Changes in Percutaneous Coronary Intervention Over the Last 20 Years: Demographic, Epidemiologic and Clinical Characteristics, Techniques, and Outcomes

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Introduction and objectives. The aim of this study was to describe the changes observed in clinical practice in our interventional cardiology unit over the last 20 years.

Methods. Between January 1, 1986 and December 31, 2005, ≥17 204 percutaneous transluminal coronary angioplasties (PTCAs) were performed at our center. They were analyzed in four periods of 5 years each. After each procedure, prospective data on patient, procedural, and outcome variables were recorded. The data were analyzed with regard to when the procedure was performed, and the patients' sex and age (ie, < or ≥75 years). Data from 2006 were used as a reference, but were not included in the analysis.

Results. The number of PTCAs increased significantly. Over the time period, mean patient age increased (from 57 [10] years to 62 [12] years for males and from 66 [10] years to 70 [11] years for females), and there were significant increases in the proportions of women (from 16% to 22%) and patients aged >75 years (from 7% to 22%). Among men, the incidence of smoking decreased while that of hypertension, diabetes, and hyperlipemia increased. Among women, however, there was no change in risk factors. The numbers of urgent and emergent procedures (17% of PTCAs were for acute myocardial infarction in 2006) increased in both sexes and age groups, more ad hoc procedures were carried out, and more lesions were treated, usually with a stent. Over time, the success rate increased and the complication rate decreased in both sexes and age groups. In-hospital mortality for all procedures, except those for acute myocardial infarction, was 0.7% in males and 1.4% in females (*P*=.012).

Conclusions. Significant changes were observed over the last 20 years in the baseline characteristics of, the techniques used in, and the outcomes obtained in patients undergoing percutaneous coronary intervention.

Key words: *Coronary angioplasty. Coronary disease. Risk factors. Myocardial infarction. Revascularization. Sex. Stent. Age.*

Evolución en los últimos 20 años en el perfil demográfico, epidemiológico y clínico, técnica y resultados de los procedimientos coronarios percutáneos

Introducción y objetivos. Describir los cambios observados en la actividad clínica de nuestra unidad de cardiología intervencionista en los últimos 20 años.

Métodos. Desde el 1 de enero de 1986 al 31 de diciembre de 2005 se realizaron en nuestro centro 17.204 angioplastias (ACTP), que se han dividido en 4 períodos de 5 años cada uno. Tras cada intervención y de forma prospectiva se recogieron una serie de variables relacionadas con el paciente, la intervención y su resultado. Se describen estas variables y se analizan de acuerdo con el período de realización de la intervención, el sexo y el grupo de edad (< o ≥ 75 años) del paciente. Como referencia, y sin que forme parte del análisis, se incluyen los datos de 2006.

Resultados. El número de ACTP ha aumentado de forma significativa. En este tiempo se ha incrementado la edad de los pacientes (de 57 ± 10 a 62 ± 12 años en los varones y de 66 ± 10 a 70 ± 11 años en las mujeres), con un aumento (del 16 al 22%) en el porcentaje de mujeres y de mayores de 75 años (del 7 al 22%). En los varones se ha observado una reducción del tabaquismo y un aumento de la hipertensión arterial, la diabetes y la hiperlipemia, mientras que en las mujeres no se han modificado los factores de riesgo. Ha aumentado el número de procedimientos urgentes y emergentes (un 17% de ACTP en el infarto agudo de miocardio en 2006) en ambos sexos y grupos de edad, se realizan más ACTP ad hoc y se tratan más lesiones, generalmente con *stent*. La tasa de éxito se ha incrementado con el tiempo y la de complicaciones ha disminuido para ambos sexos y grupos de edad. La mortalidad intrahospitalaria de los procedimientos fuera del infarto agudo de miocardio fue en 2006 del 0,7% para los varones y del 1,4% para las mujeres (p = 0,012).

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Conclusiones. Se documentan cambios importantes en las características basales, la técnica realizada y los resultados obtenidos en pacientes con intervencionismo coronario.

Palabras clave: *Angioplastia coronaria. Enfermedad coronaria. Factores de riesgo. Infarto de miocardio. Revascularización. Sexo.* Stent. *Edad.*

ABBREVIATIONS

AMI: acute myocardial infarction
CA: coronary angiography
HBP: high blood pressure
PTCA: percutaneous transluminal coronary angioplasty

INTRODUCTION

Scientific and technological advances over the last 20 years have led to considerable changes in the way in which ischemic heart disease patients are diagnosed and treated.[1-3] Our center is a tertiary-level hospital which has provided interventional cardiology services since 1985; a registry of procedures performed has been kept since that time.

The objective of the present study was to describe coronary interventions carried out in our center since 1985. We include a description of baseline patient characteristics, the clinical context, the techniques used, and the outcomes obtained. Each of these aspects is analyzed according to the period in which the procedure was performed and by patient age and gender.

METHODS

Procedures

The coronary intervention program was set up in our hospital in 1985. From January 1, 1986 to December 31, 2005, a total of 61 862 diagnostic coronary angiographies (CA) and 17 204 percutaneous transluminal coronary angioplasties (PTCAs) were carried out. These were analyzed for a series of four 5-year periods which constitute the basis of this study. Procedures performed in 2006 were included as a reference though they are not included in the analysis.

Treatment Protocols for the Different Study Periods

There have been considerable changes over the study period in the diagnosis and treatment of patients with acute coronary syndromes. For each of the different study periods, Figure 1 outlines indications for CA and the priority assigned to each diagnostic procedure based on the patient's clinical condition. Until the mid-1990's, the approach to patients with unstable angina or non-Q wave infarction was to clinically stabilize the patient and, once the initial crisis had passed, to selectively perform CA in patients with recurrent angina or evidence of ischemia. From the mid-1990's on, a more invasive strategy was adopted in non-ST segment elevation acute coronary syndromes, with CA being performed systematically and earlier, ie in the first 2-4 days after the event up to year 2000, and in the first 24 hours since then. This was followed by PTCA when indicated. Likewise, until the year 2000, patients with acute myocardial infarction (AMI) and ST segment elevation were generally treated with fibrinolysis and received CA in cases of recurrent ischemia (spontaneous or induced). Immediate PTCA was only performed when fibrinolysis was contraindicated, had failed, if there was hemodynamic compromise, or if there was immediate

