

Micha T. Maeder, Jean-Christoph Stauffer,  
Stephan Windecker, Giovanni Pedrazzini,  
André Vuillomenet, Hans Rickli;  
on behalf of the Working Group "Interventional  
cardiology and acute coronary syndrome"

## Interventional cardiology in Switzerland during the year 2005

### Summary

**Background:** Since 1987, a nationwide annual survey of percutaneous cardiac interventions is performed in Switzerland, which allows recognition of contemporary trends and comparison with other countries.

**Methods:** Based on a standardised questionnaire, all adult percutaneous cardiac intervention centres in Switzerland were asked to report on the volume and the circumstances of their activities in 2005. The response rate was 100%. Data were compared with those from previous years.

**Results:** In 2005, 36 436 coronary angiographies (CA) (2004: 35 201; + 3.5%) and 16 624 percutaneous coronary interventions (PCI) (2004: 15 680; + 6%) were carried out in 5 university hospitals, 9 public, non-university hospitals, and 13 private hospitals by 205 operators (80 of them performing only diagnostic studies). Ninety-three percent of PCI were performed *ad hoc*, and 78% were single-vessel interventions. Stents were placed in 91% of PCI (2004: 91%). Drug-eluting stents (DES) were used in 78% of procedures (2004: 66%). Emergency procedures (primary PCI or rescue PCI after failed thrombolysis) accounted for 19% of interventions. Glycoprotein IIb/IIIa inhibitors were used in 23% of PCI (2004: 23%). Myocardial infarction after PCI was reported in 1.1% of PCI, emergency coronary artery bypass grafting was needed in 0.1% of cases, and in-hospital mortality after PCI was 0.5%.

In addition, 52 mitral, 11 aortic, and 16 pulmonary balloon valvuloplasties, and 510 interventions for closure of patent foramen ovale (2004: 438) as well as 94 interventions for closure of atrial septal defect (2004: 92) were performed.

**Conclusions:** The number of CA and PCI and especially the utilisation of DES are steadily increasing in Switzerland. The number of interventions for closure of patent foramen ovale and atrial septal defect is still growing, most probably due to a more aggressive diag-

nostic work-up and treatment of patients with stroke.

**Key words:** coronary angiography; angioplasty; stents; balloon valvuloplasty; patent foramen ovale; quality control

### Zusammenfassung

**Hintergrund:** Seit 1987 werden die perkutanen kardiologischen Eingriffe zur Erkennung aktueller Trends und für den internationalen Vergleich schweizweit erfasst.

**Methoden:** Basierend auf einem standardisierten Fragebogen wurden alle Zentren, die bei Erwachsenen perkutane kardiologische Eingriffe durchführen, über Umfang und Details ihrer interventionellen Aktivitäten im Jahr 2005 befragt. Die Rücklaufquote der Fragebögen betrug 100%. Die Daten wurden mit denjenigen früherer Jahre verglichen.

**Ergebnisse:** Im Jahr 2005 wurden in 5 Universitätsspitalern, 9 öffentlichen, nicht-universitären Zentren und 13 Privatkliniken 36 436 Koronarangiografien (CA) (2004: 35 201; + 3,5%) und 16 624 perkutane koronare Interventionen (PCI) (2004: 15 680; + 6%) durchgeführt, dies durch 205 Operateure, von denen 80 ausschliesslich diagnostische Eingriffe durchführten. 93% der PCI wurden *ad hoc* durchgeführt, und 78% waren Eingefäss-Eingriffe. Stents wurden bei 91% aller PCI implantiert (2004: 91%). Medikamenten-beschichtete Stents (drug-eluting stents [DES]) wurden bei 78% der PCI mit Stenting verwendet (2004: 66%). Notfallmässige Eingriffe (primäre PCI oder Rescue-PCI nach Throm-

Correspondence:  
Micha T. Maeder, MD  
Division of Cardiology  
University Hospital Basel  
Petersgraben 4  
CH-4031 Basel  
Switzerland  
E-Mail: micha.maeder@bluewin.ch

There are no conflicts  
of interest.

bolyse-Versagen) machten 19% der Untersuchungen aus. Glycoprotein-IIb/IIIa-Antagonisten wurden bei 23% der PCI eingesetzt (2004: 23%). Myokardinfarkte nach PCI wurden auf 1,1% der Eingriffe beziffert, eine notfallmässige aortokoronare Bypass-Operation war in 0,1% der Fälle notwendig, und die Spitalmortalität nach PCI betrug 0,5%.

Zusätzlich wurden 52 Mitralkappen-, 11 Aortenklappen- und 16 Pulmonalklappen-Valvuloplastien durchgeführt sowie 510 Eingriffe zum Verschluss eines offenen Foramen ovale und 94 Interventionen zum Verschluss eines Vorhofseptumdefekts.

*Schlussfolgerungen:* Die Zahl der CA und PCI und vor allem die Verwendung von DES nehmen in der Schweiz stetig zu. Die Zahl der Eingriffe für den Verschluss von offenem Foramen ovale und Vorhofseptumdefekt wächst weiterhin, wahrscheinlich aufgrund einer aggressiveren Abklärung und Behandlung von Patienten mit Hirnschlag.

