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Improved Outcomes for Women Undergoing Contemporary Percutaneous Coronary Intervention

A Report From the National Heart, Lung, and Blood Institute Dynamic Registry

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OBJECTIVES The goal of this study was to determine whether women undergoing contemporary percutaneous coronary intervention (PCI) remain at increased risk in comparison with men and whether the outcomes in women have improved.

BACKGROUND Previous studies have shown that women treated with coronary angioplasty have a higher incidence of procedural morbidity and mortality than men.

METHODS Gender differences in wave 1 of the National Heart, Lung and Blood Institute (NHLBI) Dynamic registry were evaluated. Baseline characteristics and outcomes in women in the Dynamic registry were compared with those in women in the 1985–1986 and 1993–1994 NHLBI Percutaneous Transluminal Coronary Angioplasty (PTCA) registries.

RESULTS Women were older with a higher prevalence of diabetes mellitus, hypertension, congestive heart failure, unstable angina and single vessel disease in comparison with men. Although procedural success and in-hospital death (2.2% vs. 1.3%), myocardial infarction (MI) (2.3% vs. 3.0%) and coronary artery bypass graft surgery (CABG) (1.3% vs. 1.4%) were similar in women and men, respectively, one-year mortality (6.5% vs. 4.3%, $p = 0.02$) and combined end point of death/MI/CABG (18.3% vs. 14.4%, $p = 0.03$) were higher in women than in men. After controlling for other factors, gender was not a significant predictor of death or death plus MI at one year. Despite a higher risk profile in women in the Dynamic registry in comparison with women in the 1985–1986 NHLBI PTCA registry, in-hospital death/MI/CABG was lower (6.0% vs. 11.6%, $p < 0.001$).

CONCLUSIONS Despite persistent high-risk characteristics in women, gender differences in outcomes in patients undergoing contemporary PCI have decreased, and outcomes in women have improved. (J Am Coll Cardiol 2002;39:1608–14) © 2002 by the American College of Cardiology Foundation

Previous studies examining gender differences in patients undergoing coronary angioplasty have reported that women had a higher in-hospital mortality and were at increased risk for an adverse outcome in comparison with men (1–5). This difference in mortality was attributed, in part, to the advanced age, risk profile and comorbid disease in women. More recently, it was demonstrated that, in the confines of a randomized trial comparing coronary balloon angioplasty and coronary bypass surgery in patients with multivessel disease, women and men undergoing coronary angioplasty had a similar mortality in-hospital and at five years (6). Furthermore, single center reports as well as registry experience have noted an improved outcome in women treated with coronary balloon angioplasty (7–10). However, the influence of advances in technique and technology, particularly in the use of intracoronary stents and adjunctive antiplatelet agents on the outcome of coronary intervention in women has not yet been well defined. Accordingly, we examined the gender differences in patients undergoing contemporary percutaneous coronary intervention (PCI) in a multicenter registry experience.

METHODS

Registry design and patient population. The National Heart, Lung, and Blood Institute (NHLBI) funded Dynamic registry includes 15 clinical centers and a coordinating center located at the University of Pittsburgh Graduate School of Public Health. Of the clinical centers, 11 were participants in the 1985–1986 and 1993–1994 (the latter time period open to women only) Percutaneous Transluminal Coronary Angioplasty (PTCA) registries. Four centers were added to increase enrollment of minorities. The Dynamic registry is designed to evaluate three separate

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Abbreviations and Acronyms

CABG = coronary artery bypass graft surgery
CI = confidence interval
CPK = creatine phosphokinase
LDH = lactic dehydrogenase
MI = myocardial infarction
NHLBI = National Heart, Lung and Blood Institute
OR = odds ratio
PCI = percutaneous coronary intervention
PTCA = percutaneous transluminal coronary angioplasty
RR = relative risk

cohorts of approximately 2,000 patients, 18 months apart. Importantly, at each site, a recruitment cap on white men was instituted, so as to augment the enrollment of women and minorities. The first wave of the registry began in July 1997 and was completed in February 1998, and all registered patients are included in this report. The protocol was approved by each institution's review board, and informed consent to collect information after hospital discharge was obtained.

Data collection and management. Data collected included demographic information, medical history and risk factor status. Detailed coronary angiographic information before and after coronary intervention and left ventricular ejection fraction were obtained as were procedural strategy and procedural success of each significant (≥50%) coronary artery lesion attempted. Angiograms were interpreted at the clinical sites. Procedural outcome in terms of success and major in-hospital complications (death, nonfatal infarction, emergency coronary bypass surgery) as well as in-hospital untoward events were recorded. At one-year follow-up, the information collected included vital status, presence and type of angina, medications and intercurrent hospitalization for myocardial infarction (MI), repeat PCI or coronary artery bypass graft surgery (CABG).