<table>
<tr><th>Clinical Situation</th><th>1986-1990</th><th>1991-1995</th><th>1996-2000</th><th>2001-2005</th></tr>
<tr><td>Stable Angina.
Silent Ischemia</td><td colspan="4">Programmed Coronary Angiograph</td></tr>
<tr><td>Unstable Angina.
Non-Q Wave AMI</td><td colspan="2">Urgent CA if Angina Recurrent
Selective Programmed
CA if Angina Absent</td><td>Systematic CA
at 2-4 Days</td><td>Systematic CA
at 24 Hours</td></tr>
<tr><td>AMI With
Elevated ST</td><td colspan="3">Fibrinolysis + Urgent CA if Recurrent Ischemia.
Fibrinolysis + Programmed CA if Induced Ischemia
Urgent CA (Elective Primary PTCA)</td><td>Systematic
Primary PTCA</td></tr>
</table>

Figure 1. Time at which coronary angiograph performed according to patient's clinical situation and study period.
CA indicates coronary angiograph; PTCA, coronary angioplasty; AMI, acute myocardial infarction.

availability in the hemodynamics unit. From 2001, primary PTCA became the usual reperfusion treatment for patients attending our center, while those attending other reference hospitals were generally treated with fibrinolysis and sent for urgent CA only when fibrinolysis was contra-indicated or had failed; the remaining patients would be sent for elective CA after 24-48 hours.

Data Collection

Data collected prospectively on patients after every PTCA included the presence of risk factors, cardiac history, the clinical indication for the procedure, the technique employed, and the initial outcome. Data on in-hospital events were entered for all patients on discharge and after reviewing discharge or inter-hospital transfer reports, or death certificates. Only variables collected systematically and consistently over the last 20 years are described in this paper. Data on PTCA in AMI were available from 2000 onwards (1708 procedures).

Definition of Variables

– Smoking: current smoker or smoker within the last 5 years

– High blood pressure: earlier diagnosis of high blood pressure, or receiving treatment for high blood pressure

– Diabetes mellitus: earlier diagnosis of diabetes mellitus, or receiving treatment for diabetes

– Hyperlipidemia: earlier diagnosis of hyperlipidemia or receiving lipid-lowering treatment

– Stable angina: pattern of stable angina of > 1 month duration

– Silent ischemia: ischemia determined by electrocardiographic or imaging techniques. Angina not present

– Unstable angina: newly appearing angina, progressive, resting, or prolonged in the month prior to PTCA without positive necrosis markers

– Non-Q wave AMI: prolonged pain accompanied by electrocardiographic changes and positive markers (creatine kinase [CK] or creatine kinase MB isoenzyme [CK-MB] to 1998, and troponin I since that time)

– AMI with elevated ST segment: PTCA (primary or rescue) performed within 12 h of onset of clinical event.

– Elective PTCA: not high priority; urgent PTCA: 24-48 hours; emergent: performed immediately

– Multi-vessel angioplasty: lesions treated in more than one of the 3 major epicardial arteries

– Angiographic success: residual stenosis in <30% of the treated vessel

– Major complication: death, infarction (2-fold elevation of CK or CK-MB), repeated revascularization of the same vessel, surgery required

Statistical Analysis

Continuous variables were expressed as means (standard deviations). Categorical variables were expressed as numbers and percentages. Variables were analyzed according to the period in which the procedure was performed, gender, and age group (< or ≥75 years) for each period. Student *t* test was used to compare between normally distributed continuous variables, a test of medians was used to compare variables with a non-normal distribution, and ANOVA was used to test for change over time. Categorical variables were compared using χ^2 and change over time was assessed using a test for linear trend. A *P*-value less than .05 was considered significant. Statistical analysis was performed in SPSS version 13.0.

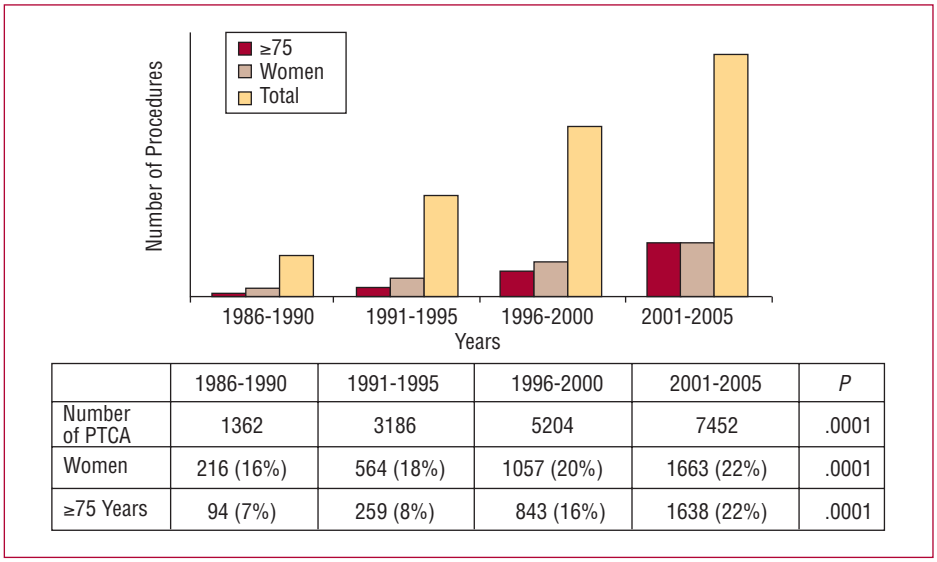
RESULTS

Of the 17 204 PTCAs performed, 20% (3500) were carried out in women and 17% (2834) in patients over 75 years of age. The number of procedures by period, sex, and age is shown in Figure 2. The proportion of women receiving the intervention increased considerably and the proportion of patients aged 75 years or over tripled. Figure 3 shows the increase in mean age in patients of both sexes for the different study periods. Figure 4 shows the classic risk factors by age, sex, and period; Figure 5 shows prior cardiac history and Figure 6 shows the clinical indication for PTCA. Table 1 shows the PTCA priority rating, the type of vessel treated, the technique used, the immediate outcome, and in-hospital events over the different study periods by gender. Table 2 provides data on the same variables for the 2 age groups, and Table 3 details the procedures performed in 2006. Figure 7 shows the change over time in the number of procedures performed immediately following AMI (first 12 hours from onset), distribution by sex and age, and the percentage of total PTCAs. Table 4 details the procedures performed immediately following AMI over the period 2001-2005.

