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Clinical Outcome 10 Years After Attempted Percutaneous Transluminal Coronary Angioplasty in 856 Patients

PETER N. RUYGROK, MB, ChB, FRACP,* Peter P. T. de JAEGERE, PhD,
RON T. van DOMBURG, MSc, MARCEL J. van den BRAND, PhD,
PATRICK W. SERRUYS, PhD, FACC, PIM J. de FEYTER, PhD, FACC
Rotterdam, The Netherlands

Objectives. This study reports the 10-year outcome of 856 consecutive patients who underwent attempted coronary angioplasty at the Thoraxcenter during the years 1980 to 1985.

Background. Coronary balloon angioplasty was first performed in 1977, and this procedure was introduced into clinical practice at the Thoraxcenter in 1980. Although advances have been made, extending our knowledge of the long-term outcome in terms of survival and major cardiac events remains of interest and a valuable guide in the treatment of patients with coronary artery disease.

Methods. Details of survival, cardiac events, symptoms and medication were retrospectively obtained from the Dutch civil registry, medical records or by letter or telephone or from the patient's physician and entered into a dedicated data base. Patient survival curves were constructed, and factors influencing survival and cardiac events were identified.

Results. The procedural clinical success rate was 82%. Follow-up information was obtained in 837 patients (97.8%). Six hundred forty-one patients (77%) were alive, of whom 334 (53%) were symptom free, and 254 (40%) were taking no antianginal medication. The overall 5- and 10-year survival rates were 90% (95% confidence interval [CI] 87.6% to 92.4%) and 78% (95% CI 75.0% to 81.0%), respectively, and the respective freedom from significant cardiac events (death, myocardial infarction, coronary artery bypass surgery and repeat angioplasty) was 57% (95% CI 53.4% to 60.6%) and 36% (95% CI 32.4% to 39.6%). Factors that were found to adversely influence 10-year survival were age ≥60 years (≥60 years [67%], 50 to 59 years [82%], <50 years [88%]), multivessel disease (multivessel disease [69%], single-vessel disease [82%]), impaired left ventricular function (ejection fraction <50% [57%], ≥50% [80%]) and a history of previous myocardial infarction (previous myocardial infarction [72%], no previous infarction [83%]). These factors were also found to be independent predictors of death during the follow-up period by a multivariate stepwise logistic regression analysis. Other factors tested, with no influence on survival, were gender, procedural success and stability of angina at the time of intervention.

Conclusions. The long-term prognosis of patients after coronary angioplasty is good, particularly in those <60 years old with single-vessel disease and normal left ventricular function. The majority of patients are likely to experience a further cardiac event in the 10 years after their first angioplasty procedure.

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Since the introduction of percutaneous transluminal coronary angioplasty into clinical practice by Andreas Gruentzig in 1977 (1,2), the efficacy of this technique in the treatment of coronary artery disease, both native and vein graft vessels, has clearly become established (3–6), with continuing growth such that the number of angioplasties performed per year equals that of coronary artery bypass operations. The immediate and medium-term outcomes are well described, with the problems of abrupt closure and restenosis continuing to elude attempts to reduce their frequency (7–10). Knowledge of the long-term outcome of coronary angioplasty continues to accumulate over time (11). Recently, King and Schlumpf (12) reported on the 10-year follow-up of Gruentzig's first 169 patients, with an overall 10-year survival rate of 89.5%.

In the present report we describe the 10-year survival and clinical events of the first 856 patients treated by angioplasty at the Thoraxcenter, Rotterdam in the years 1980 to 1985.

Methods

Patients. Between September 1980 and December 1985, percutaneous transluminal coronary angioplasty was attempted in 856 consecutive patients at the Thoraxcenter, Rotterdam. Patient characteristics are displayed in Table 1. The indication for angioplasty was stable angina in 451 patients, unstable angina in 323, acute myocardial infarction in 76 and other indications in 6. All patients were treated with a combination of beta-adrenergic and calcium channel blocking agents,

From the Catheterization Laboratory, Thoraxcenter, Erasmus University, Rotterdam, The Netherlands. This study was presented in part at the 44th Annual Scientific Session of the American College of Cardiology, New Orleans, Louisiana, March 1995 and the Annual Meeting of the European Society of Cardiology, Amsterdam, The Netherlands, August 1995. Dr. Ruygrok is the recipient of a National Heart Foundation of New Zealand training fellowship.

