Superiority of the internal mammary artery as a coronary bypass graft

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There is controversy as to the ideal conduit for coronary bypass grafting. Claims have been made that the internal mammary artery is a better conduit, based on evidence of superior patency. In contrast, many feel the internal mammary artery graft is inferior because of limited flow rate and altered hemodynamics in flow. The clinical results, and not angiographic patency or physiologic measurement, remain the best means for determining superiority of an operative technique.

Analysis of our first 1000 patients, based on computerized data, proves the superiority of the internal mammary artery as a coronary artery bypass conduit. The follow-up of these patients varied from $2^1/2$ to 8 years, with an average follow-up of greater than 4 years. The study was complete to the present in 98% of patients. The operative success was judged by overall survival, relief of angina, prevention of congestive heart failure, and nonfatal myocardial infarction rates.

Three separate comparisons were made of the clinical success: (1) All patients who had the two types of graft were compared as to the presence of any variables indicating clinical results. (2) The groups were matched according

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Table. Comparison of clinical results

Graft type and variable	Not having variable		Having variable		Chi square for comparison	p value
	No.	%	No.	%		
IMA — angina	398	(94.1)	25	(5.9)	7.601	0.00583
SV — angina	345	(91.0)	44	(9.0)		
IMA — myocardial infarction	417	(98.5)	6	(1.5)	13.842	0.00020
SV — myocardial infarction	364	(93.6)	25	(6.7)		
IMA — death	404	(95.5)	19	(4.5)	22.242	0.00001
SV — death	338	(86.9)	51	(13.1)		
IMA — postoperative CHF	408	(96.4)	15	(3.6)	6.718	0.00954
SV — postoperative CHF	359	(92.3)	30	(7.7)		

to the actual vessels bypassed and the overall mortality rates were statistically compared. (3) Possible sources of error were eliminated by exclusion of biased subsets.

To determine the source of error, a distribution correlation of the two types of grafts among 195 independent clinical variables was studied. Uneven distribution was found in a number of independent variables. These maldistributed variables were then correlated with death. If maldistribution and increased mortality were found, those patients were removed from the subgroup. The following factors were found to fit both these criteria and therefore were removed as bias factors: (1) Female. (2) Ventricular aneurysmectomy. (3) Preoperative congestive heart failure. (4) Generalized ventricular dysfunction. (5) Acute myocardial infarction. After removing the maldistributed subsets, the group for comparison had similar severity of clinical disease, anatomic location of disease, length of follow-up and other variables.

The *Table* shows that for the four clinical variables examined (angina, myocardial infarction, death from all
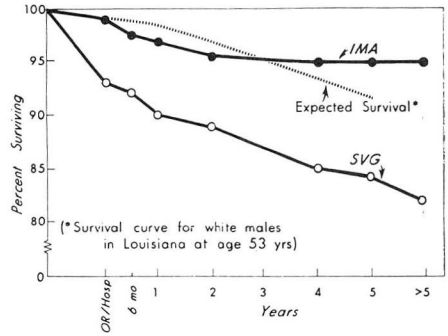
Figure. Cumulative survival curves.

causes or postoperative congestive heart failure), the internal mammary artery bypasses had significantly better clinical results.

Cumulative survival curves comparing the two groups emphasize the continued attrition rate in the group who had all saphenous vein bypasses and remarkably stable survival of patients with internal mammary artery grafts (*Figure*). With the two curves compared to the expected survival curve of comparable age in the State of Louisiana, the results indicate the longevity of patients with the internal mammary artery grafts actually exceeds that of normal men by about 3 years after operation.