DISCUSSION

The number of PCI procedures has increased considerably in Spain in recent years.[4]

The stabilization in the number of diagnostic catheterizations was accompanied by a 5% annual increase in the number of therapeutic procedures in our center stemming from broader indications for the intervention (more acute infarcts, more older patients). Patients receiving PTCA are increasingly older in Spain and in other countries.[5,6] In the series reported here, the increase in age was similar in men and women over time, which meant that the difference between them remained constant. Although the proportion of women receiving the interventions increased, it was still lower than the 34%



	1986-1990	1991-1995	1996-2000	2001-2005	*P*
Number of PTCA	1362	3186	5204	7452	.0001
Women	216 (16%)	564 (18%)	1057 (20%)	1663 (22%)	.0001
≥75 Years	94 (7%)	259 (8%)	843 (16%)	1638 (22%)	.0001

Figure 2. Number of angioplasties by study period, gender, and age group. Percentages are provided in the Table below the Figure.

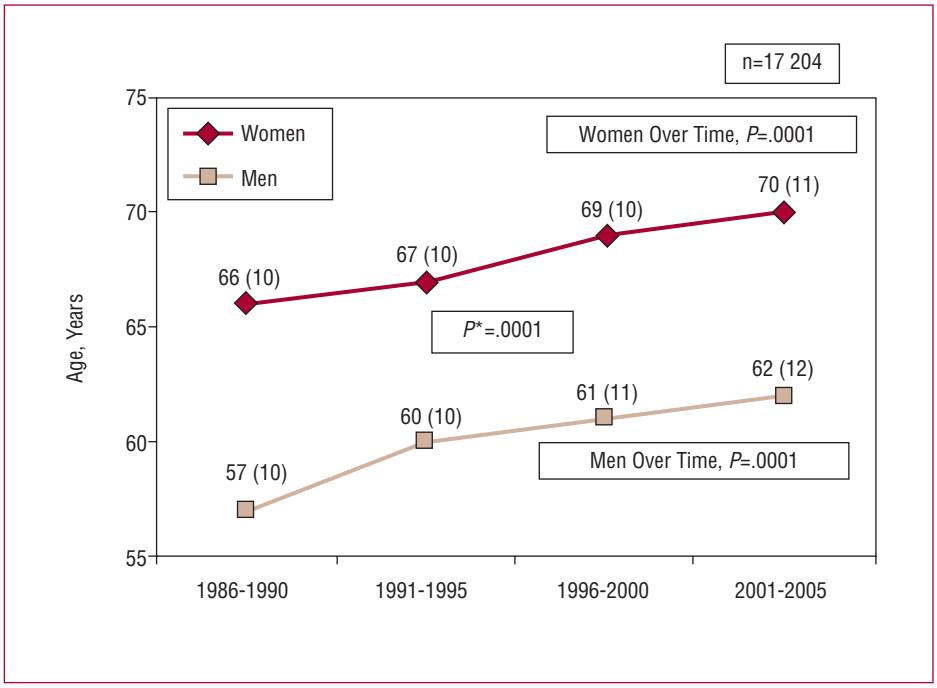


Figure 3. Mean age at angioplasty by gender.
* *P*-value for comparison by gender.

reported in the US registry.[6] Given the ageing of the population and the predominance of women among older age groups, this trend can be expected to continue in coming years.

In terms of risk factors, smoking decreased in men but not in women. From the first period on, high blood pressure, diabetes, and dyslipidemia were more frequent in women, and remained so in later periods. There was an increase in risk factors among men in later periods.

A prior history of AMI was more frequent in men in all of the periods analyzed, and a trend towards an increase over time in both sexes. The same was true regarding prior PTCA, which was observed in 25% of men and 22% of women in the last 5-year period. These figures were lower than the 32% reported for the US registry. Prior surgery was infrequent in both men and women, and was stable at around 7% in men and 5% in women. These proportions were also lower than those observed in the European[5] and US[6] registries.

Regarding indications for procedures at our center, acute coronary syndromes consistently predominated, both in men and women, with percentages of 70% in the last 5 year period. This is considerably higher than the corresponding percentages in the European Heart Survey