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*Present address and address for correspondence: Dr. Peter N. Ruygrok, Catheterization Rooms, Green Lane Hospital, Green Lane West, Auckland 3, New Zealand.

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Table 1. Clinical Characteristics of 856 Patients Who Underwent Coronary Angioplasty During 1980 to 1985

Male	684 (79.9%)
Mean age (yr)	56.3
Range	22–80
Indication for angioplasty	
Stable angina	451 (52.7%)
Unstable angina	323 (37.7%)
MI	76 (8.9%)
Other	6 (0.7%)
Previous MI	341/833 (41%)
Previous CABG	78/856 (9.1%)
No. of vessels diseased	
1	517/817 (63.3%)
2	193/817 (23.6%)
3	96/817 (11.8%)
Mainstem	11/817 (1.3%)
EF <50%	104/629 (16.5%)

Data presented are number (%) of patients, unless otherwise indicated. CABG = coronary artery bypass graft surgery; EF = ejection fraction; MI = myocardial infarction.

nitrates and, in patients in unstable condition, intravenous heparin.

Angioplasty technique. At the commencement of the angioplasty procedure, 250 mg of acetylsalicylic acid and 100 mg of heparin were administered intravenously, with additional boluses of 50 mg given hourly. After completion of the procedure, if the stability of the immediate result was in doubt, a heparin infusion was commenced to achieve an activated partial thromboplastin time of 2.0 to 2.5 times control levels for 12 to 24 h. All patients continued to receive both nifedipine (40 to 60 mg) and acetylsalicylic acid (500 mg) once daily for a period of at least 6 months. The method of coronary angioplasty changed in February 1983 when the nonsteerable catheter system originally described by Gruentzig (2) was replaced by steerable balloon systems (13). *Procedural clinical success* was defined as a reduction in the lumen narrowing to <50% of the reference diameter, by visual assessment, with no major complications (death, myocardial infarction, coronary bypass surgery or repeat angioplasty) within 24 h of the procedure. Evidence of myocardial infarction immediately after the procedure was defined by a new Q wave or elevation of myocardial enzyme levels to more than twice the upper limit of normal, or both.

Data collection and follow-up. Procedural details, including complications, were recorded at the time of the procedure and entered into a dedicated data base. Procedure-related events were included in all follow-up analyses. In 1994 all patients who survived the hospital period were initially checked against the civil registry to establish survival or death. This is a reliable and complete source of mortality data in The Netherlands. Primary end points considered at follow-up were death, nonfatal myocardial infarction, recurrent angina pectoris requiring coronary artery bypass surgery or repeat angioplasty and event-free survival. These data were retrospectively obtained from the patient by letter or telephone, from the family or from the family doctor and checked against hospital records.

Assessment of late myocardial infarction during the follow-up period included a history of prolonged chest pain necessitating hospital admission and documentation of a myocardial infarction by electrocardiographic (ECG) or enzyme criteria. Information on bypass surgery and repeat angioplasty was obtained from the patient and hospital data bases. Additionally, surviving patients were asked for information regarding symptoms of angina pectoris, graded according to Canadian Cardiovascular Society classification (14), any resultant limitation in activities and current medication. Follow-up data were obtained for all but 19 patients (2.2%), the majority of whom had moved abroad. The follow-up period ranged from 0 to 13.3 years (median 9.6).

Statistical methods. Patient survival curves were constructed according to the method of Kaplan and Meier (15). Mean values were calculated for continuous variables and absolute and relative frequencies for discrete variables. Differences between groups were examined for statistical significance by use of a two-sample *t* test for continuous variables and the chi-square test for discrete variables; $p \leq 0.05$ was considered significant. Multivariate logistic regression using a computer package (BMDP) was performed to identify factors that

