

Effect Of Peripheral Vascular Disease On Long-Term Mortality After Coronary Artery Bypass Graft Surgery

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Background. The Northern New England Cardiovascular Disease Study Group examined the effect of cerebrovascular disease (CVD) and lower extremity disease (LED) on long-term outcome following coronary artery bypass graft (CABG) surgery in patients with coronary heart disease (CHD). This article uses data provided by the authors to quantify the mortality implications of progressively more extensive atherosclerosis.

Results. After successful CABG surgery, mortality ratios for patients with CHD + CVD (107%), CHD + LED (171%), and CHD + CVD + LED (195%), respectively, were 1.6 times, 2.5 times, and 2.8 times higher than mortality ratios for patients with CHD only (69%).

Conclusions. The extent of peripheral vascular disease predicted mortality experience even after successful myocardial revascularization.

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Keywords: Peripheral vascular disease, coronary heart disease, cerebrovascular disease, lower extremity disease, coronary artery bypass graft surgery

Received: July 25, 1997

Accepted: September 15, 1997

Journal of Insurance Medicine
1997, 29:192-194

The effect of peripheral vascular disease (PVD) on long-term outcome following coronary artery bypass graft (CABG) surgery was reported by the Northern New England Cardiovascular Disease Study Group,¹ a consortium representing all five medical centers in the states of Maine, New Hampshire, and Vermont where CABG surgery is performed. The cohort consisted of 2,817 patients discharged alive after CABG surgery performed between 1987 and 1989. Four patient groups were identified by a review of medical records: (1) coronary heart disease (CHD) only-angiographically proven CHD with no evidence of PVD; (2) CHD plus cerebrovascular disease (CVD)- CHD plus history of stroke, transient ischemic attack (TIA), amaurosis fugax, carotid endarterectomy, carotid stenosis (by history alone, or $\geq 50\%$ internal or common carotid artery stenosis identified by duplex ultrasonography or arteriography), or carotid bruit; (3) CHD plus lower extremity disease (LED)- CHD plus history of claudication, lower extremity arterial bypass operation,

nontraumatic amputation, absence of palpable pedal pulses, or abdominal aortic aneurysm (repaired or not repaired); and (4) CHD plus both CVD and LED. Patients were excluded if CABG surgery was incidental to another cardiac surgical procedure.

Expected mortality was based on Canada Population Table 1990-1992. This table was chosen because the age of some subjects in the study exceeded the maximum age listed in United States population tables published in the 1990s, whereas Canada Population Table 1990-1992 listed mortality rates up to age 105. Additional data were obtained from the author.

Analysis

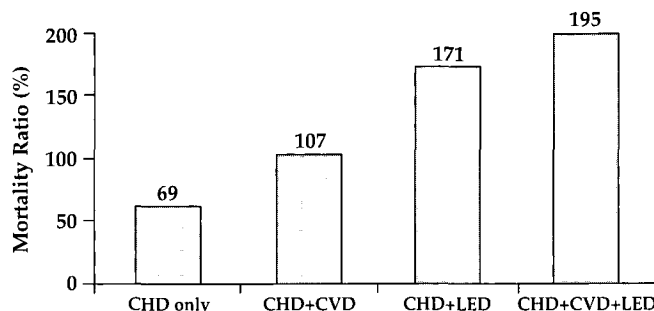
This study examined the effect of cerebrovascular and/or lower extremity atherosclerosis on long-term mortality of patients discharged from the hospital following CABG surgery. Data in Tables 1-4 indicate the extent of PVD predicted mortality experience even after successful myocardial revascularization.

- CHD without peripheral vascular disease (Table 1)- Mortality ratios averaged 58% and 69%, respectively, for durations 0-1 yr and 1-5 yr. This finding - survival that is more favorable than what would be expected in the general population - is commonly observed during the early years following CABG surgery. Longer-term studies reveal that mortality ratios increase in later years due to recurrent coronary artery stenosis, diffuse atherosclerotic disease, and the effects of comorbid impairments (e.g., diabetes mellitus, hypertension, smoking) which contributed to the development of coronary heart disease. Mortality ratios in Table 1 would be higher if based on a comparison with insured lives mortality rates.
- CHD plus cerebrovascular disease (Table 2)- The impact of more extensive atherosclerotic disease is apparent. Mortality ratios are higher than in patients with CHD only (Table 1), averaged 169% and 107%, respectively, for durations 0-1 years and 1-5 years.
- CHD plus lower extremity disease (Table 3)- Mortality ratios exhibit a further increase, averaging 155% and 171%, respectively, for durations 0-1 and 1-5 years.
- CHD plus both cerebrovascular and lower extremity disease (Table 4)- This patient group had atherosclerotic disease of vessels that supply the heart, brain, and lower extremities, and mortality ratios reflect the extent of disease, averaging 176% and 195%, respectively, for durations 0-1 yr and 1-5 yr.
- One of the most important findings in this study was the relative mortality of patients with CHD alone vs. those with CHD plus PVD. Average annual mortality ratios for duration 1-5 years are displayed in the Figure. These data may be restated as follows: after successful CABG surgery, mortality ratios for patients with CHD+CVD (107%), CHD+LED (171%), and CHD+CVD+LED (195%), respectively, were 1.6 times, 2.5 times, and 2.8 times higher than mortality ratios for patients with CHD only (69%).