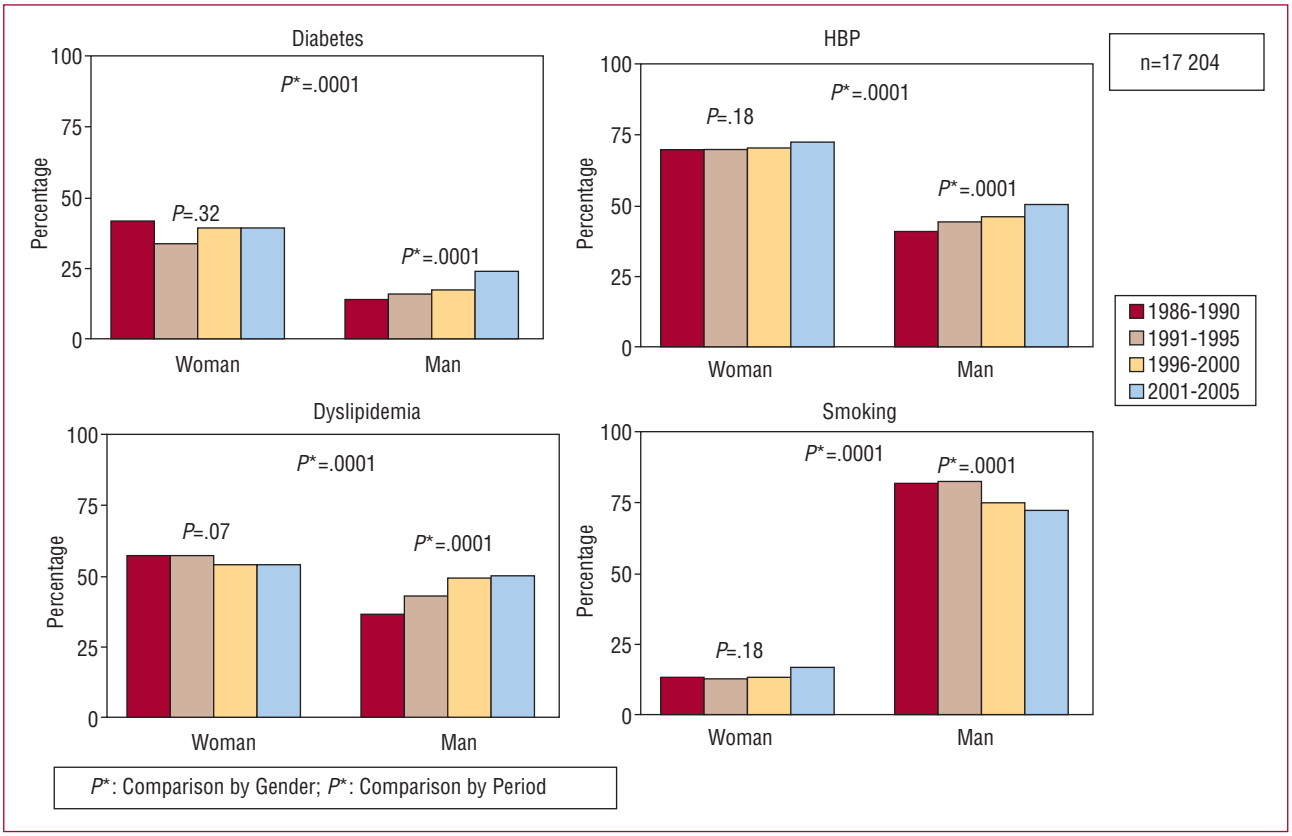


Figure 4. Risk factors by gender and study period in patients receiving an angioplasty. HBP indicates high blood pressure.

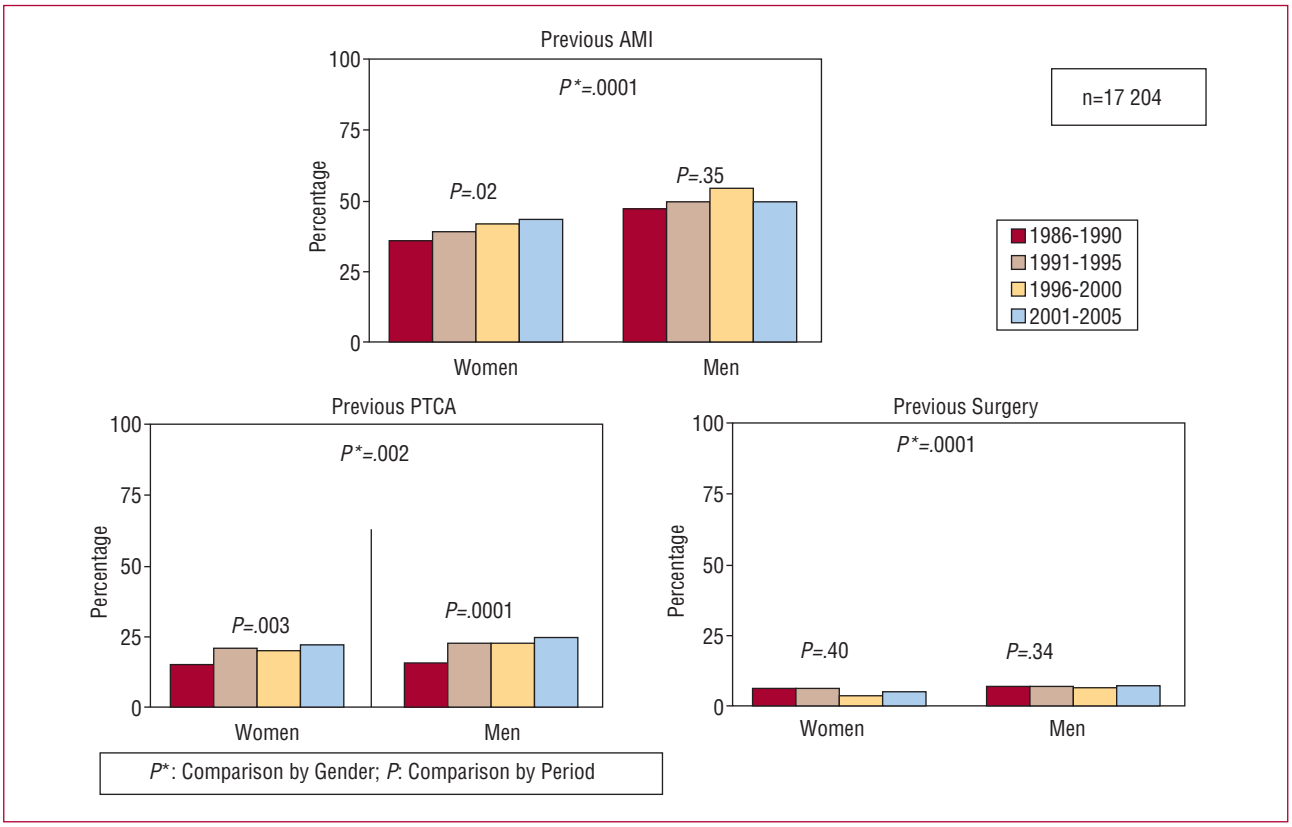


Figure 5. Cardiac history prior to the current indication for coronary angioplasty, by gender and study period. PTCA indicates percutaneous transluminal coronary angioplasty; AMI, acute myocardial infarction.