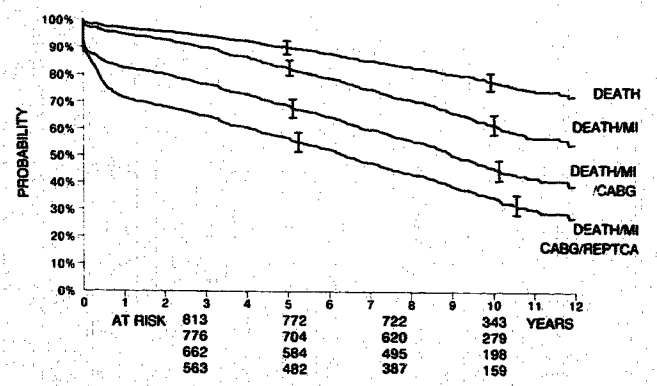

Figure 1. Ten-year cumulative survival and event-free survival rates in 856 patients who underwent coronary angioplasty during the years 1980 to 1985. **Numbers below graph** = patients at risk 2.5, 5, 7.5 and 10 years after angioplasty; **vertical lines** = 1 SE. CABG = coronary artery bypass surgery; MI = myocardial infarction; REPTCA = repeat coronary angioplasty.

Table 2. Symptomatic Status and Antianginal Medication in 630 Surviving Patients

CCS angina class	
0	334 (53%)
I	65 (10%)
II	134 (21%)
III	97 (15%)
IV	0
Limitation of activities (symptomatic patients)	
None	46 (40%)
Mild	198 (68%)
Severe	47 (16%)
Antianginal medication	
None or aspirin	254 (40%)
Single therapy*	197 (31%)
Double therapy	125 (20%)
Triple therapy	53 (8%)

*Nitrate, beta-blocker or calcium channel blocker. Data presented are number (%) of patients. CCS = Canadian Cardiovascular Society.

were related to long-term survival. A forward- and backward-stepping algorithm was used with $p < 0.05$ to identify the variables remaining as independent risk factors for long-term survival. Baseline characteristics tested were age ≥60 years, gender, prior myocardial infarction, unstable angina, multivessel disease, ejection fraction <50% and procedural failure.

Results. During the years 1980 to 1985, 969 consecutive coronary angioplasties were performed in 856 patients. The procedural success rate was 82%. Long-term follow-up information was obtained for 837 patients (97.8%).

Survival and symptoms. Six-hundred forty-one patients (77%) were alive and 196 dead 8 to 14 years after their initial angioplasty. One hundred forty-three patients had experienced a myocardial infarction, and 220 (25.7%) had undergone coronary artery bypass surgery, in 62 (7.2%) as an emergency procedure immediately after balloon angioplasty. Two hundred twenty-one patients underwent further angioplasty in the follow-up period, 81 (9.5%) within 6 months of the initial procedure. Patient survival and event-free survival curves were calculated using ranked clinical events and are displayed in Figure 1. The overall 5- and 10-year patient survival rates were 90% and 78%, respectively, and the 10-year survival rate for freedom from death, myocardial infarction, bypass surgery and repeat angioplasty was 36% (5-year freedom from cardiac events 57%). When the learning curve taken into consideration, the survival curves were recalculated comparing the first 226 patients who underwent coronary angioplasty with the nonsteerable balloon, prior to March 1983, with the 630 subsequent patients. The 5- and 10-year survival rates were identical, as was the 10-year freedom from events.

Details of symptomatic status and cardiac medication were obtained for 630 (98%) of the 640 survivors. Angina class, degree of limitation in 293 of 296 patients with angina and number of different antianginal medications (nitrates and beta- and calcium channel blockers) are displayed in Table 2. Fifty-three percent of survivors (334 patients) were symptom free, and 40% were taking no antianginal medication (254 patients).

Factors influencing cardiac events. The clinical variables age, gender, stability of angina, previous myocardial infarction, multivessel disease, impaired left ventricular function at the time of the index angioplasty and procedural success were tested to see whether they influenced long-term outcome.

Age. When patients were classified into three age groups (<50 years [n = 201], 50 to 59 years [n = 342] and ≥60 years [n = 313]), a clear survival advantage was found in the two younger groups at 5 years after the procedure (Fig. 2).

