001 and their evolution in the last 9 years are shown in Figure 1. Aside from the increase in the number of coronariographies, it should be noted that there was a decrease in the number of diagnostic studies in pediatric patients. The radial approach was used in 1685 procedures (2.1%) and percutaneous vascular closure devices (including diagnostic and therapeutic procedures) in 9331 cases, of which 5936 (64%) used collagen and 3250 (35%), suture.

Eleven centers (11.3%) carried out more than 2000 coronariographies/year, 41 centers (42.2%) carried out more than 1000 coronariographies/year, and 32 centers (32.9%) performed fewer than 500 coronariographies/year (Figure 2). Five hundred ninety-four coronariographies were made per hemodynamics unit, lower than the last available overall European figure (1995,[11] 709 coronariographies/unit), but an increase of 2% with respect to 2000. The number of coronariographies per operator and year, 291, remained stable. The data for 2000 from some neighboring countries are shown in Table 1 (courtesy of Dr. Bernhard Meier), in



Coronary	37 591	41 887	45 623	51 661	57 960	59 321	65 234	73 382	79 607
Valvular	6 951	7 476	6 872	6 761	7 681	8 084	8 426	9 532	9 452
Congenital	2 377	1 832	1 710	1 805	2 191	2 094	2 248	1 328	531
Other	3 081	3 974	3 568	3 734	4 538	4 865	6 897	4 097	5 840
Total	50 000	55 169	57 773	63 961	72 370	74 364	82 805	88 339	95 430

Fig. 1. Evolution of the number and type of diagnostic studies performed between 1993 and 2001.

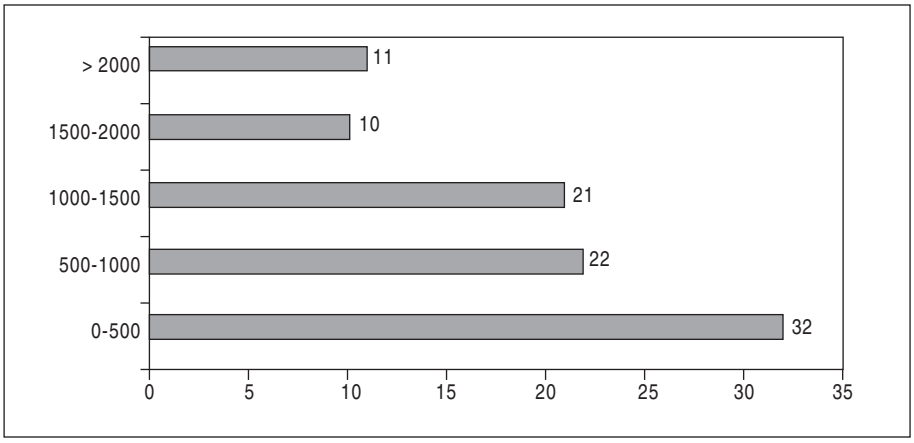


Fig. 2. Distribution of centers by the number of coronariographies.

which it is evident that in Spain fewer coronariographies/10^6 inhabitants and coronariographies per unit are performed than in countries like Germany, France, the United Kingdom, and Portugal, but the number of coronariographies per operator is similar.

A large variation was seen in the number of coronariographies per million inhabitants in the different autonomic communities of Spain. Data are shown by autonomic community in Table 2.

Among the intracoronary diagnostic techniques, the

TABLE 1. **Coronariographies and PCIs per million inhabitants, number of coronariographies and PCIs per unit and operator, and PCI/coronariography ratio in Spain and other European countries***

	Coronariography/10^6 inh.	PCI/10^6 inh.	PCI/operator	Coronariographies/operator	Coronariographies/unit	PCI/unit	PCI/coronariographies, %
Spain	1947	761	114	291	594	214	39
Portugal	2152	533	119	303	923	228	25
United Kingdom	2413	560	75	NA	833	193	23
France	3978	1548	NA	NA	NA	NA	39
Germany	7223	2193	180	334	1182	358	30

*European data for 2000, courtesy of Dr Bernhard Meier. PCI indicates percutaneous coronary intervention; NA, not available.