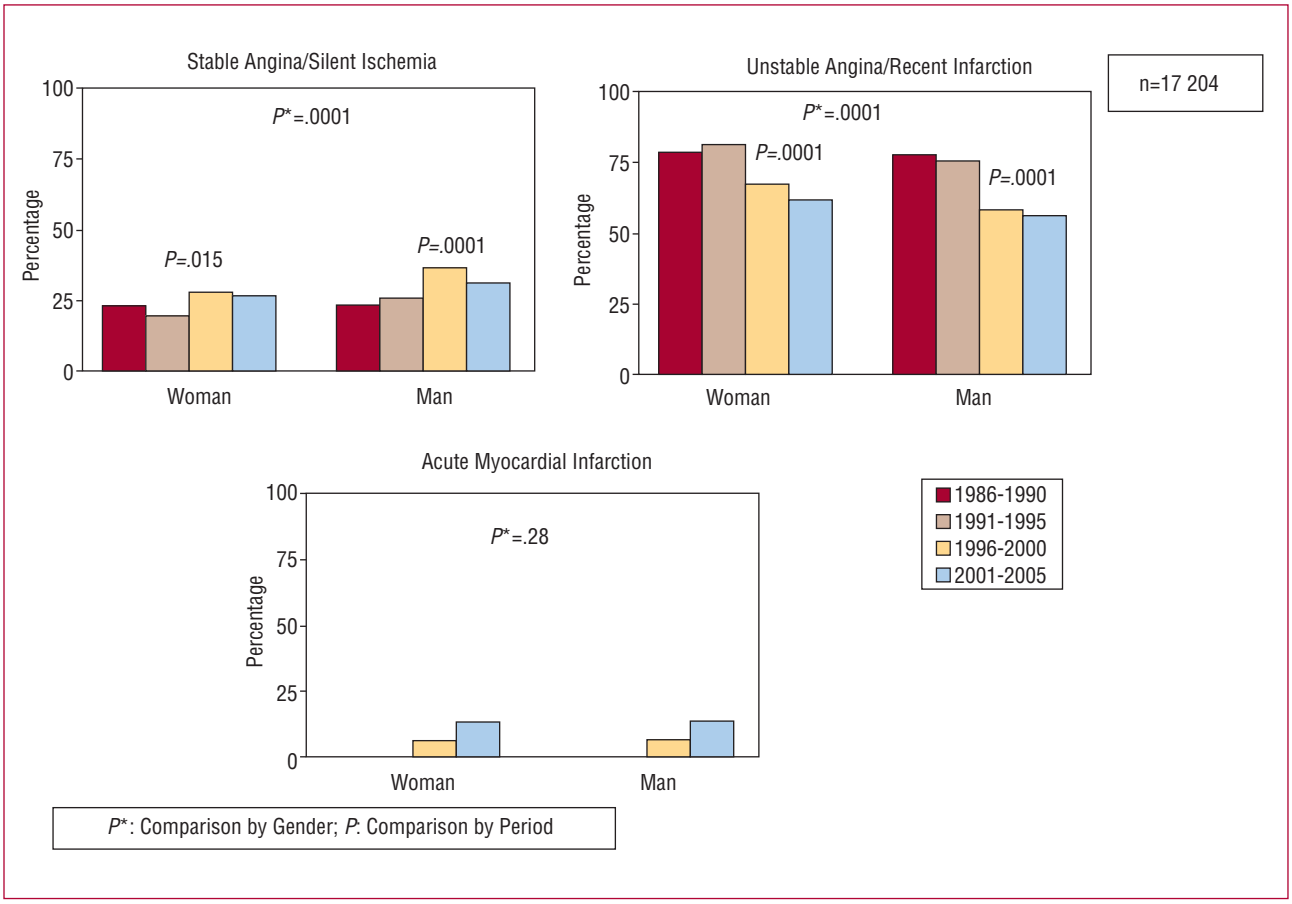
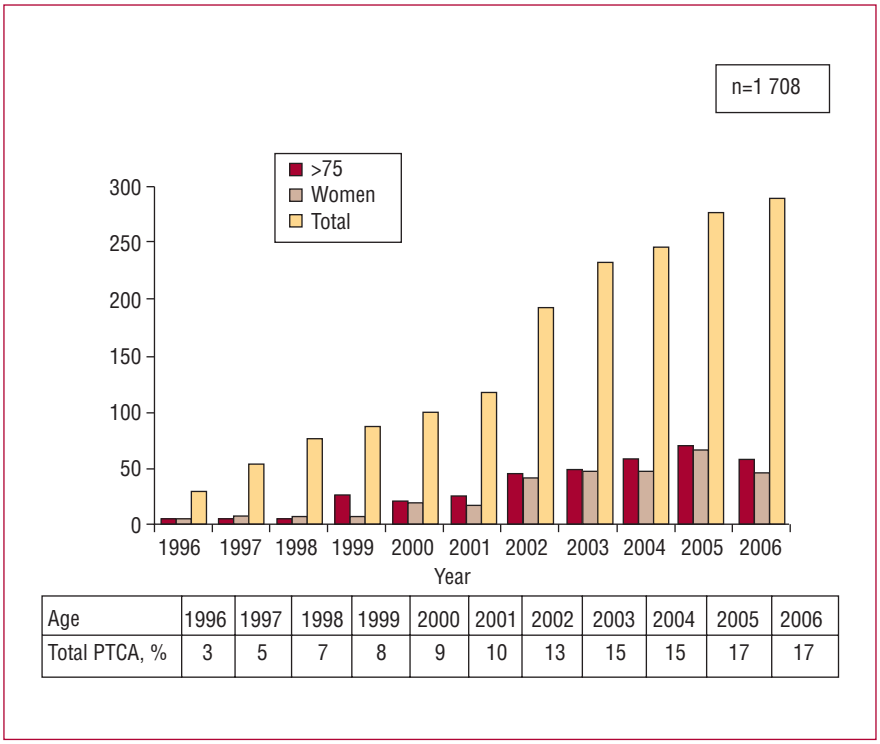


Figure 6. Clinical indication for angioplasty by gender and study period.



Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total PTCA, %	3	5	7	8	9	10	13	15	15	17	17

Figure 7. Number of procedures performed with acute myocardial infarction (AMI) in the last 10 years, percentage of women and those over 75 years. The table underneath details the percentage of angioplasties in AMI in relation to the total number of coronary angioplasties (PTCA).

