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 re-
pair of congenital cardiac anomalies is severe
pulmonary vascular sclerosis and fixed pul-
monary resistance.

Surgical treatment of acquired valvular dis-
ease now consists primarily of total valve re-
placement, although some indications for val-
vuloplasty remain. Thromboembolism is by
far the most common and difficult complica-
tion of valve replacement with synthetic prostheses.
Fortunately, these complications are rare in
aortic valve replacement, in which prosthetic
valves serve satisfactorily. For the mitral an-
nulus many modifications of prostheses have
been tried experimentally and clinically, yet
none has proved entirely satisfactory; the
search for an "ideal" mitral prosthesis con-
tinues. Recent reports of composite stinted 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, al-
though 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 car-
diac transplantation. In one patient operated
upon in our hospital a two-staged cardiac re-
placement was performed, using a total car-
diac prosthesis for the first stage. The pros-
thesis supported circulation and life for 64
hours until it was removed and a cardiac allo-
graft inserted. Although the patient died 32
hours after allografting, this case may repre-
sent a significant step forward in total cardiac
substitution, since for the first time prolonged
circulatory support was successfully achieved.
Hopefully, the experience will stimulate oth-
ers to attempt similar bold techniques in dying
patients, particularly when death in the oper-
ating room is the alternative.

Since the introduction of coronary arterio-
ography using Sones' technique, revascularization
of the ischemic heart has been attempted in a
more deliberate, practical manner than previ-
ously, 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 meth-
ods in the difficult area of cardiac surgery
enjoyed initially spectacular but very brief his-
tories. 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, con-
stancy 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 de-
scribe the task for these two comrades, surgeon
and anesthesiologist, brought together in this
struggle for progress in cardiac surgery.