TABLE 2. **Coronariographies and angioplasties (PCI) per million inhabitants in different autonomic communities**

	Coronariography	PCI
Andalusia	1280	554
Aragón	1690	875
Asturias	1686	586
Balearic Islands	2015	912
Canary Islands	2078	1049
Cantabria	2306	1020
Castilla y León	1540	709
Castilla-La Mancha	1395	530
Catalonia	1854	646
Community of Madrid	3088	1087
Community of Valencia	2059	642
Extremadura	1314	472
Galicia	2045	764
Murcia	2004	1193
Navarre	2485	1027
Basque Country	2314	1068
National mean	1947	761

greatest increment was seen in intracoronary echography, of which 1655 procedures were made, with an increase of 37% with respect to last year. To a lesser extent, the use of intracoronary pressure guidewires also increased. There were 1330 cases with an increase of 12% with respect to 2000. An intracoronary Doppler guidewire was used in 110 cases and, for the third consecutive year, no angioscopic procedure was recorded (Figure 3).

Coronary intervention

In 2001, 31 290 percutáneas coronary interventions (PCI) were carried out, with an increase of 15.4% with respect to last year; 761 PCIs per million inhabitants (Figure 4) were carried out, more than in the last published European registry, 1996[12] (599 angioplasties/10^6 inhabitants). However, the number was much lower than in countries that were leaders in this field in 1996, like Germany (1358/10^6 inhabitants.[12] The mean number of interventions per center with inter-

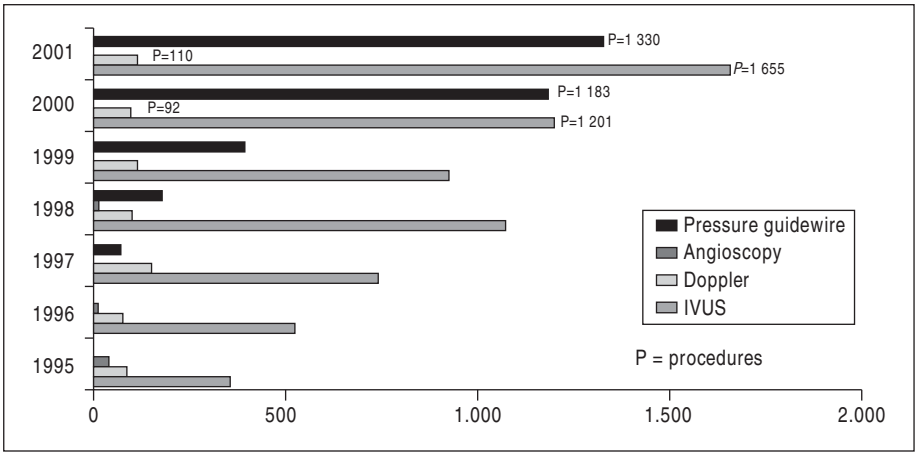


Fig. 3. Historical evolution (1995-2001) of intracoronary diagnostic techniques.

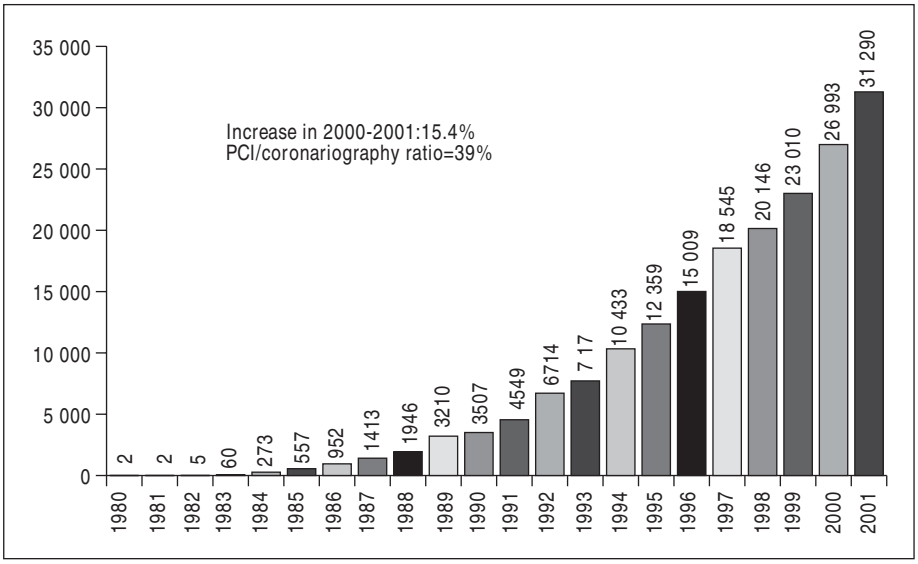


Fig. 4. Historical evolution of the number of PCI.