TABLE 1. **Data on Coronary Procedures***

			Period				
		Total	1986-1990	1991-1995	1996-2000	2001-2005	
		17 204	1362	3186	5204	7452	*P* Trend
	Women	3500 (10%)	216 (16%)	564 (18%)	1057 (20%)	1663 (22%)	Linear/ANOVA
	Men	13 704	1146	2622	4147	5789	
Type of procedure							
Ad hoc	Women	1687 (48)	55 (26)	149 (26)	422 (40)	1061 (64)	.0001
P†=.022	Men	6308 (46)	352 (31)	727 (28)	1480 (36)	3749 (65)	.0001
Urgent	Women	890 (25)	16 (7)	66 (12)	231 (22)	577 (35)	.0001
P†=.0001	Men	2887 (21)	103 (9)	258 (10)	658 (16)	1868 (32)	.0001
Emergent	Women				70 (8)	232(14)	.0001
P†=.82	Men				277(7)	829(14)	.0001
Vessel type							
Native	Women	3447 (98)	216 (100)	559 (99)	1049 (99)	1623 (98)	.0001
P†=.02	Men	13 412 (99)	1140 (99)	2581 (98)	4055 (98)	5636 (97)	.0001
Saphenous (at least 1)	Women	39 (1.1)	0 (0)	2 (0.4)	7 (0.7)	30 (1.8)	.0001
P†=.005	Men	245 (1.8)	4 (0.3)	29 (1.1)	83 (2)	129 (2.2)	.0001
Mammary (at least 1)	Women	14 (0.4)	0 (0)	3 (0.5)	1 (0.1)	10 (0.6)	.21
P†=.81	Men	51 (0.4)	2 (0.2)	12 (0.5)	10 (0.2)	27 (0.5)	.26
Vessel <3 mm	Women	1082 (31)	71 (32)	191 (34)	296 (28)	524 (32)	.01
P†=.001	Men	2667 (20)	233 (20)	558 (21)	788 (19)	1088 (19)	.0001
Type of lesion							
Restenotic	Women	351 (10)	21 (10)	65 (12)	117 (11)	148 (9)	.11
P†=.01	Men	1575 (12)	135 (12)	380 (14)	514 (12)	546 (9)	.0001
Bifurcation	Women				107 (10)	187 (11)	.0001
P†=.18	Men				499 (12)	675 (12)	.0001
Number of lesions treated‡	Women	1.33 (0.6)	1.25 (0.5)	1.30 (0.6)	1.32 (0.6)	1.36 (0.6)	.04
P†=.049‡	Men	1.31 (0.6)	1.20 (0.5)	1.28 (0.6)	1.30 (0.6)	1.35 (0.6)	.0001
Multi-vessel PTCA	Women	416 (12)	20 (9)	70 (12)	111 (11)	215 (13)	.14
P†=.44	Men	1565 (11)	95 (8)	270 (10)	482 (12)	718 (12)	.0001
Technique							
Rotational atherectomy	Women	68 (2)	0 (0)	30 (5)	18 (1.6)	20 (1.2)	.0001
P†=.11	Men	213 (2)	0 (0)	89 (3.4)	67 (1.6)	57 (1.0)	.001
PTCA with stent	Women	2380 (68)	4 (2)	73 (13)	781 (74)	1522 (92)	.0001
P†=.0001	Men	8695 (63)	42 (4)	366 (14)	3071 (74)	5216 (90)	.0001
Stents/procedure‡	Women	1.33 (0.6)	1.00 (0.0)	1.15 (0.8)	1.19 (0.4)	1.41 (0.7)	.0001
P†=.42‡	Men	1.31 (0.6)	1.02 (0.1)	1.12 (0.5)	1.23 (0.5)	1.37 (0.7)	.0001
Total length of stent, mm‡	Women	27.0 (18)	24.1 (17)	24.9 (18)	25.5 (15)	28.0 (19)	.013
P†=.048‡	Men	27.38 (18)	27.2 (23)	25.8 (20)	27.3 (17)	27.6 (18)	.185
Outcome							
Angiographic success	Women	3175 (90.7)	184 (85)	490 (87)	961 (91)	1540 (93)	.0001
P†=.001	Men	12 680 (92.5)	1002 (87)	2405 (92)	3887 (94)	5386 (93)	.0001
Failure, no complications	Women	176 (5.0)	22 (10.2)	48 (8.5)	46 (4.4)	60 (3.6)	.0001
P†=.53	Men	654 (4.8)	101 (8.8)	150 (5.7)	142 (3.4)	261 (4.5)	.0001
Major complication	Women	149 (4.3)	10 (4.6)	26 (4.6)	50 (4.7)	63 (3.8)	.3
P†=.001	Men	370 (2.7)	43 (3.8)	67 (2.6)	118 (2.8)	142 (2.5)	.06
Hospital mortality	Women	93 (2.7)	6 (2.8)	12 (2.1)	24 (2.3)	51 (3.1)	.29
P†=.001	Men	181 (1.3)	10 (0.9)	21 (0.8)	57 (1.4)	93 (1.6)	.002
Hospital mortality excluding PTCA in AMI	Women					20 (1.4)	
P†=.012	Men					35 (0.7)	

*PTCA indicates percutaneous transluminal coronary angioplasty; AMI, acute myocardial infarction.
Major complication: death, infarction, re-PTCA of same vessel, surgery.
P†: analysis women versus men overall; *P:* analysis by periods for both genders.
‡Valors (SD).

(46%)[7,8] and the US registry(62%),[6] and remained stable over the period. Ad hoc procedures were increasingly frequent in men and women in all age groups, and accounted for 65% of all procedures in the last study period. This is slightly lower than figures published for other centers and can be attributed to logistic factors and

