A surgeon's view of risk in coronary artery surgery

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Risk related to coronary artery surgery has declined significantly in 13 years of active practice. Reasons for this improvement involve multiple factors, and different conclusions have been reached by numerous investigators. Statements on risk are influenced by rapid technological advances that have occurred during the past 5 years. Whereas results have doubtless improved, an important question is whether technologic changes are responsible or whether lower risk surgical candidates are selected. In a survey of the Cleveland Clinic experience in myocardial revascularization, comparing 1967-1970 to 1978, we found a rising median age (50 to 56), more extensive coronary atherosclerosis (44% multiple-vessel disease compared to 89%) and greater prevalence of preoperative left ventricular dysfunction (41% vs 54%). The incidence of perioperative myocardial infarction and other forms of morbidity, with the exception of neurologic deficit, has fallen significantly when the early years are compared with later experiences. Other positive signs include less blood usage (from 11 units to 2 units per hospitalization), more grafts per patient (1.5 to 3.0), and higher incidence of complete revascularization (50% to 80%). So it would appear that higher-, not lower-risk patients are being accepted; yet the operative mortality has declined to

1%, morbidity has been clearly reduced, and operations are more complete.[1]

Certain aspects of risk can be calculated statistically. By multivariate analysis, Hammermeister and Kennedy[2] determined the main risk factors for 1870 surgically treated patients and found that preoperative ventricular arrhythmia, left ventricular status, congestive heart failure, and left main stenosis were highly predictive of survival. In a study of risk related to left main coronary artery patients, the CASS (Coronary Artery Surgery Study) confirmed that left ventricular impairment, severity of left main stenosis, and the extent of disease in other involved arteries increased operative risk.[3] However, the surgery site was the greatest risk factor in this multicenter experience. Thus, the surgeon and his team are an important predictor of risk. Our 1973 multivariate analysis also documented that early mortality is strongly related to diffuse coronary atherosclerosis combined with poor ventricular function. An additional calculation involved risk variables in predetermined low- and high- risk patients. A third of those who died between 1967 and 1972 did not have a strong profile of increased risk.[4] A survey of our 1979 deaths found that 40% of these patients were considered at low risk preoperatively. These figures signal the hazard of quoting risk percentages to patients preoperatively.

Coronary arteriography is a two-dimensional diagnosis of a three-dimensional subject. Numerous reports about interobserver variations in angiogram interpretation suggest that lesions in the proximal portion of major coronary vessels can be read with acceptable variability, whereas distal lesions produce different estimates of lesion severity. Kemp,[5] examining data from the CASS project, found that agreement about left main coronary artery narrowing was achieved only two-thirds of the time. Waller and Roberts[6] correlated histologic sections of atherosclerotic coronary arteries with arteriograms and concluded that lesions are often underestimated, especially those greater than 50% in cross-sectional narrowing. They postulate that the reason for underestimation is that the area adjacent for comparison is not always normal and this diffuse atherosclerosis, which is found at autopsy with equal frequency of distribution proximally and distally, makes arteriographic visual comparison difficult. The effect of these variations on operative risk is presently incalculable.

In patients with poor left ventricular function risk is elevated. The dismal natural history of this subset is well documented, but is the risk of surgery justified? In 1972, data from the Milwaukee cardiovascular registry showed a high mortality for surgical treatment, but survival was considerably higher than in the counterparts treated medically.[7] In 1977 Zubiate et al[8] reported a 60% 6-year survival for patients who had ejection fraction below 0.20. In a later experience of 57 patients from 1973 through early 1976, the operative mortality declined to 9%, and 80% of the series were alive after 3 years. Almost all of these patients had angina with poor ventricular function. Jones et al[9] reviewed a series of 188 patients with mean ejection fraction of 0.35 and reported an operative mortality of 2% and a 2-year survival of 93%. They attributed the success in these poor-risk patients, operated on mainly from 1974 through 1977, to improved prebypass monitoring, maintenance of a low-rate pressure product intraoperatively, cold potassium cardioplegia for myocardial protection, judicious use of intraaortic

balloon pump and inotropic/vasodilator support, and complete revascularization whenever possible. The authors cautioned that the results in patients with angina and poor ventricular function are appreciably better than those with congestive heart failure. Late mortality was four times greater in failure patients. Golding et al[10] reported a hospital survival of 73% in 197 bypass graft patients who were supported by balloon pumping. In 2 years of follow-up the attrition rate was only 4%, a figure similar to revascularization patients who did not require mechanical support.

Coronary artery surgery can be accomplished with lower risk than any major noncardiac operation performed in the face of severe coronary atherosclerosis. Milestones that account for reduced mortality, lower morbidity, increased graft patency, and higher 5-year survival today fall into five major categories: 1) preoperative stability, 2) anesthesia management, 3) myocardial protection, 4) technical achievement, and 5) advancements in aftercare.

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