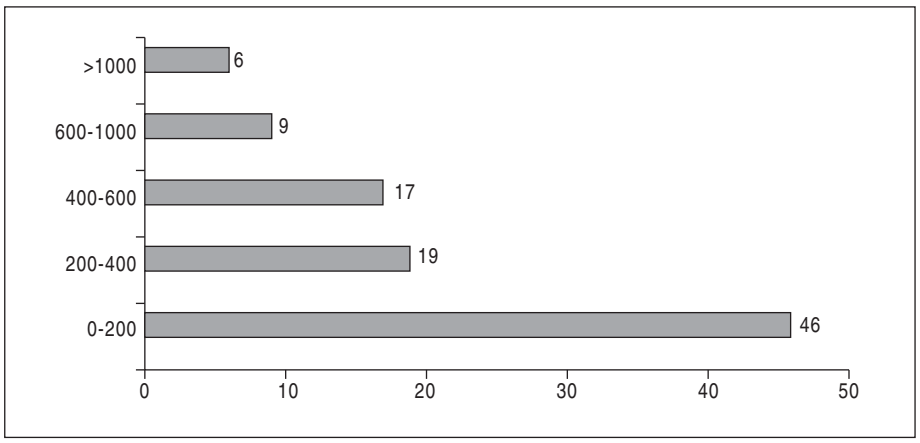


Fig. 5. Distribution of centers in relation to the number of PCIs.

ventional activity was 333 and the mean number per unit was 239 (the European mean in 1995 was 203).[11] The number of interventions per operator was 114 (European mean in 1995 of 78). In Table 1 are also shown the data of the countries mentioned above for interventional activity in 2000. It can be seen that due to the elevated PCI/coronariography ratio of Spain, we are at a higher level that Portugal or the United Kingdom in PCI/10^6 inhabitants, although distant from others like France or Germany.

The percentage of PCIs per coronariography in 2001 was 39% (37% in 2000). In 7.8% of cases, at least one restenotic lesion was approached during the procedure. In 8445 cases, multivessel PCI was performed (27%) and in 74% of cases (23 144), PCI was performed *ad hoc* in the diagnostic session. The radial approach to PCI was used in 1098 cases (3.5%).

The number of PCIs per center is shown in Figure 5. It should be noted that, despite the increase in the number of centers, 47.4% of the centers performed fewer than 200 interventions/year, and 67% less than 400. The number of PCIs per million inhabitants in the different autonomic communities is shown in Table 2, maintaining the differences already observed in the diagnostic studies.

In 7012 procedures, glycoprotein IIb/IIIa inhibitors were used as coadjuvant pharmacological treatment, which was an absolute (49%) and relative increase (22.4% of interventions vs 17% in 2000 and 12.4% in 1999). Abciximab was used in 71.1%, tirofiban in 16.1%, and eptifibatide in 12.8%. However, the use of support methods with the interventions continues to be low, intra-aortic balloon counterpulsation being used in 581 cases and percutaneous cardiopulmonary bypass in 7 cases.

With respect to the overall results of coronary intervention, figures are similar to earlier years, 94.5% success, 3.2% uncomplicated failure, and 2.3% failure with complications, including 1% mortality (54% in cardiogenic shock), 1.2% acute myocardial infarction, and 0.08% emergency surgery.

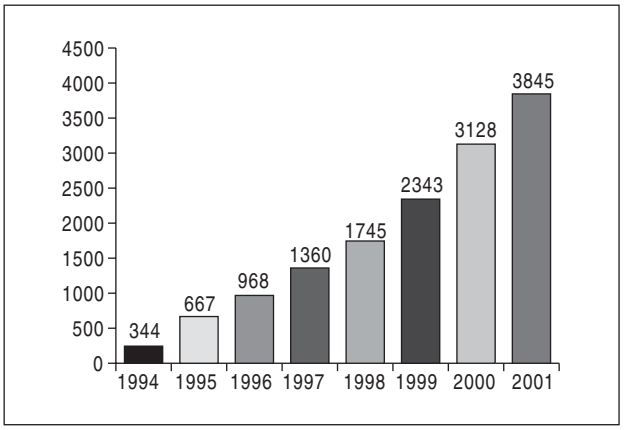


Fig. 6. PCI in acute myocardial infarction. Historical evolution (1994-2001).