*Schlüsselwörter:* Koronarangiographie; Angioplastie; Stents; Ballon-Valvuloplastie; offenes Foramen ovale; Qualitätskontrolle

## Introduction

Since 1987, an annual nationwide survey of interventional procedures in all cardiology centres in Switzerland is performed, which allows to recognise contemporary trends and the impact of study results and guidelines on daily practice [1–15]. The analysis also serves as an instrument of quality control, which is important in light of the expense and potential of complications of invasive cardiac procedures. The recorded data will also be integrated in the annual survey of the European Society of Cardiology.

The aim of the present study was to provide cardiologist but also other interested physicians with the most recent data on interventional cardiology activities in Switzerland. Importantly, due to the rapid introduction and wide embracement of drug-eluting stents (DES), Switzerland has now a privileged position in this field. Several Swiss cardiology centres have set-up prospective clinical trials investigating important practical issues of DES application [16, 17]. The present data are an important piece of information in the light of these studies and especially the newly detected problem of late and very late stent thrombosis associated with DES [18, 19].

## Methods

Based on a standardised questionnaire all cardiology centres performing interventional procedures in adult patients were asked to report on procedures performed during the year 2005. The questionnaire was not sent to the two centres, whose activities are restricted to pediatric patients (Kinderspital Zürich, Kinderspital Bern). The required items included data about infrastructure, operators, availability of cardiac surgery, number of coronary angiographies (CA) and percutaneous coronary interventions (PCI), detailed information about circumstances of PCI (*ad hoc* interventions, single-vessel PCI, multi-vessel PCI), types of stents (bare-metal stents [BMS] or DES) other revascularisation techniques (*eg* rotablator), adjunctive techniques (*eg* use of distal protection devices), use of mechanical circulatory support, use of glycoprotein IIb/IIIa inhibitors, number of peripheral and renal artery interventions, number of balloon valvuloplasties, number of interventions for closure of shunts, and complications. As in previous years, the questionnaires were returned by all centres. For some centres, information is not available for all items.

The following definitions were applied:

### Coronary angiography (CA)

Diagnostic cardiac catheterisation for visualisation of the coronary arteries, independently whether or not an intervention is performed in the same session. The number of cases is recorded.

### Percutaneous coronary intervention (PCI)

Coronary angioplasty with or without stent placement. If PCI is performed directly following the diagnostic procedure during the same session, it is referred to as "*ad hoc* PCI". The number of cases, but not the number of vessels dilated is recorded.

### Emergency PCI

Primary PCI or rescue PCI after failed thrombolysis for acute ST-segment elevation myocardial infarction (STEMI).

### Balloon valvuloplasty

Percutaneous dilatation of stenotic cardiac valves.



tres with respect to the use of glycoprotein IIb/IIIa inhibitors (fig. 9).

Distal protection devices were used in 404 (2.4% of PCI; 2004: 480) cases, an intracoronary pressure wire was employed in 436 (2.6%;

2004: 370) cases, and 67 (0.4%; 2004: 59) intracoronary Doppler and 562 (3.4%; 2004: 468) intravascular ultrasound examinations were performed.

Revascularisation techniques other than

**Table 1**

Evolution of percutaneous cardiac interventions between 1987 and 2005.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Coronary angiographies (n)			11197	12501	13016	14348	17696	20612	23150	24557	26047	27994	28003	30404	30454	32167	33066	35201	36436
Percutaneous coronary interventions (n)	1173	1605	1976	2323	2672	3141	4519	5590	6713	7720	8679	9561	9732	11080	11803	13276	14235	15680	16624
Ad hoc (%)						43	39	53	59	60	74	77	83	82	73	78	83	86	93
Multivessel (%)	29	20	13	13		11	10	10	11	12	14	15	13	14	13	17	19	20	22
Ongoing infarction (%)				4		3	3	4	6	6	7	8	10	11	12	15	19	20	19
Use of stents for PCI (%)				1		4	6	15	28	50	59	67	73	78	82	84	88	91	91
Drug-eluting stents (%)																16	52	66	78
Glycoprotein IIb/IIIa inhibitors (%)										3	7	14	17	19	22	23	21	23	23
PCI-induced myocardial infarction (%)			1.9	1.6		1.5	1.2	1.2	1.1	1.1	1.2	1.2	1.5	1.2	0.9	1.7	1.4	1.4	1.1
Emergency CABG (%)			2.7	1.6		1.2	0.8	0.9	0.7	0.4	0.3	0.2	0.3	0.2	0.1	0.1	0.1	0.1	0.1
In-hospital mortality (%)			0.6	0.9		1.0	0.6	0.6	0.6	0.7	0.6	0.6	0.9	0.6	0.5	0.5	0.7	0.5	0.5
Valvuloplasties (n)	34	43	40	39	71	71	86	53	59	56	75	53	68	82	56	56	55	68	79
Closure of structural defects (n)				5	6	8	12	32	32	42	66	69	107	167	246	328	476	548	622