Gender. Survival and event-free survival were tested for the 684 men and 172 women. Women were significantly older than men at the time of initial angioplasty, with a mean age of 60.0 years compared with 55.3 years in men ($p < 0.001$). Additionally women had suffered fewer myocardial infarctions than men before intervention (34.6% and 43.6%, respectively). There were no significant differences in the other clinical variables, namely, previous bypass surgery, number of vessels diseased and left ventricular impairment. There was no difference in mortality or event rates during the follow-up period (Fig. 3). However, surviving women did have significantly more symptoms (41% angina free vs. 56% of men, $p < 0.05$) and

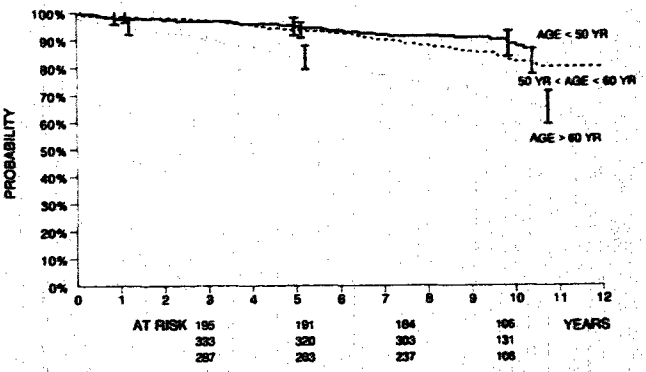

Figure 2. Cumulative survival rate for patients who underwent coronary angioplasty classified into those <50, 50 to 59 and ≥60 years old at the time of intervention. Format as in Figure 1.

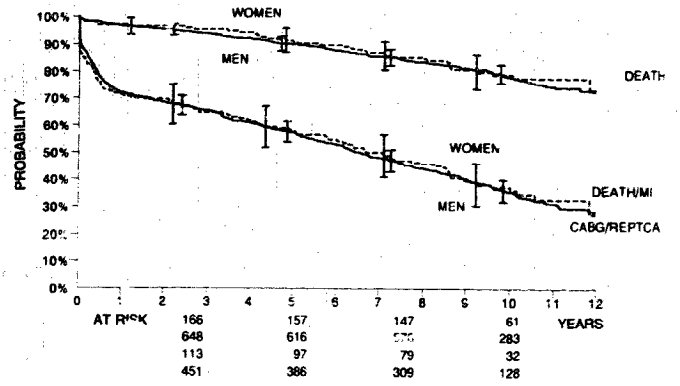

Figure 3. Cumulative survival and event-free survival rates for patients who underwent coronary angioplasty during 1980 to 1985 classified according to gender. Format and abbreviations as in Figure 1.

took significantly more antianginal medication (70% at least one antianginal agent vs. 57% of men).

Stability of angina. Four hundred fifty-one patients underwent coronary angioplasty for stable angina, 323 for unstable angina and 76 for an acute myocardial infarction. When survival curves were calculated for patients with stable and unstable angina and compared, there were no differences in long-term survival and cardiac event rates (Fig. 4). The two groups were similar with respect to other clinical variables. There were also no differences in symptoms and amount of antianginal therapy between the survivors of the two groups at the time of follow-up.

Previous myocardial infarction. Of 833 patients with documented details, 341 had a previous myocardial infarction (23 patients unknown). A significant survival benefit for those without a previous myocardial infarction was detectable only 9 years after the index angioplasty (Fig. 5).

Multivessel disease. Angioplasty was performed in 517 patients with single-vessel disease, 193 with two-vessel disease, 96 with three-vessel disease and 11 with mainstem disease (39 not recorded). When patients were classified into two groups—those with single-vessel disease and those with multivessel and mainstem disease—and survival curves constructed, a clear survival advantage was detectable for those with one-vessel disease by 1 year after the intervention, with 84% alive at 10 years versus 69% of those with multivessel disease (Fig. 6). However, there was no difference in survival or cardiac event rates when patients who underwent single-lesion (n = 672) and multiple-lesion (n = 184) angioplasty were compared.

Left ventricular function. Left ventricular ejection fraction had been calculated in 629 patients: mean [±SD] 59 ± 11%, range 19% to 86%; ≥50% in 525, <50% in 104. Survival and event-free survival curves were constructed for these two groups (Fig. 7). There was a clear survival advantage for those with ejection fraction ≥50%, with 80% remaining alive 10 years after angioplasty compared with 57% of those with ejection fraction <50%. However, event-free survival was similar, with less myocardial infarction, coronary artery bypass surgery and repeat angioplasty occurring in the follow-up period in patients with impaired left ventricular function.