Intervention in acute myocardial infarction

Three thousand eight hundred forty-five PCI procedures were performed in acute myocardial infarction, which was an increase of 22.9% with respect to 2000 and of 12.3% for all interventional procedures (Figure 6). Of these cases, 59.7% were primary angioplasties (68.7% in 2000 and 76.4% in 1999), 28.7% rescue (31.3% in 2000) and 11.5% facilitated (elective in the first 24 h of acute infarction, after thrombolytic treatment, Figure 7). Excluding the cases of rescue and facilitated angioplasty, 2297 primary angioplasties were performed, with an increase with respect to last year of 148 cases (6.8%), less than the percent increase in PCIs overall. If we consider that it is estimated that about 41 000 patients/year would be hospitalized for acute myocardial infarction in Spain,[13] although not all meet the requisite for treatment with primary angioplasty, only a small percentage would benefit from this technique, in spite of clear evidence of its benefit.[14,15]

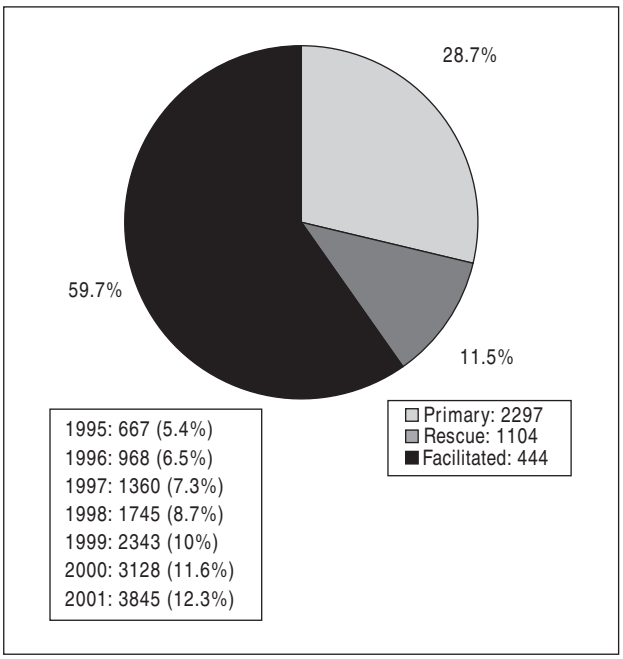


Fig. 7. PCI in acute myocardial infarction. Distribution among primary, rescue, or facilitated and percentage of total PCIs since 1995.

Only 10 centers performed more than 100 PCIs in the acute phase of myocardial infarction. Fifty centers performed fewer than 25 procedures/year (Figure 8). In a situation of cardiogenic shock, 501 angioplasties were performed, 13% of the cases in acute infarction (8.7% last year). In these cases of cardiogenic shock the mortality was 29%.

Stents

Stents have been the most frequently used devices in coronary interventions. Stents were used in 27 586 procedures and in 88.1% of the coronary interventions. This is an increase of 5006 cases (22.1%) with respect to 2000. In addition, 88.1% of the PCIs were performed with stents vs 77.2% in 2000. The stent/procedure relation was 1.25. The evolution of stent implantation in recent years is shown in Table 3.

Stents were implanted in 966 grafts, 85.9% saphenous and 14.1% mammary; 343 stents were implanted in the trunk of the left coronary, protected in 38.8% of cases and unprotected in 61.2%.

Finally, 11 280 stent procedures were made directly, without balloon pre-dilatation, in 40.9% of cases vs 8778 (38.9%) last year.

Other percutaneous intervention devices

In spite of the hegemony of coronary stent, other percutaneous intervention devices are used. Of them, the balloon was the only device used in PCI in 2385 cases (7.2%), vs 17.3% last year. Directional atherectomy was used in 114 procedures in 9 centers, double the number of the previous year, and rotational atherectomy in 445 cases in 33 centers, which was a decrease of 3.5% with respect to last year (Table 4). Among other PCI devices, the increase in the use the cutting balloon, which was applied in 423 cases (240% increment), and thrombus extraction devices, used in 329 procedures (304% increment), should be highlighted. Other techniques used were distal protection devices (43 cases), transmyocardial laser (8 cases), alcoholization of the septal branch (20 cases), and fistula embolization (14 cases).

Finally, the use of beta system brachytherapy increased in 2001. From 23 cases treated in 2000, in 2001 there were 105 patients with 107 lesions treated, 33 *de novo* and 74 restenoses. Success was achieved in 97%, with 2% of non-fatal AMI and 1% mortality.

Non-coronary interventions in adults

In 2001, 478 valvuloplasties were performed in adults at 52 centers, a decrease of 2.9% with respect to 2000 (Figure 9). There was no significant variation in the number of mitral valvuloplasties, of which 452 were performed. In addition, 9 aortic valvuloplasties and 17 pulmonary valvuloplasties were carried out.