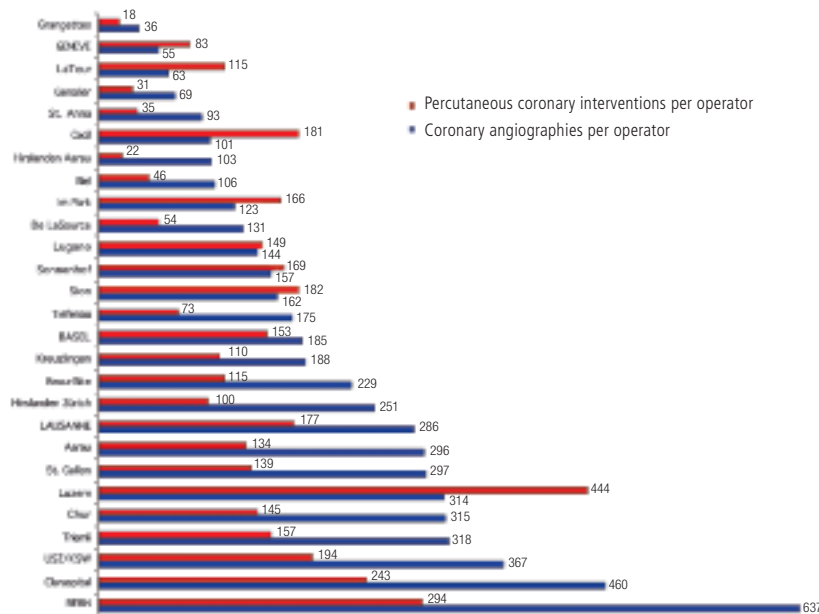
PCI = percutaneous coronary intervention; CABG = coronary artery bypass grafting

**Table 2**

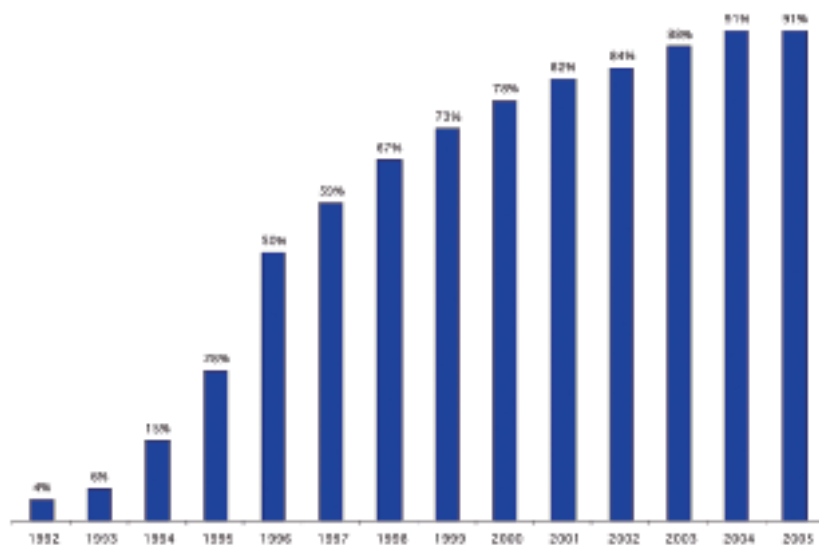
Comparison between university hospitals, public non-university hospitals, and private hospitals.

	university hospitals (n = 5)	public non-university hospitals (n = 9)	private hospitals (n = 13)
Cath labs (n)	11	12	18
Operators (n)	62	56	87
Operators performing both CAs and PCIs (n)	38	39	48
CAs (n)	13 389	12 248	10 799
CAs per operator (n)	216	219	124
PCIs (n)	6537	5702	4385
PCIs per operator (n)	172	146	91
Ad hoc PCI (%)	94	96	88 <sup>a</sup>
Multivessel PCI (%)	24	17 <sup>b</sup>	15 <sup>a</sup>
PCI for ongoing infarction (%)	23	21 <sup>c</sup>	10 <sup>a</sup>
Stents (%)	91	91	92
Drug-eluting stents (%)	72	77	91
Glycoprotein IIb/IIIa inhibitors (%)	17 <sup>d</sup>	27 <sup>c</sup>	10
PCI complicated by myocardial infarction (%)	1.4	0.6	1.2
Urgent coronary artery bypass grafting after PCI (%)	0.1	0.04	0.3
In-hospital mortality (%)	0.6	0.6	0.3
Balloon valvuloplasties (n)	67	8	4
Closure of structural defects (n)	417	104	101

CA = coronary angiography; PCI = percutaneous coronary intervention  
<sup>a</sup> data available from 12/13 centres; <sup>b</sup> data available from 7/9 centres; <sup>c</sup> data available from 8/9 centres;  
<sup>d</sup> data available from 4/5 centres

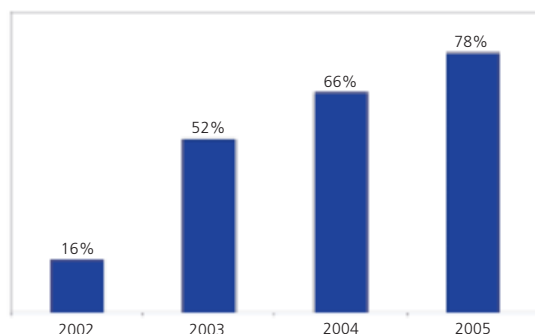


**Figure 3** Coronary angiographies and percutaneous coronary interventions per operator in different centres (grouped according to the annual average volume per operator). USZ = UniversitätsSpital Zürich; KSW = Kantonsspital Winterthur



**Figure 4** Evolution of the use of stents between 1992 and 2005. The bars represent the stent utilisation rates (percutaneous coronary interventions with stent placement / all percutaneous coronary interventions).