After adjustment for multiple risk factors, most of the extra mortality risk in subjects

with CHD plus cerebrovascular disease occurred in patients with clinical manifestations of CVD (stroke, TIA, or carotid endarterectomy), although risk was also increased to a lesser extent by the presence of subclinical disease (asymptomatic carotid

**Average Annual Mortality Ratios,
Duration 1-5 Years***



* CHD = coronary heart disease, CVD = cerebrovascular disease, LED = lower extremity disease

bruit or stenosis). With respect to cases with CHD plus lower extremity disease, mortality risk was elevated both in patients with symptomatic (claudication, lower extremity arterial bypass operation, or nontraumatic amputation) and asymptomatic (absence of palpable pedal pulses) LED, as well as in patients with abdominal aortic aneurysm (repaired or not repaired). These results agree with other studies which concluded that PVD increases mortality risk in patients with medically or surgically treated CHD.

There are several possible reasons for the adverse impact of PVD on mortality experience following CABG surgery. First, patients with PVD may have a higher prevalence of distal, microvascular coronary disease that is not amenable to bypass surgery. Second, PVD may be a marker for rapidly progressive CHD, both in native coronary vessels and bypass grafts. Finally, patients with PVD may have increased mortality due to sequelae of their noncardiac arterial disease, e.g., stroke, mesenteric ischemia, and lower extremity complications.

References

1. Birkmeyer JD, et al. The effect of peripheral vascular disease on long-term mortality after coronary artery bypass surgery. *Arch Surg* 1996;131:316-21.

Table 1.
Mortality Experience Following CABG Surgery, CHD only

Duration t to t+Δt	Entrants [#]	Mortality Rate [*]		Comparative Experience [*]	
		Observed q	Expected q'	Mortality Ratio 100q/q'	Excess Death Rate 1000(q-q')
0-1 yr	2116	0.012	0.02033	58	-9
1-5 yr	2092	0.017	0.02518	69	-8

* For interval 1-5 years, mortality rates are average annual values. Mortality ratios and excess death rates for this interval represent average annual experience.

Entrants are the number of subjects alive at the beginning of the interval.

Table 2.
Mortality Experience Following CABG Surgery, CHD + CVD

Duration t to t+Δt	Entrants [#]	Mortality Rate [*]		Comparative Experience [*]	
		Observed q	Expected q'	Mortality Ratio 100q/q'	Excess Death Rate 1000(q-q')
0-1 yr	311	0.046	0.02729	169	19
1-5 yr	297	0.035	0.03296	107	2

* For interval 1-5 years, mortality rates are average annual values. Mortality ratios and excess death rates for this interval represent average annual experience.

Entrants are the number of subjects alive at the beginning of the interval.

Table 3.
Mortality Experience Following CABG Surgery, CHD + LED

Duration t to t+Δt	Entrants [#]	Mortality Rate [*]		Comparative Experience [*]	
		Observed q	Expected q'	Mortality Ratio 100q/q'	Excess Death Rate 1000(q-q')
0-1 yr	246	0.037	0.02375	155	13
1-5 yr	237	0.049	0.02846	171	20

* For interval 1-5 years, mortality rates are average annual values. Mortality ratios and excess death rates for this interval represent average annual experience.

Entrants are the number of subjects alive at the beginning of the interval.

Table 4.
Mortality Experience Following CABG Surgery, CHD + CVD + LED

Duration t to t+Δt	Entrants [#]	Mortality Rate [*]		Comparative Experience [*]	
		Observed q	Expected q'	Mortality Ratio 100q/q'	Excess Death Rate 1000(q-q')
0-1 yr	144	0.044	0.02498	176	19
1-5 yr	138	0.059	0.03041	195	29

* For interval 1-5 years, mortality rates are average annual values. Mortality ratios and excess death rates for this interval represent average annual experience.

Entrants are the number of subjects alive at the beginning of the interval.