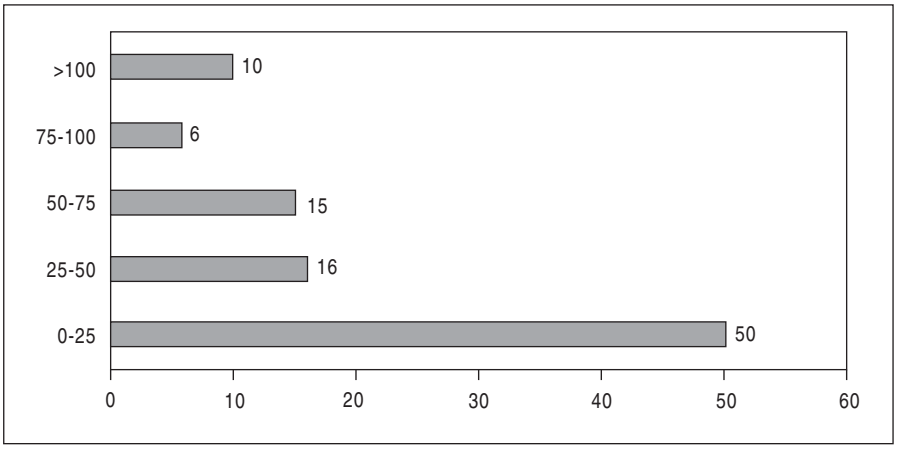


Fig. 8. PCI in acute myocardial infarction. Distribution of centers by number of procedures performed.

Table 3. **Evolution of coronary stent (1996-2001)**

	1996	1997	1998	1999	2000	2001
Centers	66	69	70	80	87	94
Procedures	3418	7104	14 497	17 783	22 580	27 586
Unit implanted	8873	14 170	19 378	22 946	29 504	39 356
Stents/procedure	1.26	1.24	1.34	1.3	1.27	1.43
Percentage of cases with stent/total PCIs	27.6	47.3	61.5	71.9	77.3	88.1

Table 4. **Evolution of rotational and directional atherectomy (1995-2001)**

	1995	1996	1997	1998	1999	2000	2001
Rotational atherectomy							
Procedures	330	367	554	549	473	461	445
Centers	23	18	33	36	32	28	33
Directional atherectomy							
Procedures	186	96	92	81	52	57	114
Centers	23	12	8	6	5	4	9

In the 452 cases of mitral valvuloplasty, a 93.2% success rate was obtained, with 3.3% uncomplicated failures and 3.5% major complications (3.1% severe mitral insufficiency, 0.2% cardiac tamponade, and 0.2% deaths).

Atrial septal defect was closed with a percutaneous device in 161 cases, an increase of 60% over the year before. The procedure was successful in 126 cases (89.4%), with uncomplicated failures in 13 (9.2%) and complications in 2 (1.4%).

Interventions in pediatric patients

Although there was a decrease in the number of diagnostic cases with respect to the previous year for the second consecutive year, there was a large increase in the number of interventional procedures, with 943 procedures performed in 23 centers. This was an increase of 15.4% with respect to 2000 and included above all dilatations (347 cases), closure of atrial septal defects (134), and closure of ductus arteriosus (157). The techniques most often used are summarized in Figure 10.

CONCLUSIONS

One of the most important missions of the Working Group of Hemodynamics and Interventional Cardiology of the Sociedad Española de Cardiología is to present information about annual activity in Spain to the cardiological community.

In the area of ischemic heart disease there has been an increase in activity, both diagnostic and therapeutic, although the level of activity in Spain is still distant from that of more active countries, like France and especially Germany. However, the level of interventional

