The Anesthesiologist and the Cardiac Surgeon

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New and rapidly changing techniques in cardiac surgery have steadily increased the burden placed upon the anesthesiologist during the past two decades. Not long ago, the anesthesiologist had, and often exercised, the prerogative of recommending that operation be deferred because of an inordinate anesthetic risk. Now he is practically obliged by modern practice to accept the assignment and share the challenge, striving desperately with the surgeon to salvage the patient by his determined skill with intra- and postoperative anesthetic techniques, assisted by pharmacologic and respiratory support. Today, intensely cyanotic patients, many of them newborn infants, undergo thoracotomy for cardiac repair. Adult patients with advanced acquired heart disease are seldom refused operation unless irreversible myocardial damage or advanced pulmonary, hepatic, or renal disease is present. Recently, for example, moribund patients with terminal irreversible heart disease have undergone cardiac transplantation and recovered.

The close alliance necessary between surgeon and anesthesiologist demands that the anesthesiologist continually familiarize himself with cardiac diseases and new surgical procedures designed to treat these diseases in order to anticipate the special problems during and after operation.

The era of open intracardiac surgery began about 15 years ago with the introduction of total-body hypothermia combined with caval inflow occlusion. The limitations of this method were many, and it was soon replaced by the technique of temporary cardiopulmonary bypass. Pumps and oxygenators have not yet been standardized in all centers, and wide varieties of both are used today with satisfactory results. For the past six years we have used exclusively the plastic disposable bubble diffusion oxygenator primed with 5 per cent dextrose solution, and have kept the patient normothermic. In addition to its important advantages of convenience, economy, and absence of certain cardiopulmonary and hematologic complications, this method also allows surgeons to perform open-heart surgery on Jehovah’s Witnesses without using blood—a special problem for the anesthesiologist who is concerned with blood replacement. We have done open-heart operations on 70 Jehovah’s Witnesses without using blood before, during, or after operation. Disc oxygenators primed with fresh heparinized or even ACD bank blood still remain the choice in some hospitals. At one time a hyperbaric environment for cardiac surgery seemed an attractive prospect and was used in many newborn infants. Because of its cumbersome equipment, complicated physiologic problems (mainly respiratory), and hazard to personnel, most centers now use this method only for medical, and not for surgical, problems. The membrane-type oxygenators with ultra-thin silastic membranes have attracted interest recently; they promise prolonged cardiorespiratory support in the desperately ill patient. Other types of mechanical oxygenation are unsatisfactory for this purpose since they require prolonged direct exposure of blood to a gaseous interface. The membrane oxygenator will not, however, replace the simpler and more efficient bubble diffusion and filming oxygenators for open-heart surgery.

Almost daily advances are being made in surgery for congenital heart disease, as one anomaly after another becomes operable. One exciting example is the complete correction of transposition of the great arteries—an anomaly long considered to be incurable. Truncus arteriosus, another complicated defect, is correctable with a composite homograft of ascending aorta and aortic valve. This homograft has been used successfully in severe cases of tetralogy of Fallot with pulmonic valve atresia and in cases of transposition of the great vessels with large ventricular septal defect. At pres-
ent, the only remaining barrier to surgical repair of congenital cardiac anomalies is severe pulmonary vascular sclerosis and fixed pulmonary resistance.

Surgical treatment of acquired valvular disease now consists primarily of total valve replacement, although some indications for valvuloplasty remain. Thromboembolism is by far the most common and difficult complication of valve replacement with synthetic prostheses. Fortunately, these complications are rare in aortic valve replacement, in which prosthetic valves serve satisfactorily. For the mitral annulus many modifications of prostheses have been tried experimentally and clinically, yet none has proved entirely satisfactory; the search for an "ideal" mitral prosthesis continues. Recent reports of composite stented grafts using homo- or heterograft semilunar valves or valves fashioned with autologous viable fascia lata are promising.

The cardiac surgeon still finds his major challenge in surgery for advanced primary myocardial disease. Coronary atherosclerosis is the most prevalent cause of this disease, although a variety of cardiomyopathies also are recognized clinically. Cardiac transplantation, first attempted clinically two years ago, has prolonged the lives of many patients. At least ten of about 150 such patients throughout the world have survived a year or more after cardiac transplantation. In one patient operated upon in our hospital a two-staged cardiac replacement was performed, using a total cardiac prosthesis for the first stage. The prosthesis supported circulation and life for 84 hours until it was removed and a cardiac allograft inserted. Although the patient died 32 hours after allografting, this case may represent a significant step forward in total cardiac substitution, since for the first time prolonged circulatory support was successfully achieved. Hopefully, the experience will stimulate others to attempt similar bold techniques in dying patients, particularly when death in the operating room is the alternative.

Since the introduction of coronary arteriography using Sones' technique, revascularization of the ischemic heart has been attempted in a more deliberate, practical manner than previously, when less precise diagnostic methods were employed. During the past few years implantation of the internal mammary artery into the myocardium has been performed in several thousand patients, but within the past few months the technique has been replaced by a direct attack upon the occluded coronary artery. Using the autologous saphenous vein graft bypass so successfully employed for the occluded superficial femoral artery, cardiac surgeons are anastomosing coronary vessels one or two millimeters in diameter to aortic or coronary grafts. While results at this early stage are being highly acclaimed, one must maintain a healthy skepticism for the future of these operations; too often have new methods in the difficult area of cardiac surgery enjoyed initially spectacular but very brief histories. Meanwhile, the anesthesiologist must continue offering his cooperation, indulgence, and valued assistance to the cardiac surgeon in a mutual effort to improve and expand the surgical attack upon coronary disease.

"Death and sorrow will be the companions of our journey; hardship our garment, constancy and valor our only shield. We must be united, we must be undaunted, we must be inflexible." These impassioned words of Winston Churchill (1940) may serve to describe the task for these two comrades, surgeon and anesthesiologist, brought together in this struggle for progress in cardiac surgery.