Definitions. Death was defined as mortality from any cause. Myocardial infarction was defined as evidence of two or more of the following: 1) typical chest pain >20 min duration not relieved by nitroglycerin; 2) serial electrocardiogram recordings showing changes from baseline or serially in ST-T and/or Q-waves in two or more contiguous leads; 3) serum enzyme elevation of creatine phosphokinase (CPK)-myocardial band >5% of total CPK, total CPK >2× normal, lactic dehydrogenase (LDH)-1 greater than LDH-2 or troponin >0.2 μg/ml; and 4) new wall motion abnormalities. Angiographic success was defined as an absolute 20% reduction in lesion severity and a final stenosis of <50%. Angiographic success was classified as either partial, when at least one lesion was successfully treated, or total, when all attempted lesions were successfully treated. Coronary artery bypass graft surgery was classified as elective, urgent or emergency according to clinical circumstances. Procedural success was defined as either partial or total angiographic success without death, Q-wave MI or emergency CABG.

Data analysis. Women and men were compared according to demographics, baseline history, risk factors, angiographic and procedural characteristics, initial success and complications and in-hospital outcomes using the chi-square test (or Fisher exact test) for categorical data and the Student *t* test or Wilcoxon rank-sum test for continuous data. One-year event rates were calculated using the Kaplan-Meier method (11) and compared using log-rank statistics. In-hospital outcomes, including death and death plus MI and emergency CABG, were modeled with logistic regression (12). Explanatory variables considered for the models were baseline characteristics that either were independently related to the outcome and/or differed significantly between women and men. Once a model was found that included only significant predictors ($p < 0.10$), gender was added. Cox regression analysis was used to compare one-year outcomes in women and men with adjustments for baseline characteristics that were distributed differently for women and men and/or related to the outcome (13).

In comparing women from the 1985–1986, 1993–1994 and Dynamic registries, a different group of women was considered. Only patients who were enrolled consecutively (patients enrolled before the first recruitment cap was reached at each site) and who had not had any prior coronary angioplasty procedure were included. This was done because otherwise the proportion of minority patients and, thus, the distribution of many clinical factors would not be comparable to the earlier registries. Demographic data and in-hospital outcomes were compared between the 1985–1986, the 1993–1994 and Dynamic registries looking at time trends. There was no follow-up for the 1993–1994 registry, but one-year event rates were estimated for the 1985–1986 and Dynamic registries using the Kaplan-Meier method. Logistic regression was used to compare in-hospital outcomes for the 1985–1986 and Dynamic registries and the 1993–1994 and Dynamic registries. Cox regression analysis was used to compare one-year outcomes for women from the 1985–1986 and Dynamic registries with adjustment for baseline characteristics that were distributed differently between the registries and/or were related to the outcome. Time period was used as the first explanatory variable. Statistical significance was assumed for $p < 0.05$.

RESULTS

Of the 2,524 patients registered, 2,205 were consecutively enrolled, and the remainder were women and minority patients. Of the total 2,524 patients, 895 (35%) were women. The proportion of women at the 15 clinical sites ranged from 25% to 45%.

Baseline clinical and angiographic characteristics. On average, the women were significantly older than the men (Table 1), and a higher proportion of women than men were

Table 1. Baseline Clinical Characteristics by Gender From the 1997–1998 Dynamic Registry

	Men (n = 1,629)	Women (n = 895)	p Value
Demographics			
Mean age (yrs)	60.7 ± 11.4	66.1 ± 11.4	≤0.001
Age ≥65 yrs (%)	37.2	57.9	≤0.001
Race (%)			≤0.001
White	80.8	79.3	
Black	5.8	11.2	
Asian	5.3	4.0	
Hispanic	8.1	5.5	
Height (cm)	174.2 ± 7.9	160.5 ± 6.9	≤0.001
Weight (kg)	85.3 ± 15.5	73.4 ± 15.6	≤0.001
Body mass index (kg/m^2)	28.1 ± 4.6	28.5 ± 5.8	0.416
Medical history			
Prior percutaneous procedure(s) (%)	29.0	25.9	0.091
Prior CABG (%)	17.7	13.8	0.013
Prior myocardial infarction (%)	40.7	36.3	0.030
History of diabetes (%)	23.7	35.8	≤0.001
Insulin (%)	5.9	13.7	≤0.001
History of CHF (%)	8.5	12.8	≤0.001
History of hypertension (%)	54.3	68.7	≤0.001
History of hypercholesterolemia (%)	60.1	62.7	0.226
Current smoker (%)	27.9	20.6	≤0.001
Severe noncardiac concomitant disease (%)	27.4	33.7	≤0.001