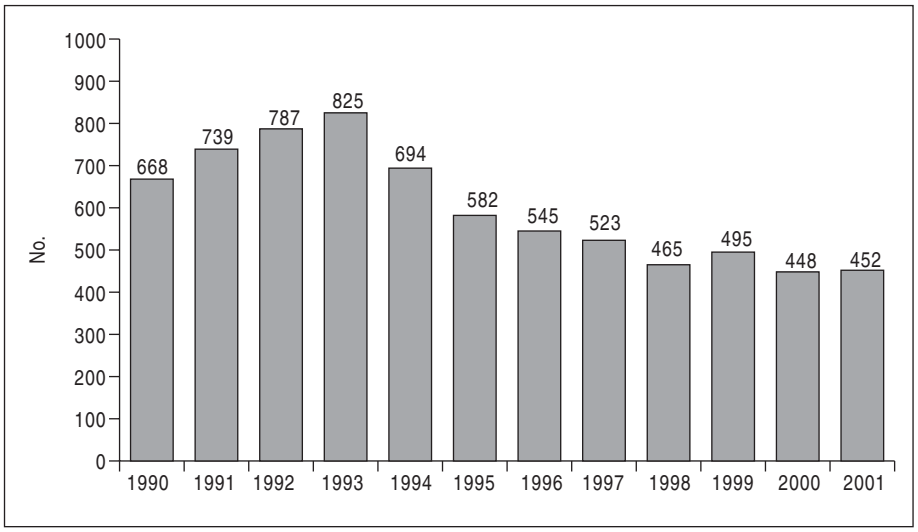


Fig. 9. Historical evolution of the number of mitral valvuloplasty procedures since 1990.

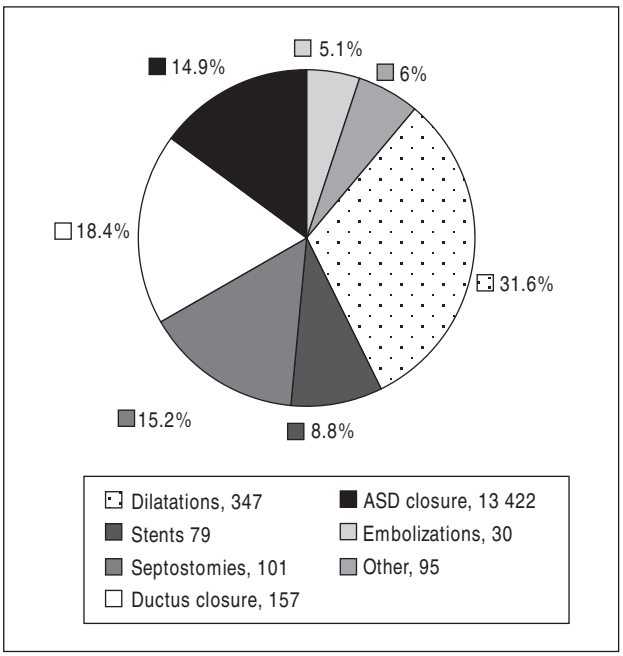


Fig. 10. Distribution of pediatric interventions.

activity is similar to or higher than that other European countries, like Portugal or the United Kingdom. There were no large differences in the number of coronariographies and PCIs per operator compared with the countries mentioned, but Spain had markedly fewer coronariographies per unit. When the number of PCIs per unit are considered, these differences decrease and even disappear since Spain has an elevated PCI/coronariography ratio. On the other hand, there was a large variability between autonomic communities in the number of procedures, whether diagnostic or therapeutic.

Among the diagnostic intracoronary techniques, the 37% increase in the use of intravascular echography with respect to the previous year is noteworthy and, to a lesser extent, the use of intracoronary pressure guidewires, which consolidated with an increase of 12% after a large increase in 2001.

With respect to interventional procedures, in 27% PCIs were performed in multiple vessels, with stents being implanted directly in 40.9% of cases and stents being used in 88.2% of the procedures. Glycoprotein IIb/IIIa inhibitors were used in 22.4%.

There was a growth of 22.9% in the use of angioplasty in acute myocardial infarction compared with 2000, although primary angioplasty increased by only 6.8%.

Finally, the number of valvuloplasties performed in adult patients stabilized, as a result of the stabilization of the number of mitral valvuloplasties. In contrast, a 15.4% increase in interventional activity in pediatric patients was recorded.

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ANNEX 1. **Questionnaire for the activity registry of the Working Group of Hemodynamics and Interventional Cardiology 2001**