Procedural success. Angioplasty was successful in 700 patients (82%). When these patients were compared with those with unsuccessful angioplasty with or without a complication, long-term survival was similar. However, significantly more

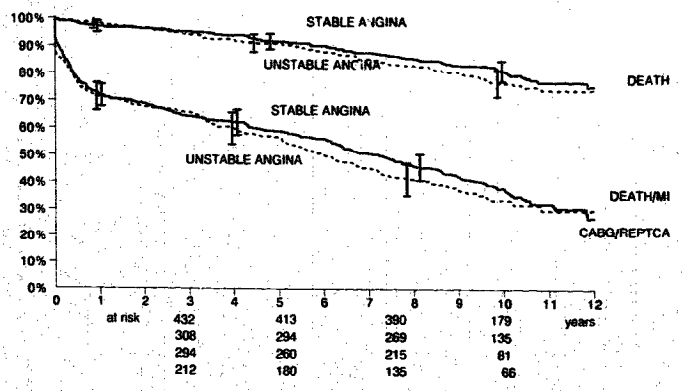

Figure 4. Cumulative survival and event-free survival rates for patients classified according to stability of angina (stable, unstable) at the time of initial angioplasty. Format and abbreviations as in Figure 1.

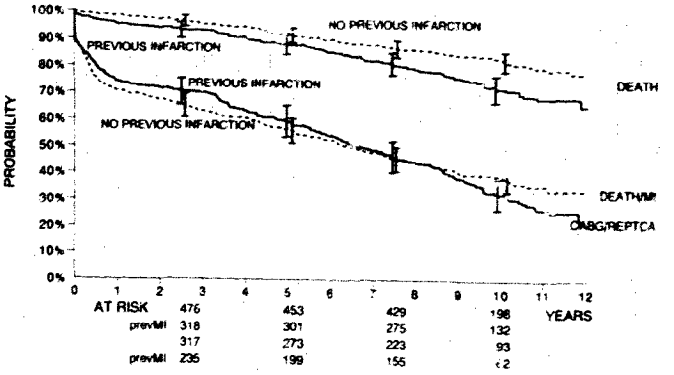

Figure 5. Cumulative survival and event-free survival rates for patients who underwent coronary angioplasty during the study period classified according to a positive or negative history for previous myocardial infarction. Format and abbreviations as in Figure 1.

major events occurred in patients with a procedural failure, predominantly about the time the angioplasty was performed (Fig. 8).

The 5- and 10-year cumulative survival rates for the various subgroups evaluated are shown in Table 3. Univariate analyses were used to test the influence of the previous seven clinical factors on long-term survival. The odds ratios (ORs) for these variables, with 95% confidence intervals (CIs), are displayed in Figure 9. Multivariate analysis could be performed for 579 patients with complete data. Age ≥60 years (OR 2.42, 95% CI 1.62 to 3.63), ejection fraction <50% (OR 2.22, 95% CI 1.33 to 3.70), multivessel disease (OR 1.60, 95% CI 1.06 to 2.42) and a history of previous myocardial infarction (OR 1.54, 95% CI 1.00 to 2.37) were found to be independent predictors of a diminished long-term survival.

Discussion

In patient management an inevitable question is, What is the prognosis?. The answer can be given only in the light of temporal information gained from similar groups of patients treated by similar means in the past. This also holds true for the management of coronary artery disease by coronary angioplasty. Regardless of an evolving change in patient characteristics, procedural indications, technique and expertise, knowledge of the long-term outcome of early angioplasty practice remains an important source of information and guidance for contemporary cardiologists and patients.

In the present study, we examined the late clinical outcome of the first 856 patients who underwent attempted angioplasty in a single center during the years 1980 to 1985. Our patient group included 76 who underwent coronary angioplasty for an evolving acute myocardial infarction and 156 (18%) in whom the procedure was an angiographic failure: thus, this was an intention to treat analysis. Our finding of an overall 5-year survival rate of 90%, although favorable, appears to be lower than previously reported (Table 4). It is recognized that the prognosis of patients with single-vessel disease and good ventricular function is excellent even when managed conservatively (17). When our patients were compared with other studies, we found that our patients were older and more likely to have multivessel disease, both factors associated with a decreased likelihood of event-free survival (18–20). We suggest that the baseline characteristics of our patients more closely resemble those of patients encountered in current angioplasty practice. The 10-year survival rate of our cohort of