**Figure 5** Evolution of the use of drug-eluting stents between 2002 and 2005. The bars represent the drug-eluting stent utilisation rates (interventions with drug-eluting stent placement / all interventions with stent implantation).



balloon angioplasty including rotablator (59 cases; 2004: 40), sonotherapy (14 cases, 2004: 0 patients), or laser wire recanalisation (1 case, 2004: 0 patients) have rarely been applied. Atherectomy has not been done in any patient (2004: 0). The number of cases with application of intracoronary brachytherapy has further decreased from 35 in 2004 to 17 cases in 2005. There was an increase in the use of mechanical circulatory support systems consisting of 436 (2004: 332) intraaortic balloon pumps and 37 (2004: 10) percutaneous left ventricular assist devices.

**Complications after PCI**

Myocardial infarction after PCI was reported in 179/16 624 (1.1%; 2004: 1.4%) cases, emergency coronary artery bypass grafting was needed in 21/16 624 (0.1%; 2004: 0.1%) patients, and 87 (2004: 86) patients were reported to have died during the in-hospital period following PCI. Thus, the mortality rate after PCI is approximately 0.5% (2004: 0.5%). The reported rate of complications after PCI since 1987 is shown in figure 10.

**Non-coronary interventions**

The number of balloon valvuloplasties did not significantly differ from previous years (fig. 11). In contrast, the number of procedures for closure of structural defects, especially for patent foramen ovale (PFO), is steadily increasing over the last years (fig. 12).

Peripheral angioplasties are carried out by radiologists and angiologists in most hospitals. However, cardiologist reported 197 iliac or lower extremity interventions (57% with stent placement), 93 carotid artery angioplasties (81% with stent implantation), and 152 renal artery interventions (82% with stent placement). In addition, alcohol ablation of septal hypertrophy was done in 17 patients.

**Comparison between university, non-university public, and private hospitals**

In table 2, there is a comparison of university hospitals, non-university hospitals, and private hospitals with respect to infrastructure, procedures, and complications. When referring to the data from 2004 [15], it becomes obvious that especially in public non-university hospitals and private hospitals the number of CA and PCI is continuously growing. Interestingly, glycoprotein IIb/IIIa inhibitors were more frequently applied in public non-university hospitals as compared to university hospitals despite similar rates of PCI for STEMI.

The DES utilisation rate is higher in private hospitals as compared to university and non-university public hospitals.

## Discussion

Despite the retrospective nature of this study with its inherent limitations, the present survey closely mirrors daily practice in interventional cardiology in Switzerland. In 2005, similar trends as in the previous year could be observed: the number of CA and PCI is still slightly growing, and the use of DES and the

number of interventions for PFO closure are steadily increasing.

In our last report, we have extensively discussed the current Swiss practice of interventional cardiology in the light of the guidelines of the European Society of Cardiology [20]. In this context, there are no entirely novel aspects. Accordingly, we herein focus on two particularly pertinent topics, *ie* DES utilisation and management of PFO.

## DES utilisation in Switzerland

There was no further increase in the percentage of interventions with stent placement within the last three years, which is likely related to technical limitations (small vessels, tortuous vessels, proximal stent with the impossibility to deploy a stent distally) rather than lack of indication. In contrast, the DES utilisation rate increased from 52% in 2003 to currently 78% in 2005. This is not surprising when one considers the dramatic benefit in terms of both angiographic (late lumen loss) and clinical (target vessel revascularisation) endpoints observed in large trials with medium-term follow-up [21, 22]. In fact, the problem of in-stent-restenosis has almost disappeared in daily practice, and alternative procedures to resolve this problem (*ie* brachytherapy) have hardly ever been performed during the year 2005. However, in most other European countries the introduction of DES was much slower (*eg* 28% DES utilisation in Germany in 2005 [23]), most probably due to financial constraints. Thus, Switzerland has an exceptional position with a comparatively large experience with DES use. There is still some variation in the DES utilisation in different Swiss centres as shown in figure 6. However, at least three quarters of all centres have a DES rate  $\geq 75\%$ .

## Results from prospective studies on DES in Switzerland

The non-restricted application of DES provided the unique opportunity for Swiss cardiology centres to be among the first to set-up prospective, randomised studies evaluating the benefit of DES in real world patients. The SIR-TAX study found that a sirolimus-eluting stent is superior to a paclitaxel-eluting stent with respect to clinical and angiographic measures of restenosis [16]. The BASKET trial revealed that in an "all-comers" setting, the higher costs for DES as compared to BMS were not compensated by lower follow-up costs at six months, and that DES are only cost effective for elderly patients in specific high-risk groups [17]. The

