

Working Group Report

The European Registry of Cardiac Catheter Interventions 1997

W. Maier¹, P. Camici², S. Windecker³, D. Pfiffner³, W. Wijns⁴, B. Meier³ on behalf
of the working group Coronary Circulation of the
European Society of Cardiology

¹University Hospital, Zürich, Switzerland; Hammersmith Hospital, London, U.K.; ³Swiss Cardiovascular Center, Bern, Switzerland; ⁴Cardiovascular Center, Aalst, Belgium

Introduction

Interventional cardiology in Europe in 1997 has highlights and some remarkable trends. It continues the tradition of yearly reports initiated in 1992^[1–5].

Methods

Set-up of the registry

A detailed questionnaire with instructions and examples was mailed to the presidents or designated delegates of the national societies of cardiology represented in the European Society of Cardiology. They distributed a copy of the questionnaire to all institutions performing diagnostic or interventional cardiac catheterizations in their respective countries. Upon completion the questionnaires were returned to the representatives to be compiled in a national summary data sheet. The summary data sheets were entered into a central database and subsequently analysed. No data were received from Cyprus and Ireland until entry closure. Sufficiently complete surveys were available from 29 countries representing more than 550 million people in Europe. The definitions of diseases and procedures were used according to previously published reports^[4].

Limitations of the registry

The data acquired by the process described above represent registry data with several sources of potential

error. They include limited external validation of the data provided by the local institutions, different local depths of documentation, and communication errors between the institutions, national coordinators, and the central database. While there is reluctance to provide data on sensitive items in the questionnaire (complications, mortality etc.), elementary data on coronary angiography, coronary angioplasty (PTCA), and stenting are supplied readily. Computerized statistics exist in most European catheterization laboratories. They provide the sources for this registry. The involvement of the national societies of cardiology, either directly or by designated delegates, ensures conformity with national registries and statistics. Approval of the data at the national level was sought by submitting the European summary sheet to the national coordinators for review. Overall, the data provide an important overview of interventional cardiology (electrophysiology excluded).

Results

The major procedures (coronary angiography, PTCA, stenting, new devices, coronary ultrasound) are listed for all countries involved in [Table 1](#) in absolute numbers and numbers per 10⁶ inhabitants. Also depicted are changes related to the previous year 1996.

Coronary angiography

Overall, 1 248 435 coronary angiograms were reported during 1997 in Europe. Since angiography data were not available for the Netherlands and the U.K. this year, the overall absolute numbers cannot be compared with 1996. The angiography data for Belgium showed a considerable variation during the years 1995 through 1997, with a marked decrease from 1995 to 1996, followed by a disproportional increase from 1996 to

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The coordinators of the countries participating in this survey are listed in the [Appendix](#)

Correspondence: Bernhard Meier, MD, Professor and Chairman, Swiss Cardiovascular Center Bern, University Hospital, 3010 Bern, Switzerland.