CABG = coronary artery bypass surgery; CHF = congestive heart failure.

black. Overall, women were significantly more likely to have a history of diabetes mellitus, hypertension and severe noncardiac comorbid disease. Women were more likely than men to have single-vessel disease, and, on average, they had fewer significant lesions and vessels that were totally occluded (Table 2). Compared with men, women's reference vessel size was significantly smaller although lesion length was similar (Table 3).

Procedural characteristics. The primary reason for revascularization was more likely to be unstable angina for women than for men (Table 2). The number of multilesion attempts was similar for women and men although women were less commonly treated with a IIb/IIIa platelet receptor antagonist than men. Women were less likely to receive a stent. On a lesion level, initial and final percent stenosis and lesion success did not differ significantly by gender. Difference in stent use was not statistically significant, on a lesion level, once reference vessel size was taken into consideration.

Adverse events and in-hospital outcomes. There were no differences in procedural complications, including the incidence of coronary dissection and abrupt vessel closure, between women and men with the exception of major entry site complications (5.0% vs. 2.6%, $p \leq 0.001$) and bleeding requiring transfusion (3.2% vs. 1.1%, $p \leq 0.001$), which occurred more frequently in women than in men. Procedural success was similar between genders. Of note, there were no significant differences in unadjusted rates for in-hospital death, MI, CABG or the combined outcome of death, MI and emergency CABG between women and men (Table 4). Female gender was not a significant predictor of in-hospital death (odds ratio [OR] = 1.60, 95% confidence interval [CI] = 0.76, 3.35) or death plus MI and emergency CABG (OR = 1.15, 95% CI = 0.74, 1.79) after controlling for other significant factors.

Outcomes at one year. At one year after the procedure, mortality was significantly higher (6.5% vs. 4.3%, $p = 0.02$) (Fig. 1). However, after controlling for other significant factors, gender was not a significant predictor of death (relative risk [RR] = 1.26, 95% CI = 0.85, 1.87) or death plus MI (RR = 1.14, 95% CI = 0.86, 1.50). The combined end point of death plus MI and CABG occurred significantly more frequently in women than in men (Table 5), but this difference did not appear until approximately 90 days after the procedure. During the first 90 days, women and men had similar rates for the combined outcome (Kaplan-Meier estimates for cumulative rates at 90 days 8.8% for women vs. 8.5% for men, $p = 0.859$).

Comparison of the registries. Table 6 depicts the demographic data and event rates between women in the 1985–1986, 1993–1994 and Dynamic registries. Women in the Dynamic registry were older with more comorbid disease, diabetes mellitus, hypertension, hypercholesterolemia and more multivessel disease than women in the earlier registries. Yet, in-hospital mortality was similar and angiographic and procedural success higher in the Dynamic registry in comparison with the 1985–1986 and 1993–1994 registries. Unadjusted one-year event rates did not differ between the Dynamic registry and the 1985–1986 registry, with the exception of a lower repeat revascularization rate in the Dynamic registry. However, after adjustment for baseline characteristics, the Dynamic registry time period was a significant independent predictor of a lower mortality (RR = 0.51, 95% CI = 0.29 to 0.90) at one year in comparison with the 1985–1986 registry time period.

Table 2. Patient Angiographic and Procedural Characteristics by Gender From the 1997–1998 Dynamic Registry