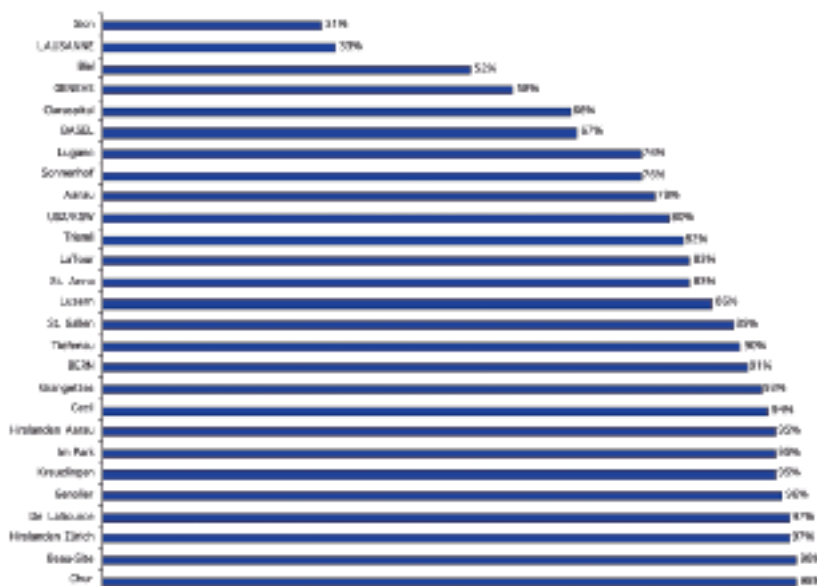


Figure 6

Drug-eluting stent utilisation rates (interventions with drug-eluting stent placement / all interventions with stent implantation) for percutaneous coronary interventions in different centres. USZ = UniversitätsSpital Zürich; KSW = Kantonsspital Winterthur

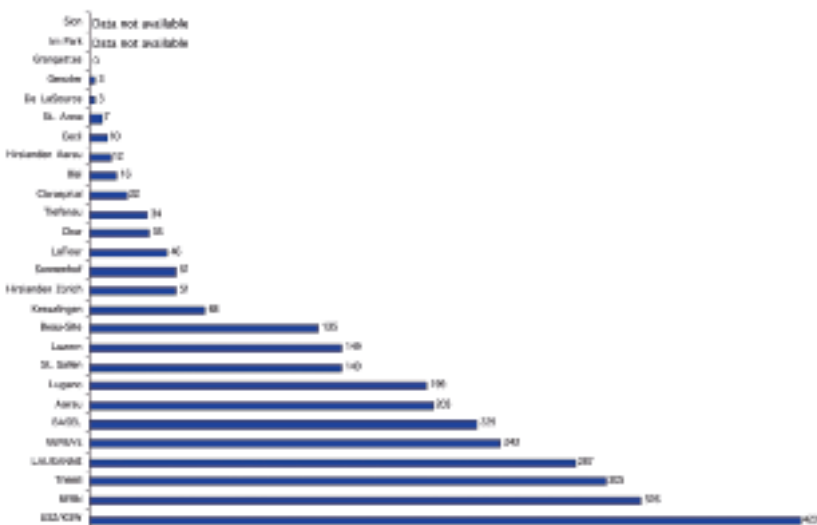
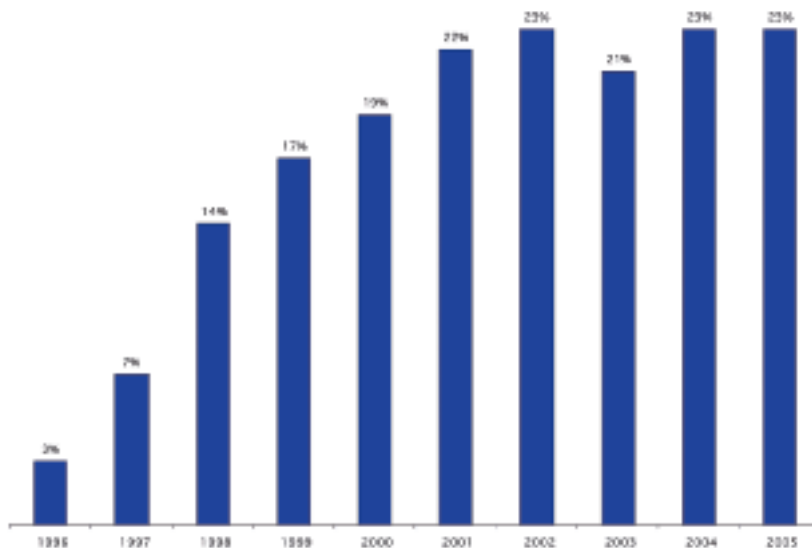


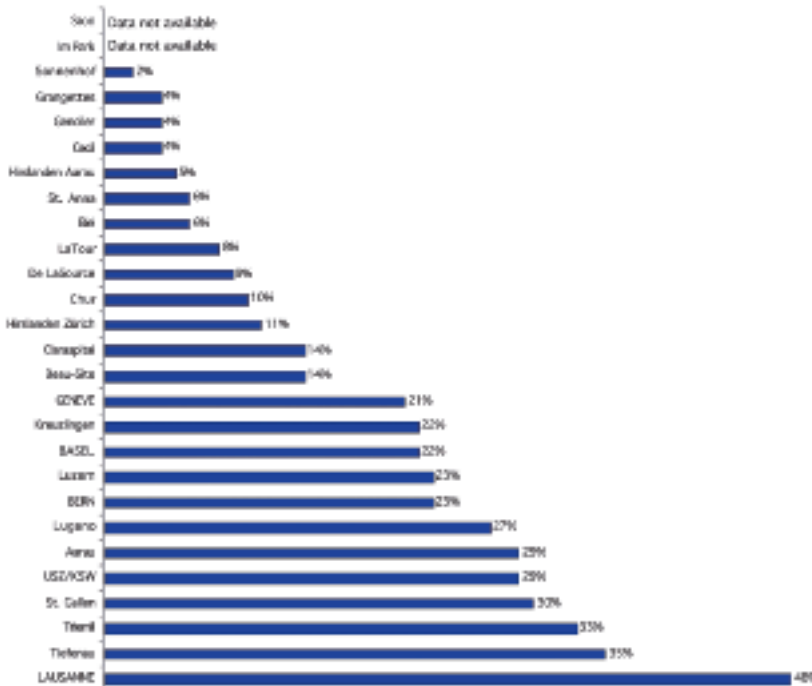
Figure 7

Absolute numbers of emergency percutaneous coronary interventions in different centres. USZ = UniversitätsSpital Zürich; KSW = Kantonsspital Winterthur