Table 1 *European Registry of Cardiac Interventions — selected country data*

1997	Austria	Belgium	Bulgaria	Croatia	Czechia	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Italy	Latvia
Population to serve (million inhabitants)	8.0	10.5	8.0	4.5	10.4	5.2	1.4	5.1	57.5	81.3	10.0	10.0	0.3	57.0	2.5
Coronary angiography (n)	28 809	45 805	2870	2811	18 595	10 073	1671	11 920	198 735	542 232	20 332	9654	1048	102 878	1159
D 96/97 (%)	9	41	73	33	29	22	6	2	10	20	17	21	6	15	30
Coronary angiography per million population (n)	3601	4362	359	625	1788	1937	1152	2315	3456	6379	2033	965	3881	1774	464
PTCA (n)	7608	13 501	510	376	5262	2829	314	2239	69 801	169 243	5013	1296	373	26 582	329
D 96/97 (%)	14	-3	197	44	51	25	-6	7	11	34	20	31	7	36	196
PTCA per million population (n)	951	1286	64	84	506	544	217	435	1214	1991	501	130	1381	458	132
Stent (n)	4390	3920	141	224	3507	1992	53	685	50 541	94 411	3259	389	220	16 580	82
D 96/97 (%)	40	16	1182	177	87	66	1225	30	40	69	62	412	34	60	645
Stent/PTCA (%)	58	29	28	60	67	70	17	31	72	56	65	30	59	62	25
Sum new devices (n)	314	71	na	0	14	na	0	23	817	6504	51	22	7	665	na
Sum ultrasound and Doppler (n)	211	89	na	0	21	na	0	31	1230	8298	239	12	0	1541	6
PTCA per angiography (%)	26	29	18	13	28	28	19	19	35	31	25	13	36	26	28
Multivessel PTCA per PTCA (%)	10	12	36	31	17	na	5	20	na	11	14	14	17	na	29
Angiography per angiography center (n)	1108	975	574	469	979	na	836	1084	946	1506	1130	1379	524	879	386
Angiography per angiography operator (n)	200	na	103	165	232	na	167	na	na	301	194	197	105	na	193
PTCA per PTCA center (n)	380	422	128	125	310	na	157	249	445	664	418	185	373	316	329
PTCA per PTCA operator (n)	90	na	43	63	110	na	52	na	na	201	81	72	93	na	110

na = not available.

Table 1 Continued

1997	Lithuania	Luxembourg	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	Switzerland	Turkey	UK
Population to serve (million inhabitants)	3-7	0-4	15-3	4-3	38-6	10-0	23-0	5-0	1-9	39-0	8-5	7-0	62-0	58-0
Coronary angiography (n)	3431	1287	na	13 650	28 445	13 963	3194	3666	1908	57 960	25 000	26 047	71 292	na
D 96/97 (%)	52	na	na	25	21	3	42	17	21	12	38	6	15	na
Coronary angiography per million population (n)	927	3218	na	3174	735	1396	139	667	984	1486	2941	3721	1150	na
PTCA (n)	724	384	14 874	4026	7343	3017	399	465	474	18 545	6073	8847	12 590	22 902
D 96/97 (%)	37	45	5	14	47	30	4	40	64	24	17	15	33	12
PTCA per million population (n)	196	960	972	936	190	302	17	85	244	476	714	1264	203	395
Stent (n)	83	252	7526	2778	2292	1959	108	128	284	11 417	4124	5097	5454	13 741
D 96/97 (%)	196	74	50	na	191	58	69	73	457	59	56	32	95	50
Stent/PTCA (%)	11	66	51	69	31	65	27	28	60	62	68	58	43	60
Sum new devices (n)	na	23	287	na	68	111	0	2	na	684	201	70	85	213
Sum ultrasound and Doppler (n)	na	16	na	na	167	156	0	0	na	888	na	317	na	na
PTCA per angiography (%)	21	30	na	29	26	22	12	13	25	32	24	34	18	na
Multivessel PTCA per PTCA (%)	10	7	34	na	8	21	24	13	na	na	42	13	na	16
Angiography per angiography center (n)	1144	1287	na	1517	813	1164	799	1222	na	773	1042	1042	1658	na
Angiography per angiography operator (n)	191	184	na	na	na	274	266	262	na	254	na	189	na	na
PTCA per PTCA center (n)	241	387	1144	575	334	251	100	233	na	na	506	421	na	395
PTCA per PTCA operator (n)	45	77	na	na	na	86	50	93	na	na	101	113	na	64

na = not available.

1997. The population adjusted rate of coronary angiograms amounted to a mean of 2600 per 10⁶ inhabitants for all of Europe during 1997 (ranging from as high as 6379 in Germany to as low as 139 in Romania), a 19% increase compared with 1996. As in previous years, the highest absolute number was reported from Germany with 542 232 and the lowest absolute number from Latvia with 1159 coronary angiograms. Again, the highest relative growth was observed in eastern European countries, mostly in those countries with the biggest backlog (e.g. Bulgaria +73, Lithuania +52%, Romania +42%), whereas the growth in the more advanced eastern countries slowed down slightly (e.g. Czechia +29%, Poland +21%). The average, calculated by averaging the country means, was 2060 ± 1505 angiograms per 10⁶ inhabitants (mean ± standard deviation). More than 3000 coronary angiograms per 10⁶ inhabitants were reported in decreasing order from Germany, Belgium, Iceland, Switzerland, Austria, and France, whereas less than 500 coronary angiograms per 10⁶ inhabitants were observed in decreasing order in Bulgaria and Romania. Croatia and Latvia have increased their numbers above this limit since 1996.