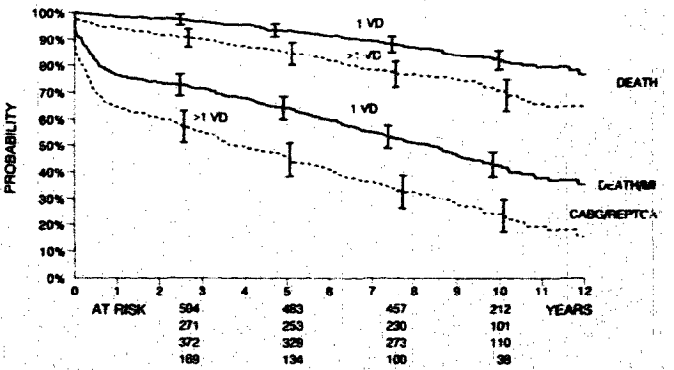

Figure 6. Cumulative survival and event-free survival rates for all patients classified according to the presence of single (1 VD) or multivessel disease (>1 VD). Format and other abbreviations as in Figure 1.

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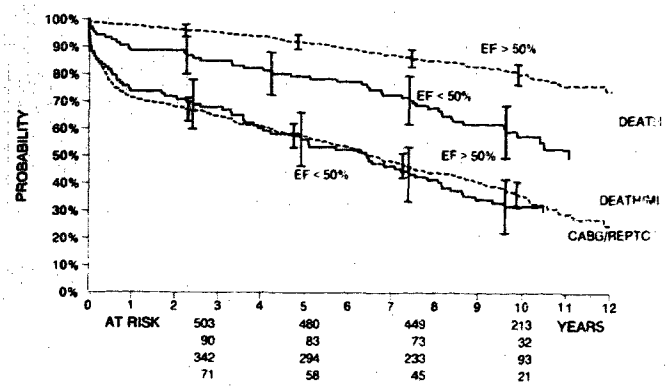

Figure 7. Cumulative survival and event-free survival rates for the 629 patients with a calculated ejection fraction (EF), classified into those with ejection fraction <50% and ≥50%. Format and other abbreviations as in Figure 1.

patients was 78%, and to our knowledge, the only reported data for comparison are from Gruentzig's first 169 patients in whom the 10-year survival was 89.5% (12). His patients were a highly selected group in whom only proximal, discrete, predominantly left anterior descending artery lesions (73%) were treated because of the limitations of the equipment available at the time. Furthermore, his patients were younger and had a mean age of 49.8 years compared with 56.3 years in our study. In our study, 543 patients were <60 years old, with a 10-year survival rate of 85%.

Only 36% of our patients were free from further cardiac events 10 years after the index procedure (57% event free at 5 years), no doubt a result of our more general patient cohort (myocardial infarction in 41%, prior coronary bypass surgery in 9%, multivessel disease in 36.7%, impaired left ventricular function in 16.5%). Virtually all patients with angiographically unsuccessful angioplasty early in the study period were referred for semiurgent coronary bypass surgery. This tendency decreased as confidence in the technique grew, with an overall rate of 7.2% over the 5-year period. Recent data (21) show that the emergency bypass surgery rate is now <1%, and it along with an improved procedural success rate (now >90%) are most likely the most changed factors when our study patients are compared with those of the present day because the rates of death, myocardial infarction, restenosis and repeat intervention have changed little in the past decade (21,22). The long-term outcome of patients undergoing contemporary angioplasty may therefore be more comparable to patients in the present study with a successful procedure.

Factors influencing survival. We tested the clinical factors of age, gender, previous myocardial infarction, stability of angina, multivessel disease and left ventricular function to assess whether they influenced long-term survival. Although coronary angioplasty has been shown to be safe and effective in elderly patients with coronary artery disease (23), our data, in agreement with others, show significantly reduced long-term survival in patients ≥60 years old at the time of their first angioplasty procedure (24). This result may be explained by the more extensive coronary artery disease, with possibly less complete revascularization, in this group of patients. Additionally, it is possible that more deaths resulted from other disease processes more likely to manifest with advancing years because our mortality data included deaths from all causes.