long-term follow-up of these studies however, revealed that DES are not only associated with high cost, but also late stent thrombosis, an unpredictable and sometimes fatal event. Therefore, it seems prudent to revisit the indication of DES in daily practice and to carefully weigh the risks and benefits of DES [18, 19].



**Figure 8**  
Evolution of the use of glycoprotein IIb/IIIa inhibitors between 1996 and 2005. The IIb/IIIa inhibitor utilisation rates (percutaneous coronary interventions with IIb/IIIa inhibitors / all percutaneous coronary interventions) are given.



**Figure 9**  
Glycoprotein IIb/IIIa inhibitor utilisation rates (percutaneous coronary interventions with IIb/IIIa inhibitors / all percutaneous coronary interventions) for percutaneous coronary interventions in different centres. USZ = UniversitätsSpital Zürich; KSW = Kantonsspital Winterthur

### DES: implications for future practice

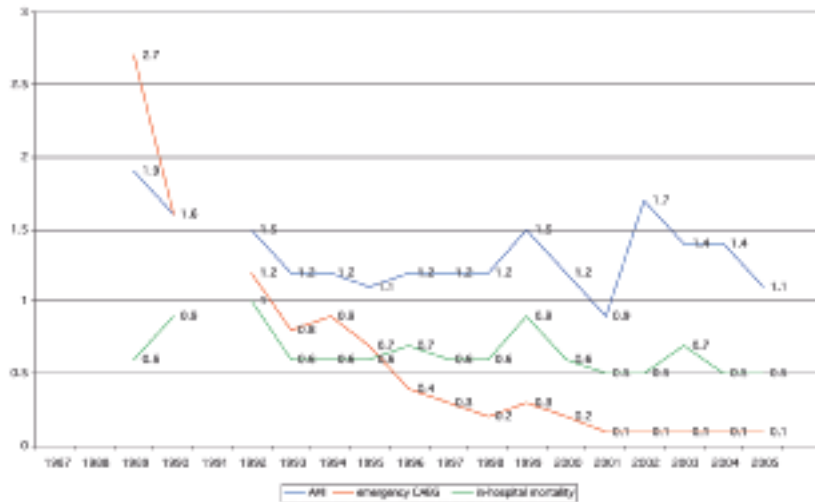
After DES implantation dual antiplatelet therapy is required for several months. It is currently unclear how long both aspirin and clopidogrel must be given to safely prevent late DES stent thrombosis, or whether it can not be prevented at all. Dual antiplatelet therapy however, is associated with an increased risk of bleeding and is difficult to manage in patients also requiring oral anticoagulation (eg for atrial fibrillation or recurrent thrombosis / pulmonary embolism). There is an ongoing debate on a more strict definition of indications and especially contraindications for DES placement.

### Non-coronary interventions

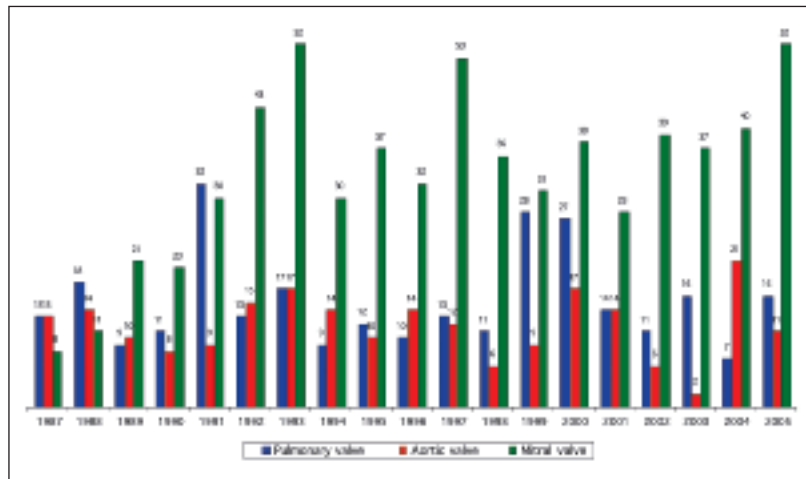
The number of balloon valvuloplasties did not significantly change as compared to previous years, probably due to the fact that the diagnosis of congenital or rheumatic valve disease in adults has become rare. In contrast, PFO is a frequent anatomical variant, and due to the more aggressive diagnostic approach in patients with stroke, the condition is more frequently detected. Indications for PFO closure are still under debate, and there is no consensus of optimal management of patients with PFO and stroke. Some authors recommend that high risk features including a temporal association between Valsalva-inducing manoeuvres and stroke, a co-existing hypercoagulable state, recurrent strokes, PFO with large opening, large right-to-left shunt, or right-to-left shunt at rest, or atrial septal aneurysma, should prompt PFO closure [24]. In contrast, others restrict PFO closure to patients with recurrence of stroke despite therapeutic anticoagulation [25]. In practice, PFO closure is often much more liberal, as it is difficult not to perform the intervention after PFO has been detected since not only referring physicians but also patients want the "hole in the heart" to be closed. Until further studies clarify indications for PFO closure, a further increase in the number of interventions can be expected.