	Men (n = 1,629)	Women (n = 895)	p Value
LVEF			
Mean LVEF (%) (938 men; 510 women)	54.1 ± 14.4	56.3 ± 13.6	0.011
Abnormal LVEF (%) (1,055 men; 594 women)	30.1	22.6	≤0.001
Vessel disease (%)			0.025
Single	40.1	45.7	
Double	33.0	30.1	
Triple	26.9	24.2	
Any total occlusion (%)	42.4	34.1	≤0.001
Mean number significant lesions	2.9 ± 2.1	2.7 ± 2.0	0.004
Primary reason for revascularization (%)			0.055
Asymptomatic coronary artery disease	2.4	1.7	
Stable angina	25.9	22.8	
CCSC I/II	12.1	10.1	0.126
CCSC III/IV	13.0	12.5	0.764
Unstable angina	44.8	50.6	
Acute myocardial infarction	19.5	18.7	
Cardiogenic shock	1.8	1.6	0.614
Thrombolytic therapy	5.0	4.0	0.281
Other	7.4	6.2	
Medication <24 h before or during procedure (%)			
Ticlopidine	51.0	47.7	0.119
IIb/IIIa receptor antagonist	26.5	20.4	≤0.001
Number of lesions attempted			
2 or more (%)	33.6	31.5	0.289
(Mean)	1.5 ± 0.8	1.4 ± 0.7	0.142
Number of vessels attempted			
2 or more (%)	10.0	7.8	0.075
Graft attempted (%)	8.6	5.2	0.002
Lesion with total occlusion attempted (%)	20.9	15.6	≤0.001
Balloon only/balloon + local drug (%)	24.1	28.9	0.007
RA use overall (%)	10.4	15.3	≤0.001
Stent use overall (%)	70.0	62.7	≤0.001

CCSC = Canadian Cardiovascular Society Classification; LVEF = left ventricular ejection fraction; RA = rotational atherectomy.

Table 3. Attempted Lesion Characteristics by Gender From the 1997–1998 Dynamic Registry

	Men	Women	p Value
Total attempted lesions	n = 2,373	n = 1,250	
Reference vessel size (mm)	3.09 ± 0.95	2.90 ± 0.58	< 0.001
Lesion length (mm)	12.49 ± 8.02	12.14 ± 7.22	0.770
Lesion characteristics (%)			
Total occlusion	15.5	12.5	0.015
Evidence of thrombus	20.5	17.9	0.066
Calcified	29.2	30.7	0.352
Ulcerated	13.7	10.3	0.004
Bifurcation	12.6	11.7	0.453
Receive collateral	13.8	12.5	0.322
Supply collateral	6.0	4.5	0.081
Ostial lesion	7.9	10.0	0.029
Mean diameter % stenosis	84.5 ± 14.1	84.1 ± 14.4	0.428
Final % stenosis	11.7 ± 20.5	11.3 ± 19.0	0.418
Lesion success (%)	93.8	94.3	0.569
Device usage (%)			≤ 0.001
Balloon only/balloon + local drug	32.1	36.1	
Balloon + RA/RA only	4.2	6.1	
Balloon + stent/stent only	55.7	48.3	
Balloon + RA + stent	5.2	7.0	
Other combinations	2.8	2.6	

RA = rotational atherectomy.

Table 4. In-Hospital Outcomes by Gender From the 1997–1998 Dynamic Registry

	Men (n = 1,629)	Women (n = 895)	p Value
Total angiographic success (%)	91.9	92.7	0.450
Procedural success (%)	95.0	94.2	0.372
Death (%)	1.3	2.2	0.072
Stroke (%)	0.2	0.7	0.181
MI (%)	3.0	2.3	0.333
Q-wave (%)	0.2	0.7	0.104
Enzymes >2× normal (%)	2.6	2.1	0.422
CABG (%)	1.4	1.3	0.991
Death/any MI/E CABG (%)	4.5	4.8	0.711

CABG = coronary artery bypass surgery; E = emergency; MI = myocardial infarction.

Table 5. Status at One Year by Gender for the 1997–1998 Dynamic Registry

	Men	Women	p Value
Death (%)	4.3	6.5	0.022
MI (%)	5.5	5.5	0.925
CABG (%)	6.4	8.7	0.048
Repeat PCI (%)	14.0	15.9	0.244
Death/MI (%)	9.0	11.1	0.135
Death/MI/CABG (%)	14.4	18.3	0.027
CABG/repeat PCI (%)	19.0	22.5	0.072
Angina status (%) (n = 1,999)			≤ 0.001
No angina, nitrates not used	61.6	51.9	
No angina, nitrates used	14.8	18.2	
Angina	23.6	29.8	

CABG = coronary artery bypass surgery; MI = myocardial infarction; PCI = percutaneous coronary intervention.

DISCUSSION

Although early studies evaluating gender differences in patients undergoing coronary revascularization noted a significantly worse outcome and higher mortality in women in comparison with men (1–5), more recent reports suggest that the differences in outcome between women and men treated with coronary balloon angioplasty have decreased and that the overall outcomes in women have improved (6–9). However, because the prevalence of coronary artery disease is lower in women than in men, the number of women studied has necessarily been limited, and the influence of new technology and adjunctive pharmacology in women undergoing PCI has been difficult to capture in the rapidly changing field of interventional cardiology.