Coronary angioplasty

A total of 405 939 PTCA procedures were reported in Europe during 1997, a 24% increase compared with 1996. The mean European number of PTCA per 10⁶ inhabitants increased by 22% from 599 in 1996 to 733 in 1997. The average, calculated by averaging the country means, was 581 ± 497 PTCA per 10⁶ inhabitants. As in 1996, the highest absolute and population adjusted number of PTCA were reported from Germany with 169 243 procedures (1991 per 10⁶ inhabitants), a 35% increase compared with 1996. In contrast, the lowest absolute number of PTCA were observed in Estonia with 314 and the lowest number of PTCA per 10⁶ inhabitants again in Romania with 17. Parallel to the growth of infrastructure and economics, eastern countries showed the steepest increase in coronary interventions: Bulgaria +196%, Latvia +194%, Slovenia +64%, Czechia +51%, Poland +47%, Croatia +44%, Slovakia +40%. More than 1000 PTCA per 10⁶ inhabitants were reported in decreasing order from Germany, Iceland, Belgium, Switzerland, and France, whereas fewer than 100 PTCA per 10⁶ inhabitants were observed in decreasing order in Slovakia, Croatia, Bulgaria, and Romania.

The ratio of PTCA per coronary angiography showed a slightly increasing tendency: comparing Europe as a whole, 29% in 1997 vs 27% in 1996, and 24% (1996: 23%) when averaging the country means. The ratio of PTCA to coronary angiograms ranged from 36% in Iceland to 12% in Romania.

The percentage of percutaneous interventions performed at the time of the diagnostic study may be considered either as an indicator of effectiveness or just as a procedural characteristic. Data were available for

countries representing 52% of the absolute population. These data show a clear tendency towards ad hoc PTCA. The mean percentage of ad hoc PTCA, calculated as the sum of all ad hoc PTCA reported and related to the sum of interventions for the reporting countries, was 43%. It was 35%, calculated as average of the country means. For comparison, the 1996 average of the country means has been 26%. The highest rate was reported from Switzerland (74%).

Data on multivessel PTCA were available for 59% of the data providers. The mean incidence of multivessel PTCA, calculated as the sum of all reported multivessel PTCA related to the sum of interventions for the reporting countries, was 14%.

Coronary stenting

From 1996 to 1997, reported procedures with stenting increased by 60% from 147 781 to 235 637. The overall stenting ratio, calculated as the sum of all reported stenting procedures related to all reported interventions was 58%, compared with 45% in 1996. Germany performed the highest absolute number of stent procedures (94 411), followed by France (50 541), which remained the country with the highest stenting ratio (72%). The stenting ratio was >50% in the majority of countries, except for (first in decreasing and second in alphabetical order): Turkey, Finland, Poland, Hungary, Belgium, Bulgaria, Slovakia, Latvia, Estonia, Romania, Lithuania (Table 1).

Other new devices

The use of other new therapeutic devices, such as laser angioplasty, directional coronary atherectomy, or rotablation was reported in a total of 10 209 cases, an increase of 26% related to the previous year, which parallels the absolute increase in interventions. The ratio of new devices to all coronary interventions remained unchanged at 2.5%. The majority consisted of rotablator and directional atherectomy, and the highest absolute numbers of those procedures were reported for Germany (3755 rotablations, 1078 atherectomies) and France (956 rotablations, 58 atherectomies).

Intracoronary ultrasound (10 306) and Doppler flow measurements (2916) increased in 1997 in terms of absolute figures. The ratio of reported intracoronary ultrasound and Doppler flow measurements per intervention with specified ultrasound data amounts to 5.6%, supporting a growing tendency. A total of 441 angioscopies were reported.