The finding that men and women have a similar outcome after angioplasty in the intermediate term (16,25) has been

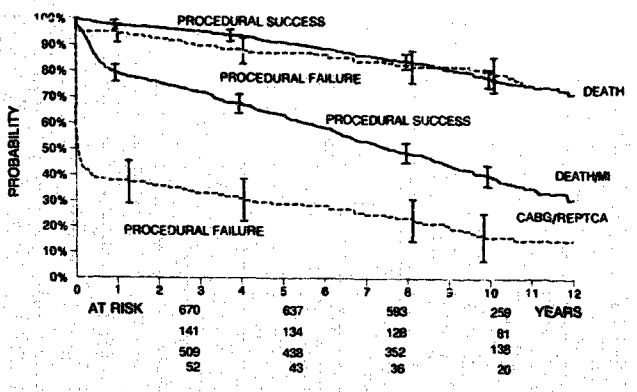

Figure 8. Cumulative survival and event-free survival rates for all patients classified according to whether the procedure was a success or failure. Format and abbreviations as in Figure 1.

Table 3. Factors Influencing 5- and 10-Year Survival

	Survival Rate				
	5 Year	95% CI	10 Year	95% CI	p Value
Overall	90%	87.6–92.4%	78%	75.0–81.0%	
Age					
<50 yr	95%	91.8–98.2%	88%	83.4–92.6%	
50–59 yr	93%	90.2–95.8%	82%	77.6–86.4%	
≥60 yr	84%	79.6–88.2%	67%	61.4–72.6%	< 0.0005
Male	90%	87.4–92.6%	78%	74.6–81.4%	
Female	91%	86.6–95.4%	79%	72.6–85.4%	0.97
No previous MI	92%	89.4–94.6%	83%	79.4–86.6%	
Previous MI	88%	84.4–91.6%	72%	67.0–77.0%	< 0.005
Stable angina	92%	89.2–94.8%	80%	76.0–84.0%	
Unstable angina	91%	87.8–94.2%	76%	71.0–81.0%	0.72
Single-vessel disease	93%	90.6–95.4%	82%	78.4–85.6%	
Multivessel disease	84%	79.8–88.2%	69%	63.2–74.8%	< 0.005
EF ≥50%	91%	88.4–93.6%	80%	76.2–83.8%	
EF <50%	79%	71.0–87.0%	57%	47.4–66.6%	< 0.0005
Procedural success	91%	88.8–93.2%	77%	73.6–80.4%	
Procedural failure	87%	82.0–92.0%	80%	73.4–86.6%	0.65

CI = confidence interval; other abbreviations as in Table 1.

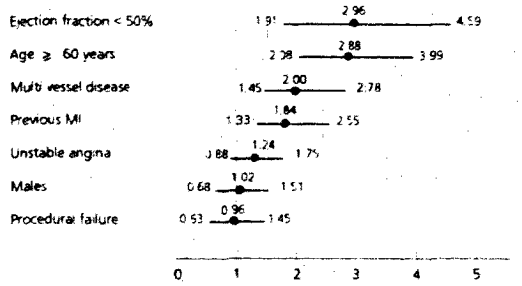

Figure 9. Univariate calculation of the odds ratio for death in the follow-up period, with 95% confidence intervals for the clinical factors listed. MI = myocardial infarction.

extended to the long term by our study. The 10-year survival rate was 78% for men and 79% for women, and the event-free survival rate was identical at 36%. However, there are several important differences in demographic, clinical and angiographic characteristics between these two groups. In our study, women were significantly older than men at the time of coronary angioplasty, a factor found to be associated with a less favorable outcome. It is possible that had these two groups been matched for age, women may have had a more favorable outcome than men. This argument is confounded by the development of coronary artery disease at a later age in women than men and is related to the protective effect of estrogen. Other important factors not assessed in our study are the increased likelihood of an adverse risk factor profile (16) and smaller coronary vessels, making angioplasty technically more difficult in women. Our finding of significantly more angina in surviving women than in men (59% vs. 44%) is consistent with the findings of Kelsey et al. (25), who reported angina in 30% of women and 19% of men 4 years after the angioplasty.