### Limitations of the study

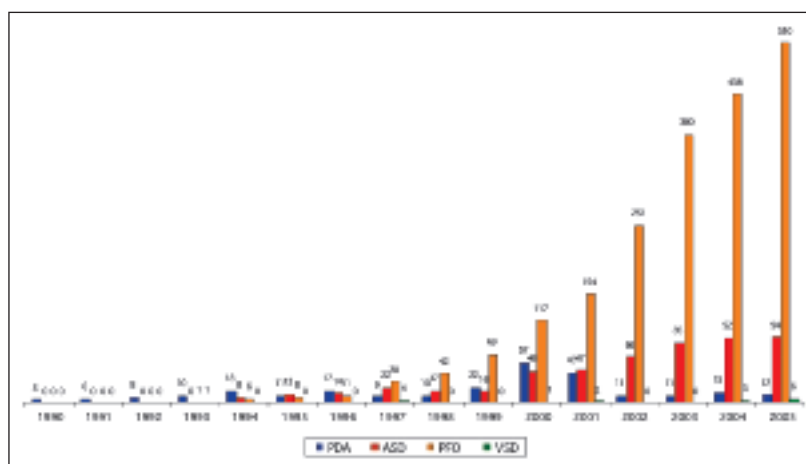
Due to the retrospective nature of the study, some inaccuracies must be assumed. Although the study reflects the practice of interventional cardiology in Switzerland, especially the reported rate of periprocedural complications must be interpreted with caution. A catheterisation laboratory-based retrospective analysis is unlikely to be complete, and we can assume that only complications occurring immediately at the time of catheterisation will have been



**Figure 10**  
Complications following percutaneous coronary interventions between 1987 and 2005. AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; data for 1991 and 1992 are not available.



**Figure 11**  
Balloon valvuloplasties from 1987 to 2005.



**Figure 12**  
Interventions for closure of structural defects from 1990 to 2005. PDA = persistent ductus arteriosus; ASD = atrial septal defect; PFO = patent foramen ovale; VSD = ventricular septal defect.

included. Regarding the high mortality of patients undergoing PCI for cardiogenic shock, these patients have probably not been included into the statistics. In addition, non-obvious complications such as contrast nephropathy will have been missed. Therefore, a more comprehensive data collection with respect to complications is planned based on a work sheet discussed at the business meeting of the Working Group in 2005 in Lausanne. This sheet has been sent to all centres to be included in the local databases on an optional base.

In addition, despite a more stringent definition of the term “emergency procedures” in the questionnaire (“PCI for STEMI”), a similar number of such interventions was reported when compared to the year 2004, indicating that not only PCI for STEMI but also other urgent interventions might have been reported.

During the writing process we were aware that the activities of the new cath lab in the Lindenhofspital in Berne have not been included in the analysis. Of course, this cath lab should also be included in future surveys.

## Conclusions

The number of CA and PCI and the use of DES increased steadily during the last years. Due to full reimbursement of DES, Switzerland has an exceptionally high DES utilisation rate. Given the new problem of late stent thrombosis, DES utilisation might change in coming years. There is also a significant increase in number of interventions for PFO closure, which is probably due to a more aggressive diagnostic approach in patients with stroke.

## Appendix

### Local coordinators

Aarau, Kantonsspital	A. Vuillomenet
Aarau, Hirslanden Klinik	P. Lüthy
Basel, Universitätsspital	C. Kaiser
Basel, Claraspital	B. Hornig
Bern, Universitätsspital	S. Windecker
Bern, Klinik Beau-Site	C. Noti
Bern, Klinik Sonnenhof	A. Garachemani
Bern, Tiefenauspital	M. Brack
Biel	C. Röthlisberger
Chur, Kantonsspital	P. Müller
Genève, Clinique des	P. Chatelain
Grangettes	
Genève, Hôpitaux	E. Camenzind
Universitaires	

Kreuzlingen, M. Pieper  
 Herzzentrum Bodensee  
 Lausanne, Clinique Cecil J. C. Stauffer  
 Lausanne, E. Eeckhout  
 Centre Hospitalier  
 Universitaire Vaudois  
 Lausanne, G. Rouvinez  
 Clinic de la Source  
 Lugano, Cardiocentro G. Pedrazzini  
 Luzern, Kantonsspital P. Erne  
 Luzern, Klinik St. Anna R. Hämmerli  
 Meyrin, Genolier Clinique E. De Benedetti  
 Meyrin, Hôpital La Tour P. Urban  
 Sion, Hôpital Régional P. Vogt  
 St. Gallen, Kantonsspital D. Weilenmann  
 Winterthur, Kantonsspital C. Neuen-  
 schwander  
 Zürich, Klinik Hirslanden P. Wadgi  
 Zürich, Klinik im Park F. W. Amann  
 Zürich, Triemli Stadtsptial E. Straumann  
 Zürich, UniversitätsSpital F. Eberli