TABLE 2. **Data on Therapeutic Coronary Procedures***

			Period				
		Total	1986-1990	1991-1995	1996-2000	2001-2005	
		17 204	1362	3186	5204	7452	*P* Trend
	≥75	2834 (16.5%)	94 (7%)	259 (8%)	843 (16%)	1368 (22%)	Linear/ANOVA
	<75	14 370	1268	2927	4361	6084	
Type of procedure							
Ad hoc	≥75	1504 (53)	41 (44)	80 (31)	356 (42)	1027 (62)	.0001
P†=.0001	<75	6491 (45)	366 (29)	796 (27)	1546 (36)	3783 (65)	.0001
Urgent	≥75	778 (27)	14 (15)	38 (15)	174 (21)	552 (34)	.0001
P†=.001	<75	2999 (21)	105 (8)	286 (10)	715 (16)	1893 (33)	.0001
Emergent	≥75				70 (8)	261 (16)	.0001
P†=.0001	<75				276 (6)	800 (14)	.0001
Type of vessel							
Saphenous (at least 1)	≥75	85 (0.3)	0 (0)	3 (1.2)	26 (3.1)	56 (5.0)	.017
P†=.0001	<75	199 (0.01)	4 (0.3)	28 (1)	64 (1.5)	103 (1.7)	.0001
Mammary (at least 1)	≥75	6 (0.2)	0 (0)	0 (0)	0 (0)	6 (0.4)	.07
P†=.11	<75	59 (0.4)	2 (0.2)	15 (0.5)	11 (0.3)	31 (0.5)	.16
Vessel <3 mm	≥75	749 (29)	28 (33)	70 (31)	222 (33)	429 (27)	.018
P†=.0001	<75	3000(23)	276 (25)	679 (27)	862 (24)	1183 (21)	.0001
Type of lesion							
Number of lesions treated‡	≥75	1.35 (0.6)	1.27 (0.5)	1.32 (0.6)	1.37 (0.6)	1.37 (0,6)	.26
P†=.0001‡	<75	1.29 (0.6)	1.20 (0.5)	1.28 (0.6)	1.27 (0.5)	1.34 (0.6)	.0001
Multi-vessel PTCA	≥75	367 (13)	6 (7)	35 (14)	121 (15)	205 (12)	.11
P†=.015	<75	1613 (11)	109 (9)	305 (11)	472 (11)	727 (13)	.0001
Technique							
Rotational atherectomy	≥75	70 (2.5)	0 (0)	19 (7.3)	23 (0.4)	28 (0.3)	.002
P†=.0001	<75	211 (1.5)	0 (0)	100 (3.4)	62 (1.4)	49 (0.8)	.0001
PTCA with stent	≥75	2174 (76)	1 (1)	34 (13)	651 (77)	1488 (90)	.0001
P†=.0001	<75	8601 (62)	47 (4)	412 (14)	3211 (74)	5231 (90)	.0001
Number stents/procedure‡	≥75	1.36 (0.6)	1	1.24 (0.9)	1.30 (0.6)	1.39 (0.7)	.01
P†=.001‡	<75	1.31 (0.6)	1.04 (0.2)	1.15 (0.5)	1.27 (0.6)	1.36 (0.7)	.0001
Total length of stents, mm‡	≥75	27.27 (17)	15	28.3 (22)	26.1 (16)	27.8 (17)	.17
P†=.97‡	<75	27.31 (18)	27.2 (23)	25.8 (20)	27.0 (17)	27.7 (19)	.08
Outcomes							
Angiographic success	≥75	2581 (90.7)	82 (87)	234 (90)	1506 (91)	.15	
P†=.001	<75	13 274 (92.4)	1104 (87)	2661 (91)	4089 (94)	5240 (93)	.0001
Failure, no complications	≥75	128 (4.5)	5 (5.3)	12 (4.6)	38 (4.5)	73 (4.4)	.75
P†=.24	<75	702 (4.9)	118 (9.3)	186 (6.4)	150 (3.4)	248 (4.3)	.0001
Major complication	≥75	136 (4.8)	7 (7.4)	13 (5.0)	46 (5.5)	70 (4.2)	.11
P†=.001	<75	383 (2.7)	46 (3.6)	80 (2.7)	122 (2.8)	135 (2.3)	.015
In-hospital mortality	≥75	97 (3.4)	4 (4.3)	7 (2.7)	32 (3.8)	54 (3.3)	.8
P†=.001	<75	177 (1.2)	12 (0.9)	26 (0.9)	49 (1.1)	90 (1.6)	.006

*Major complication: death, infarction and/or need for surgery.
P†: analysis <75 versus ≥75 years; *P:* analysis by period by gender.
‡Valors (SD).

to a policy of joint decision-making with specialist clinicians when doubt exists. The number of urgent and immediate procedures also increased over successive study periods and was slightly higher in women and older patients in all study periods.

Both the number of lesions treated and the number of multi-vessel procedures increased slightly but consistently over the entire study period in men and women, and in both age groups. In the series as a whole, only 12% of all procedures were multi-vessel, with a mean of 1.3 lesions treated per procedure.

Vessels treated were smaller in women; in the series as a whole, 34% of dilated vessels were under 3 mm in women compared to 22% in men. Vessels treated also tended to be smaller in older patients, in part at least because of the greater prevalence of women in this group. Dilatation of non-native (saphenous and mammary) vessels accounted for under 2% of the total number of angioplasties in all periods, in both sexes and in both age groups.

Rotational atherectomy was only used in a small proportion of patients. In the last 10 years, it was used

TABLE 3. **Contemporary Angioplasty (2006)***

Variable	n=1686		P
Number	Women	369 (22)	.0001
	Men	1317 (78)	
Age, mean (SD), years	Women	70(12)	.0001
	Men	63 (12)	
Indication			
Stable/silent angina	Women	76 (21)	
	Men	254 (19)	
Unstable angina	Women	95 (26)	
	Men	250 (19)	
Angina/asymptomatic post-AMI	Women	99 (27)	
	Men	398 (30)	
NSTE-ACS	Women	49 (13)	
	Men	170 (13)	
STE-ACS	Women	50 (14)	
	Men	245 (17)	
Priority			
Urgent procedure	Women	72 (20)	.99
	Men	257 (20)	
Emergent procedure	Women	53 (14)	.048
	Men	248 (19)	
Description of procedure			
Ad hoc	Women	243 (66)	.33
	Men	831 (63)	
Lesions treated†	Women	1.31 (0.6)	.0004
	Men	1.42 (0.7)	
Multi-vessel PTCA	Women	38 (10)	.06
	Men	185 (14)	
Restenotic PTCA lesion	Women	27 (7)	.41
	Men	114 (9)	
Maximum balloon diameter, mean (SD), mm	Women	2.99 (0.5)	<.0001
	Men	3.16 (0.5)	
Maximum diameter <3 mm	Women	137 (38)	.0001
	Men	335 (26)	
Rotational atherectomy	Women	4 (1)	.03
	Men	41 (3)	
Stent	Women	352 (95)	.29
	Men	1237 (94)	
PTCA with all direct stent	Women	118 (32)	.61
	Men	403 (31)	
Number stents/PTCA stents†	Women	1.37 (0.7)	.05
	Men	1.45 (0.8)	
Stent total length/PTCA stent†	Women	23.8 (15)	.03
	Men	25.9 (16)	
PTCA ≥1 drug-eluting stent	Women	242 (66)	.18
	Men	813 (62)	
Successful dilatation	Women	348 (94)	.81
	Men	1238 (94)	
Failure, no complications	Women	14 (3.8)	.84
	Men	47 (3.6)	
Major complications	Women	7 (1.9)	.45
	Men	34 (2.6)	
In-hospital mortality	Women	6 (1.6)	.6
	Men	27 (2.1)	
In-hospital mortality excluding PTCA in AMI	Women	2/319 (0.6)	.75
	Men	12/1072 (1.1)	