Demographic data
Hospital: Address: Zip code: Province:
Telephone: Extension: Fax: E-mail:
Contact physician (responsible for data):
Laboratory data:
Number of units: Conventional: Digital:
Number of staff doctors:
Number of staff doctors who perform PTCA: No. of nurses: No. of radiology technicians:
On call 24 hours: Yes: No:
Availability of cardiovascular surgery at the center: Yes: No:
Availability of a database of activity: Diagnostic activity
Total number of diagnostic procedures: No. of coronariographies:
No. of studies in valve patients: No. of endomyocardial biopsies: No. of adults with congenital disease:
No. of pediatric patients: Others: No. of procedures via a radial approach:
The combination of right and left cardiac catheterization is considered a single diagnostic procedure, whether or not it is accompanied by coronariography. A complete study of a patient with valve disease to which coronariography is added is a study in a valve patient. An isolated coronariography in a patient with valve disease is recorded as a coronariography. A biopsy for which coronariography is made is a single procedure and should be recorded as a biopsy to avoid interfering with the coronariography/PTCA index.
Other diagnostic coronary studies
Quantitative angiography: Yes: No:
No. of studies with intracoronary echography: No. of studies with a pressure guidewire: No. of studies with a Doppler guidewire:
These intracoronary studies are not recorded separately among the total number of procedures. For example: a diagnostic coronariography accompanied by a pressure guide-wire study is a single procedure; a PTCA with IVUS is a single procedure.
Coronary interventional activity
Total no. of procedures:* No. of multivessel procedures:
No. of procedures performed in the same session as the diagnostic procedure: No. of procedures in restenosis:**
No. of procedures in saphenous vein: No. of procedures in mammary artery:
No. of procedures in trunk: Protected: Unprotected:
No. of exclusively balloon procedures: No. of procedures via a radial approach:
No. of procedures with anti-IIb/IIIa:
Abciximab: Eptifibatide: Tirofiban:
No. of procedures with ionic contrast: No. of procedures with non-ionic contrast:
Results:
Total no. of successful procedures: Total no. of procedures with uncomplicated failure:
Total no. of procedures with major complications: Non-fatal AMI:
Emergency surgery (24 hours): Hospital death:
*A coronary therapeutic procedure is an attempt to treat one or more coronary lesions, as long as an attempt is made to introduce a guidewire in a coronary artery. No matter how many devices are used in the procedure (stent, IVUS, atherectomy, etc), it is recorded as a single procedure. **At least one of the lesions treated in a session is restenotic.
Support measures for interventional procedures
No. of procedures with intra-aortic balloon counterpulsation:
No. of procedures with percutaneous cardiopulmonary bypass:
Interventional activity in acute myocardial infarction
Total no. of procedures in AMI:*
Primary PTCA: Rescue PTCA*: Facilitated PTCA: **
Results: Success without complications: Major complications:
Urgent surgery: Hospital death:
No. of cases in cardiogenic shock (within the first 24 hours of AMI):
Results: Success without complications: Major complications:
Urgent surgery: Death:
No. of procedures with stent: No. of exclusively balloon procedures:
No. of procedures with anti-IIb/IIIa: No. of procedures with thrombus extraction devices:
No. of procedures with distal protection devices:
*Rescue PTCA: after failed thrombolytic treatment in the first 24 hours post-IAM.
**Facilitated PTCA: elective after thrombolytic treatment (with or without anti-IIb/IIIa) in the first 24 hours post-IAM
Coronary stent
Total no. of procedures: Total no. of stents implanted:
Total no. of procedures without predilatation:* No. of coated stents:
*All lesions in the session treated without predilatation.

(continued)

ANNEX 1. **Questionnaire for the activity registry of the Working Group of Hemodynamics and Interventional Cardiology 2001** (continued)

Other devices/procedures		
Total no. of procedures:	Directional atherectomy:	Rotational atherectomy:
Other types of atherectomy:	Coronary laser:	Laser guide:
Transmyocardial laser:	Radiofrequency balloon:	Ultrasonic therapy:
Cutting balloon:	Thrombus extraction devices:	
Distal protection devices:	Percutaneous closure devices:	
With collagen:	With suture:	Others:
Ablation of the branch septal:	Fistula embolization:	Brachytherapy:
Total no. of procedures:	Beta:	Gamma:
Total no. of lesions approached:	De novo:	Restenotic:
Initial results:	Total no. of successful procedures:	Total no. of major complications:
Death:	Non-fatal AMI:	Surgery:
INTERVENTIONS IN ADULT VALVE PATIENTS		
Percutaneous mitral commissurotomy		
Total no. of procedures:	Results:	Success:
Complications:	Cardiac tamponade:	Severe mitral incompetence:
Stroke:	Death:	
Aortic valvuloplasty		
Total no. of procedures:	Results:	Success:
Complications:	Severe AI:	Stroke: Death:
Pulmonary valvuloplasty		
Total no. of procedures:	Results:	Success:
Complications:	Cardiac tamponade:	Death:
Procedures in adults with congenital heart disease		
ASD closure:	No. of procedures:	Success:
Uncomplicated failure:	Complications:	Aortic coarctation:
Other procedures in adults with congenital heart disease (specify):		
Therapeutic procedures in pediatric patients		
Dilatations:	Pulmonary valve:	Aortic valve:
Aortic coarctation:	Subaortic stenosis:	Pulmonary branches:
Other dilatations:	Stent implantation in:	Pulmonary artery branches:
Aortic coarctation:	Ductus:	Other locations:
Atrial septostomy in:	ICU:	Hemodynamics:
Ductus closure:	ASD closure:	Embolization:
Others:	Observations and commentaries	