The detrimental influence of a previous myocardial infarction and related left ventricular impairment on survival has again been demonstrated in the present study. However, those patients with impaired left ventricular function had fewer myocardial infarctions and underwent less bypass surgery and repeat angioplasty in the follow-up period, resulting in 5- and 10-year event-free survival rates nearly identical to those in patients with normal left ventricular function. This finding may be a result of the tendency to manage this higher risk group, who often have fewer anginal symptoms, conservatively and that a myocardial infarction is more likely to result in death in these patients with an already compromised myocardium. The negative influence of multivessel disease has been discussed previously. The long-term outcome of patients classified into those with stable and unstable angina syndromes at the time of initial angioplasty also revealed no significant differences, with 5- and 10-year survival rates of 92% and 91% and 80% and 76%, respectively. These data support and extend information reported for the intermediate term, with a similar survival rate in both groups of patients of 95% to 96% at 2 and 3 years after coronary angioplasty (26,27). Although direct comparison with angioplasty is not possible without a randomized study, some comment can be made on the results of management of unstable angina by other methods. Luchi et al. (28) randomized patients with unstable angina to undergo medical or surgical therapy. The overall 2-year survival rate was 93% and was similar for both treatment groups, although patients with impaired left ventricular function appeared to benefit from operation. In another large observational study (29), the 10-year survival rate after coronary bypass surgery for unstable angina was found to be 83%.

Comparison with other treatment modalities. The 15-year outcome of patients initially treated by medication or operation in the Coronary Artery Surgery Study (CASS) trial (30) has recently been reported. The 15-year survival rate was similar for both treatment groups at around 50%. The 10-year survival rates in the same study were 65% and 72% for those initially assigned to medical and surgical therapy, respectively. Between 10 and 15 years, there was a 22% mortality rate in the surgical group compared with 15% in the medical group, consistent with advancing vein graft disease (30). Although this population of patients cannot be directly compared with our study patients, our 10-year survival rate of 78% appears favorable.

The long-term benefit of percutaneous coronary angioplasty compared with bypass surgery remains unknown. The intermediate results of randomized trials of patients with multivessel disease have recently been reported. In the Randomized Intervention Treatment of Angina (RITA), trial (31), 1,011 patients with unstable or severe angina were randomized to angioplasty or bypass surgery. The 2.5-year interim analysis showed no differences between these two treatment modalities for the principal end point of death or myocardial infarction. However, the prevalence of anginal symptoms was higher in the angioplasty group, of whom almost four times as many

Table 4. Long-Term Outcome After Percutaneous Transluminal Coronary Angioplasty

Study (ref no.), Year	No. of Pts	Mean Age (yr)	Pts With MVD (%)	Angiographically Successful PTCA (%)	Survival Rate (%) 5 Year	Survival Rate (%) 10 Year	Comment
Weintraub et al. (16), 1994	10,785	58.3	29	90	94	—	1980–1991; infarction excluded; intention to treat
Henderson et al. (18), 1992	899	54.9	50	81.6	89.2	—	All PTCAs; intention to treat
Kadel et al. (19), 1992	798	52.8	0	81.2	96	—	Single-vessel disease; single center; total occlusions excluded
Talley et al. (11), 1988	427	53.6	14	84	96.3	—	All PTCAs; single center; intention to treat
King and Schlumpf (12), 1993	169	49.5	42	78.6	—	89.5	All PTCAs; single center; intention to treat
Present study	856	56.3	36.5	82	90	78	All PTCAs; single center; intention to treat

MVD = multivessel disease; PTCA = percutaneous transluminal coronary angioplasty; Pts = patients; ref = reference; — = not available.

patients required repeat angiography or intervention than those in the surgery group (31). These findings have been confirmed by the Emory Angioplasty Versus Surgery Trial (EAST) (32) and the German Angioplasty Bypass Surgery Investigation (GABI) (33). In both studies, patients who underwent coronary angioplasty required significantly more revascularization procedures in the follow-up period (3 years for EAST, 1 year for GABI), with an increased need for anginal therapy, than those who underwent operation.

Continued long-term follow-up of these groups of patients is essential to establish whether those assigned to coronary angioplasty obtain a survival benefit once vein graft disease becomes advanced, as is suggested by the CASS registry data, thus perhaps justifying the frequent need for early reintervention.

Conclusions. Long-term survival in our first 856 patients who underwent attempted coronary angioplasty during the years 1980 to 1985 is good, particularly in those patients <60 years old at the time of intervention and those with single-vessel disease and normal left ventricular function. The long-term outcome in terms of survival and freedom from cardiac events was similar in men and women and those with stable and unstable angina. The majority of patients experienced a further cardiac event, most likely as a result of procedural failure and restenosis in the early follow-up period and incompleteness of revascularization and progression of atherosclerosis subsequently. Although significant advances have occurred, particularly in improving the immediate success of coronary angioplasty and in the complexity of lesions treated, making comparison with current practice difficult, knowledge of long-term outcome remains essential in planning treatment strategies.

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