*PTCA indicates percutaneous transluminal coronary angioplasty; AMI, acute myocardial infarction; NSTE-ACS: non ST elevation acute coronary syndrome; STE-ACS: ST elevation coronary syndrome.
†Valors (SD).

in 1%-2% of procedures, with a slight increase (to 3%) in 2006. There was no difference in its rate of use by gender, though it was used slightly more often in older patients. The number of procedures employing stents increased rapidly in the second half of the 1990s and accounted for over 90% of procedures in 2000, and 94% in 2006. The number of stents per procedure and the length of the stents also increased; the increase was similar in men and women and in the 2 age groups. The percentage of interventions employing drug-eluting stents also increased from their first use in 2001 to 63% in 2006. Drug-eluting stents were used more frequently in women than men because of the higher prevalence of diabetes and small-caliber blood vessels. This type of stent is used systematically in our center in both of these circumstances.

Outcomes of PTCA have improved over time, from an 87% success rate in the first period to 93% in the last. Over the first three 5-year periods, success rates in women were slightly lower, but differences decreased to the extent that no significant differences were observed between men and women in the last year. As observed in other series,[9] in-hospital mortality is still significantly higher in women, even in elective procedures, although there is a tendency toward a reduction in the differences between men and women in PTCA-related mortality. The success rate was also slightly lower in older patients, and rates of complications were higher. Hospital mortality rates were higher in patients over 75 years of age. The number of procedures performed during AMI has increased substantially, from 3% of the total number of PTCAs carried out in 1996 to 17% in 2006. Both male and female patients receiving the procedure with an AMI were somewhat younger (about 2 years) than those in the overall series, but there were no differences in terms of risk factors. The only exception to this was the presence of diabetes, which was more frequent in women in the series as a whole (38%) compared to those receiving PTCA with AMI (28%). This difference was not seen in male patients (20% in the overall series compared to 19% in the AMI patients). No differences were observed between men and women in terms of prior history (although there was a trend towards a greater frequency of prior PTCA in men), nor in infarct site.

A higher rate of rescue angioplasties was observed in males and there was a longer delay for both primary[11,12] and rescue[13] PTCAs in women, with a difference of 80 min between sexes for both types of procedure. As described elsewhere,[14-16] cardiogenic shock was more frequent in women. Stents were implanted in a similar number of procedures (92% in both sexes) and angiographic success was achieved in 94%, with no differences by gender. However, 30 day mortality was greater in women,[17-19] in part because of a higher frequency of cardiogenic shock, although the difference was maintained even when cases of cardiogenic shock were

TABLE 4. **Angioplasties in Acute Myocardial Infarction. Period 2001-2005***

Period 2001-2005	All, n=1059	Women, n=232 (22%)	Men, n=827 (78%)	*P*
Mean age		68.9 (12.6)	60.7 (12.5)	.0001
Total percentage of angioplasties	14%	14%	14%	
Diabetes	223 (21)	65 (28)	158 (19)	.003
HBP	486 (46)	139 (60)	347 (42)	.0001
Dyslipidemia	451 (43)	112 (48)	339 (41)	.047
Smoking	646 (61)	58 (25)	588 (71)	.0001
Clinical history				
Previous infarction	130 (12)	26 (11)	104 (13)	.57
Previous PTCA	84 (8)	12 (5)	72 (9)	.08
Previous surgery	19 (1.8)	3 (1.3)	16 (1.9)	.78
Previous CCI	74(7)	21 (9)	53 (6)	.16
Infarction site				.056
Anterior	458 (43)	104 (45)	354 (43)	
Inferior	548 (52)	110 (47)	438 (53)	
Lateral	53 (5)	18 (8)	35 (4)	
Type of procedure				.001
Primary	856 (81)	205 (88)	651 (79)	
Rescue	203 (19)	27 (12)	176 (21)	
Time with symptoms, mean (SD), hour				
Primary	4.82 (3.4)	5.71 (4.2)	4.52 (3.1)	.029
Rescue	7.58 (4.6)	8.64 (5.2)	7.37 (4.4)	.06
Cardiogenic shock	104 (9.8)	34 (14.7)	70 (8.5)	.005
Primary	75 (8.8)	30 (14.6)	45 (6.9)	.001
Rescue	29 (14.3)	4 (14.8)	25 (14.2)	.93
Stent	973 (92)	211 (91)	762 (92)	.56
Successful dilatation	998 (94)	217 (93.5)	781 (94.4)	.6
Successful dilatation + TIMI 3	912 (86.1)	194 (83.6)	718 (86.8)	.21
Mortality, 30 days (n=1009)	89 (8)	31 (13)	58 (7)	.002
Mortality 30 days (no shock)	42 (4.4)	16 (8.1)	26 (3.4)	.005
Mortality 30 days (shock)	47 (45.2)	15 (44.1)	32 (45.7)	.88

*PTCA indicates percutaneous transluminal coronary angioplasty; HBP, high blood pressure.

excluded from the analysis (8% vs 3.4% mortality, respectively, for women and men).

CONCLUSIONS

Significant changes were observed over the last 20 years in the baseline characteristics of, the techniques used in, and the outcomes obtained in patients undergoing percutaneous coronary intervention. The data provided complement those provided by the hemodynamics unit registry and help to characterize the changes that have taken place over the last 20 years.

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