ANNEX 2. **Activity registry of the Working group of Hemodynamics and Interventional Cardiology. Participating laboratories in 2001**

ANDALUCÍA
Cádiz
- Hospital Universitario Puerta del Mar
- Hospital Universitario de Puerto Real
- Clínica Nuestra Señora de la Salud

Córdoba
- Hospital Universitario Reina Sofía

Granada
- Hospital Universitario Virgen de las Nieves

Huelva
- Hospital Juan Ramón Jiménez

Jaén
- Hospital Universitario Ciudad de Jaén

Málaga
- Complejo Hospitalario Carlos Haya
- Hospital Universitario Virgen de la Victoria
- Clínica El Ángel
- Clínica Parque San Antonio
- Clínica Santa Elena

Sevilla
- Hospital Universitario Virgen Macarena
- Hospital Universitario Virgen del Rocío

ARAGÓN
Zaragoza
- Hospital Clínico Universitario
- Hospital Universitario Miguel Servet

ASTURIAS
- Hospital Central de Asturias
- Centro Médico de Asturias

BALEARES
- Hospital Son Dureta
- Policlínica Miramar
- Clínica Rotger

CANARIAS
Las Palmas
- Hospital de Gran Canaria Dr. Negrín
- Hospital Universitario Insular de Gran Canaria

Tenerife
- Hospital Universitario de Canarias
- Complejo Hospitalario Nuestra Señora de la Candelaria
- Hospiteal Rambla

CANTABRIA
- Hospital Universitario Marqués de Valdecilla

CASTILLA y LEÓN
León
- Hospital de León

Salamanca
- Hospital Universitario de Salamanca

Valladolid
- Hospital Universitario de Valladolid
- Centro Médico de Intervencionismo. Hospital de Valladolid

CASTILLA-LA MANCHA
Albacete
- Clínica Recoletas

Toledo
- Hospital Virgen de la Salud

CATALUÑA
Barcelona
- Ciutat Sanitaria i Universitària de Bellvitge. L'Hospitalet de Llobregat
- Hospital Clínic i Provincial de Barcelona
- Hospital de la Santa Creu i Sant Pau
- Hospital Universitario Germans Trias i Pujol. Badalona
- Hospital General Vall d'Hebron
- Hospital General de Catalunya
- Centre Cardiovascular Sant Jordi
- Centro Médico Teknon
- Clínica Corachan
- Clínica Quirón
- Hospital de Barcelona
- Clínica Sagrada Familia
- Hospital Sagrat Cor (Angiocor)

Gerona
- Hospital Dr. Josep Trueta

Tarragona
- Hospital Juan XXIII

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

COMUNIDAD VALENCIANA
Alicante
- Hospital General Universitario de Alicante
- Hospital de San Juan
- Sanatorio Perpetuo Socorro
- Hospital Clínica Benidorm

Castellón
- Hospital General de Castellón

Valencia
- Hospital Clínico Universitario
- Hospital General Universitario de Valencia
- Hospital Universitario La Fe
- Hospital Universitario Dr. Peset
- Hospital de la Ribera. Alzira
- Hospital Nueve de Octubre

EXTREMADURA
Badajoz
- Hospital Universitario Infanta Cristina

Cáceres
- Hospital Virgen de Guadalupe

(continued)

ANNEX 2. **Activity registry of the Working group of Hemodynamics and Interventional Cardiology. Participating laboratories in 2001** (continued)

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

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

NAVARRA
- Hospital de Navarra
- Clínica Universitaria de Navarra

PAÍS VASCO
Álava
- Hospital Txagorritxu

Guipúzcoa
- Policlínica Guipuzkoa

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

CENTROS CON ACTIVIDAD PEDIÁTRICA DIFERENCIADA
Barcelona
- Hospital Sant Joan de Deu

Madrid
- Hospital 12 de Octubre
- Hospital La Paz
- Hospital Ramón y Cajal

Sevilla
- Hospital Virgen del Rocío

Valencia
- Hospital Universitario La Fe