The design and concept of the Dynamic registry, which enrolls consecutive patients at multiple centers, with an added sample of women and minorities and with the ability to compare three sets of patients over time, allows a more thorough evaluation of the influence of contemporary practice on outcome. Our sites are geographically diverse with U.S. sites in the Northeast, Mid-Atlantic, South, Midwest and West Coast, a Canadian site in Montreal and a European site in Prague, Czech Republic. While the majority of our sites are from academic institutions, we also include four community practices. To date, the results of the present study of the first wave of patients are encouraging and suggest that, despite the persistent and well-recognized baseline gender differences in patients with coronary artery disease, the outcomes of contemporary PCI in women have improved.

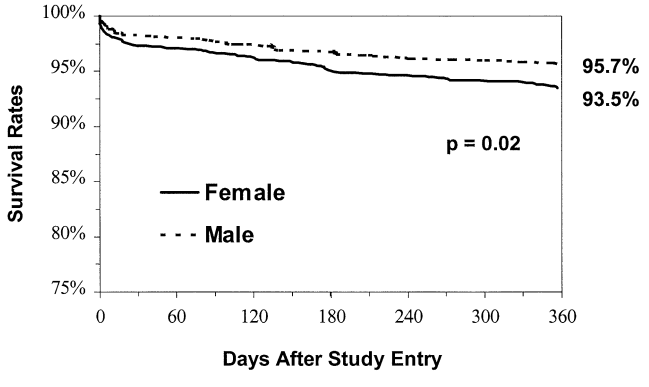

Figure 1. One-year survival rates by gender.

Baseline clinical, angiographic and procedural characteristics. Because the age at clinical presentation of coronary artery disease in women lags 10 to 20 years behind that in men (14), women continue to be older than men when they are in need of revascularization, and this observation is once again supported by the older age of women in this registry. Women are generally smaller than men, and this difference in body size, a surrogate for coronary vessel diameter, has been thought to influence in-hospital outcome, particularly in patients treated with CABG (15,16). It has been postulated that advances in technology leading to smaller guiding and balloon catheters would result in a more favorable outcome in women, and this is supported by the similar lesion, angiographic and procedural success rates between women and men seen in this study, despite the smaller reference vessel size in women.

Similar to earlier reports, women had a higher prevalence of risk factors such as diabetes mellitus, hypertension and hypercholesterolemia (although a lower prevalence of current smoking, previously shown to be related to older age) in comparison with men (1,2). Yet, the extent of epicardial vessel disease was less in women than in men and whether this observation suggests that the traditional risk factors are less potent in women is unclear. Furthermore, despite the lower incidence of previous MI and better preserved systolic left ventricular function in women in comparison with men, the incidence of congestive heart failure was once again higher in women than in men. A higher incidence of hypertensive heart disease, a steeper pressure volume relationship, and more diastolic dysfunction in women in comparison with men has been thought to account for this observation (17–19).

Women were less likely to receive treatment with IIb/IIIa platelet receptor antagonists than men, and this may reflect the lower incidence of ulcerated lesions in women. Similar to the reason for the decreased use of stents in women is the reason for the increased use of rotational atherectomy in