Non-coronary interventions

Balloon valvuloplasty constituted the most frequent non-coronary intervention reported in 1997 with a total

of 2630 mitral valvuloplasties (1996: 2853), 249 aortic valvuloplasties (1996: 307), and 457 pulmonary valvuloplasties (1996: 817). Other percutaneous interventions included 395 cases of closure of a patent ductus arteriosus (1996: 472), 136 cases of closure of a patent foramen ovale (1996: 57), and 205 cases of closure of an atrial septal defect (1996: 109).

Catheterization facilities

For the year 1997, the number of catheterization facilities and trained operators was provided for 34% of the total population sample size. Per country data are listed in Table 1.

In this subgroup, the average numbers of diagnostic or therapeutic interventions were, per catheterization centre 998 and 363 and per operator, 206 and 86, respectively, calculated as averages of the country means.

Discussion

The growth in interventional cardiology has kept its pace according to the 1997 survey of cardiac catheter interventions in Europe, with increases again in the order of 20–25% with respect to the major procedures (coronary angiography and angioplasty). Compared with bypass surgery, coronary angioplasty procedures outnumbered coronary bypass grafting by a factor 1.8^[6]. In 1997 almost 60% of all reported interventions were completed with implantation of at least one stent. Disappointing data on the effectiveness of other therapeutic devices seems to have relegated their use to niche applications for good.

A comparison with 1996 reveals the persistence of a remarkable disparity in utilization of percutaneous coronary revascularization procedures across Europe, primarily driven by the economic gradient between western and eastern European countries. However, selected countries have almost completely caught up. Czechia reported 506 interventions per 10⁶ inhabitants, which comes close to the average of the country means. It has surpassed the U.K. (395 interventions per 10⁶ inhabitants) by far. The U.K. has fallen below the central continental countries to a level only slightly above the developing eastern European countries. The highest relative growth compared with 1996 was again reported from those eastern countries, in which epidemiological data indicate a revascularization demand at least in the order of magnitude of the central European countries^[7]. However, given the low absolute level in many of these countries, it will take still several years of steady growth to achieve this goal. An exception is Romania from which basically no augmentation of interventions was reported.

A comparison with the U.S. is speculative since a registry does not exist. The only available figure is the estimate of percutaneous interventions published on the American Heart Association's website^[8]. At present there are data for 1998 indicating a total of 539 000 percutaneous coronary interventions, representing 1994 interventions per 10⁶ inhabitants. The 1997 data for Germany (1991) equal this number, but for Europe as a whole, the respective number of 733 amounts to only slightly more than one third the U.S. ratio. Thus, a general overuse of percutaneous coronary revascularization in Europe in 1997 is highly unlikely.

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Appendix

We are indebted to all representatives of the national societies of cardiology participating in this survey. Furthermore we acknowledge the tremendous effort of all individual centres in collecting the surveyed data and completing the questionnaires. The principal data coordinators of each individual country participating in this survey are in alphabetical order:

Austria: Mühlberger V. *Belgium:* Heyndrickx G. *Bulgaria:* Finkov B. *Croatia:* Miharov S. *Czech Republic:* Vojacek J. *Denmark:* Thayssen P. *Estonia:* Peeba M. *Finland:* Romo M. *France:* Lablanche JM. *Germany:* Bonzel T. *Greece:* Foussas S. *Hungary:* Duba J. *Italy:* Piscione F. *Iceland:* Eyjolfsson K. *Latvia:* Kalnins U. *Lithuania:* Navickas R. *Luxembourg:* Beissel J. *The Netherlands:* Bonnier JJM. *Norway:* Vik-Mo H. *Poland:* Ruzyllo W. *Portugal:* Palos JL. *Romania:* Iacob M, Fotiade B. *Slovak Republic:* Fridrich V. *Slovenia:* Cijan A. *Spain:* Soriano J. *Sweden:* Albertson P. *Switzerland:* Meier B. *Turkey:* Özmen F. *United Kingdom:* De Belder M.