## References

- Meier B. Örtliche Entwicklung der Koronarangioplastie. *Schweiz Med Wochenschr.* 1989;119:1033–9.
- Meier B, Pfisterer M. Coronarographie, angioplastie percutane transluminal coronaire et chirurgie coronaire, interventions valvulaires et anti-arrhythmiques et fibrinolyse pour infarctus aigu du myocarde en Suisse. *Schweiz Med Wochenschr.* 1990;120:1559–64.
- Meier B, Pfisterer M, Bertel O. Interventions cardiaque en Suisse. *Schweiz Med Wochenschr.* 1992;122:432–40.
- Rouvinez G, Bertel O, Urban P, Meier B. Herzeingriffe in der Schweiz 1992. *Schweiz Med Wochenschr.* 1994;124:1284–94.
- Röthlisberger C, Meier B, Urban P. Herzeingriffe in der Schweiz 1993. *Schweiz Rundsch Med Prax.* 1995;84:402–11.
- Goerre S. Herzeingriffe in der Schweiz 1994. *Schweiz Rundsch Med Prax.* 1996;85:1071–80.
- Goerre S. Herzeingriffe in der Schweiz 1995. *Schweiz Rundsch Med Prax.* 1997;86:425–31.
- Pedrazzini G. Herzeingriffe in der Schweiz 1996. *Schweiz Rundsch Med Prax.* 1998;87:821–31.
- Roffi M. Herzeingriffe in der Schweiz 1997. *Kardiovaskuläre Medizin.* 1999;2:302–18.
- Roffi M. Herzeingriffe in der Schweiz 1998. *Kardiovaskuläre Medizin.* 2000;3:89–103.
- Wahl A. Herzeingriffe in der Schweiz 1999. *Kardiovaskuläre Medizin.* 2001;4:268–81.
- Togni M, Meier B. Herzeingriffe in der Schweiz 2000. *Kardiovaskuläre Medizin.* 2002;5:238–48.
- Schlüter L, Rickli H, Vuillomenet A, Chatelain P, Eberli F, Meier B, et al. Interventions cardiaque percutanées en Suisse en 2001. *Kardiovaskuläre Medizin.* 2004;7:61–70.
- Reho I, Eberli F. Trends of percutaneous cardiac interventions in Switzerland [abstract]. *Kardiovaskuläre Medizin* 2005;8(Suppl 8):S39.
- Maeder M, Stauffer JC, Windecker S, Eberli F, Pedrazzini G, Vuillomenet A, et al. Interventional cardiology in Switzerland 2004. *Kardiovaskuläre Medizin.* 2006;9:213–26.
- Windecker S, Remondino A, Eberli F, Jüni P, Räber L, Wenaweser P, et al. Sirolimus-eluting and paclitaxel-eluting stents for coronary revascularization. *N Engl J Med.* 2005;353:653–62.
- Kaiser C, Brunner-La Rocca HP, Buser PT, Bonetti PO, Osswald S, Linka A, et al. BASKET Investigators. Incremental cost-effectiveness of drug-eluting stents compared with a third-generation bare-metal stent in a real-world setting: randomised Basel Stent Kosten Effektivitäts Trial (BASKET). *Lancet.* 2005;366:921–9.
- Pfisterer M, Brunner-La Rocca HP, Buser PT, Rickenbacher P, Hunziker P, Mueller C, et al. for the BASKET investigators. Late thrombotic events after clopidogrel discontinuation may limit the benefit of drug-eluting stents: an observational study of drug-eluting vs. bare-metal stents. *J Am Coll Cardiol.* 2006;48:2584–91.
- Wenaweser P, Abrecht L, Morger C, Togni M, Billinger M, Cook S, et al. Late and very late stent thrombosis in patients with drug-eluting stents. *Kardiovaskuläre Medizin.* 2006;9(Suppl.12):S43.
- Silber S, Albertson P, Avilés FF, Camici PG, Colombo A, Hamm C, et al., for the Task Force for Percutaneous Coronary Interventions of the European Society of Cardiology. *Eur Heart J.* 2005;26:804–47.
- Morice MC, Serruys PW, Sousa JE, Fajadet J, Ban Hayashi E, Perin M, et al. A randomised comparison of a sirolimus-eluting stent with a standard stent for coronary revascularization. *N Engl J Med.* 2002;346:1773–80.
- Stone GW, Ellis SG, Cox DA, Hermiller J, O'Shaughnessy C, Mann JT, et al. A polymer-based, paclitaxel-eluting stent in patients with coronary artery disease. *N Engl J Med.* 2004;350:221–31.
- Brucknerberger E. Herzbericht 2005 mit Transplantationschirurgie. 18. Bericht. Hannover: Eigenverlag; 2006. Website: [www.brucknerberger.de](http://www.brucknerberger.de).
- Wu LA, Malouf JF, Dearani JA, Hagler DJ, Reeder GS, Petty GW, et al. Patent foramen ovale in cryptogenic stroke: current understanding and management options. *Arch Intern Med.* 2004;164:950–6.
- Kizer JR, Devereux RB. Patent foramen ovale in young adults with unexplained stroke. *N Engl J Med.* 2005;353:2361–72.