Table 6. Demographic Data and Event Rates of Women by Registry Time Period

	1985–1986	1993–1994	Dynamic 1997–1998	p Value
Total patients (women)	n = 620	n = 436	n = 500	
Demographic data				
Mean age (yrs)	61.8 ± 11.0	65.0 ± 11.5	66.0 ± 11.4	≤ 0.001
White (%)	86.1	84.4	82.0	0.072
Black (%)	7.6	7.3	10.2	0.128
Concomitant disease (%)	9.5	17.9	31.8	≤ 0.001
History of diabetes (%)	20.3	32.4	33.8	≤ 0.001
History CHF (%)	9.0	15.2	10.7	0.295
History of hypertension (%)	57.7	62.0	66.3	0.003
History of hypercholesterolemia (%)	38.0	40.8	59.5	≤ 0.001
Prior MI (%)	35.5	28.9	29.5	0.025
Prior CABG (%)	9.2	11.0	9.8	0.689
Acute MI (%)	8.6	25.0	23.6	≤ 0.001
Evidence of calcified lesion (%)	13.9	16.5	31.1	≤ 0.001
Evidence of thrombus (%)	13.9	17.9	24.4	≤ 0.001
Multivessel disease (%)	49.4	52.1	57.8	0.005
Presence of total occlusion (%)	30.8	32.1	33.8	0.287
Number of significant lesions (mean)	2.52 ± 1.76	2.39 ± 1.81	2.52 ± 1.87	0.969
Number of lesions attempted (mean)	1.51 ± 0.87	1.30 ± 0.62	1.37 ± 0.69	0.002
In-hospital events				
Death (%)	3.2	2.3	3.0	0.784
Death/MI/E CABG (%)	9.8	6.7	5.2	0.003
Death/MI/CABG (%)	11.6	8.0	6.0	≤ 0.001
Total angiographic success (%)	85.2	89.0	93.8	≤ 0.001
Procedural success (%)	84.7	89.0	92.2	≤ 0.001
One-year events				
Death (%)	5.8		7.4	0.314
MI (%)	6.8		5.6	0.309
CABG (%)	12.2		9.5	0.080
Repeat PCI (%)	16.6		14.7	0.454
Death/MI (%)	10.8		11.9	0.701
Death/MI/CABG (%)	18.3		19.4	0.906
CABG/repeat PCI (%)	26.9		21.9	0.030

CABG = coronary artery bypass surgery; CHF = congestive heart failure; E = emergency; MI = myocardial infarction; PCI = percutaneous coronary intervention.

women in comparison with men, which likely reflects smaller vessel size in women. Furthermore, after adjusting for reference vessel size, stent use was similar for the two genders. It is noteworthy, however, that stents were used in over 50% of lesions in this 1997–1998 experience, and the favorable influence of the increased use of stents on overall angiographic success and subsequent revascularization has been reported (20).

Outcomes in-hospital and at one year. Although it is natural to relate the similar and improved angiographic and procedural success rates to the similar death, MI and emergency CABG rates between women and men, it is important to recall that in-hospital death was 10-fold higher in women than in men (despite a similar angiographic and procedural success rate) in the 1985–1986 registry report (2). Although the expected risk factors for mortality such as age, cardiogenic shock and congestive heart failure were independent predictors of in-hospital death, female gender was not independently and significantly related to in-hospital mortality after controlling for other factors. Given the small number of mortal events in the Dynamic registry (41 deaths), it is possible that this negative finding is due to a lack of statistical power. However, while our findings are consistent with a slightly higher risk for in-hospital mortality for women compared with men, they clearly show that the differences are much smaller than they were 10 years ago. Our results are also consistent with those published from the National Cardiovascular Network, a large-scale registry of patients undergoing PCI between 1994 to 1997. In-hospital mortality was significantly higher in women in comparison with men, but mortality risk was similar in women and men after adjustment for baseline differences (10). Furthermore, the lack of a gender difference in the combined end point of death, MI and emergency CABG (116 events) in the present study is reassuring.

Although the death rate at one year was higher in women than in men, female gender again did not independently predict mortality. Repeat revascularization was slightly, but not significantly, higher in women than in men at one year, and female gender was associated with an increase in risk for the combined end point of death, MI and CABG. The less frequent use of stents in women may relate to the need for subsequent revascularization.

Comparison of the registries. Artificial comparisons between the young and the elderly, between patients of different race and between women and men continue to be

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made for the purpose of focusing on higher-risk subsets of patients. Because women will no doubt continue to be at higher risk than men for revascularization based on advanced age and comorbid disease, it is important to compare the outcome in women over time. Examination of the 1985–1986 and 1993–1994 NHLBI PTCA registries allows us to do so. Despite older women with a higher prevalence of risk factors and concomitant disease in the Dynamic registry, in-hospital and one-year mortality was similar in women in the Dynamic registry and the earlier registries and the incidence of repeat revascularization at one year significantly lower in the Dynamic registry in comparison with the 1985–1986 registry. In addition, compared with the 1985–1986 registry time period, the Dynamic registry time period was a significant predictor of lower mortality at one year after adjusting for baseline differences between women in the two registries.

These data suggest that the gender differences in outcomes in patients undergoing contemporary PCI have decreased and that the outcomes in women undergoing these procedures have improved. Whether these more favorable results in women are due to the focus on women's health issues in general, or on women and heart disease in particular, or to the increasing appreciation of the issues specific to women or to the increased use of stents and adjunctive pharmacologic agents is unclear. However, it is important to note that women in need of coronary revascularization who are candidates for a PCI should be referred for the procedure with the expectation of an excellent outcome, which is no longer associated with undue risk.

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