America's First Human Heart Transplantation

The Concept, the Planning, and the Furor

ADRIAN KANTROWITZ

Thirty years ago, medical science reached an extraordinary—but not rare—moment when several groups were independently preparing to introduce a new therapy. In the late 1960s, that therapy was transplantation of a heart from one human being to another. We at Maimonides Medical Center* in Brooklyn, New York, were one of those groups.

Word that Christiaan Barnard had performed the world’s first human heart transplantation at Groote Schuur Hospital in Cape Town, South Africa, on December 3, 1967, came just as we were finalizing plans for our own trial. Our transplantation, performed 3 days later, was the first recorded heart transplantation in a human infant and the first human heart transplantation in the United States. It was actually our second attempt. The first, aborted in the operating room, had taken place in June, 1966.

That week in December, 1967, news of the Cape Town and Brooklyn transplantations eclipsed all other world events. At first, the reaction was breathless optimism. Newsweek hailed the Cape Town transplantation as “the opening of a new era in medicine...an era as significant as the age of the atom...”

But not everyone agreed. There were also many criticisms. Doctors were “playing God,” people said. Perhaps unaware of the published experimental work, some of our colleagues thought heart transplantations were premature. Others complained that by focusing attention on transplantation, we were hampering efforts to prevent heart disease or correct it in the early stages. During the next year, 101 heart transplantations were performed worldwide. Their disappointing results touched off yet more criticism that surgeons were undertaking the operations in a cavalier manner.5

Today, heart transplantation is well accepted, with nearly 70% of patients surviving more than 5 years.7 Although controversial, the early transplantations helped set the stage for later successes. To commemorate the 30th anniversary of the first heart transplantations, we recall that pivotal “moment in history.”

Early Research

Our work was built on years of animal experiments by many research groups (see 1984 review by Griep and Ergin8). The pioneers in this field were Alexis Carrel and C. C. Guthrie, who in 1905 transplanted the heart of a small dog into the neck of a larger dog.9 In 1933, Frank C. Mann and his coworkers described a technique for transplanting the heart of one dog into the neck of another (without requiring it to maintain the entire circulation), which became the standard for such experiments.10 Twenty years later, Willard B. Neptune and his coworkers reported the first complete heart-lung transplantations in dogs. Neptune’s group used hypothermia to completely stop the circulation long enough to remove and replace the heart and lungs in three dogs, with survival up to 6 hours. The transplanted hearts maintained the circulation and allowed the return of reflexes, normal body temperature, and spontaneous respiration.7 In 1964, Dr. James Hardy transplanted a chimpanzee heart into a human. Dr. Hardy had been unable to wean his patient from the pump oxygenator. This desperate attempt turned out poorly; the recipient died at surgery.5

The modern surgical technique of orthotopic cardiac transplantation was described by Richard Lower and Norman Shumway in 1960. They immersed the donor heart in cold saline, used cardiopulmonary bypass in the recipient, and combined the pulmonary venous and vena caval anastomoses into two atrial anastomoses. In their experiments, five of eight dogs survived 6 to 21 days with transplanted hearts completely supporting the circulation.7 These experiments were the first in which dogs resumed activity—eating and exercising normally—with their circulation supported by a transplanted heart. The Lower and Shumway report generated considerable interest, and several other groups reported their experiences with the same technique. In 1963, D. A. Blumenstock and coworkers reported experiments in which 50 dogs survived for periods ranging from 1 to 42 days.10

It was against this background that we began planning our own animal experiments in 1961.

Rationale

From the beginning, we believed that transplantation would prove to be the treatment of choice for infants and children with otherwise lethal cardiac lesions. A natural heart, unlike an implanted mechanical device, would grow with the child; it was possible that an infant’s less developed immune system might make management of any rejection process easier; and anencephalic infants comprised a potential donor pool. Born without a brain, anencephalic infants have no chance of developing into functioning human beings, and most die within 48 hours of birth. However, a large percentage of them have good hearts. (Citing studies begun at Maimonides Medical Center, 244

---

*The hospital was known as Maimonides Hospital until 1967, when the name was changed to Maimonides Medical Center.
our colleagues Jacques Cahasson, William Blanc, and Howard Joos would report in 1969 that most hearts from anencephalic infants were suitable as donor hearts. Their study of 79 anencephalic infants, 34 of whom had been born alive, found that only 1 in 20 had major cardiac anomalies that might interfere with transplantation.\textsuperscript{11} We felt, then, that it would be ethical to use their hearts. As I saw it, transplanting a heart from an anencephalic infant was a way to make one whole individual out of two, neither of whom had a chance at survival. It turned out that using anencephalic infants as a source of donor organs would become a matter of substantial national discussion. But as will be seen, another ethical issue—the definition of death—figured even more prominently in this case.

**Our Experiments**

Over a 5-year period beginning in 1962, we focused on developing surgical techniques, analyzing the outcome of transplantations in puppies, determining appropriate sources of donor organs, and improving methods of allograft preservation. Using unrelated mongrel puppies, we set out to modify the older and Shumway technique to make it suitable for very young patients. At that time, cardiopulmonary bypass raised significant technical problems in infants, so we decided to base our technique on circulatory arrest and deep hypothermia. The method was technically challenging, but it seemed feasible with the methods then available.

Our transplantation experiments on 411 puppies between 1962 and 1967 yielded a high rate of survivors, with some dogs surviving for unexpectedly long periods. One animal lived 213 days with no evidence of rejection, and another died of subacute rejection on the 57th postoperative day.\textsuperscript{12,13} In later work, two dogs lived 49 months after transplantation. Of all the dogs we transplanted over the 5-year period, 37 survived 2 weeks or longer. Dogs that survived more than 2 weeks grew, developed, and behaved normally. Other work in our laboratory showed the value of histocompatibility matching in heart transplantation. Electrocardiographic signs of rejection appeared to occur earlier in puppies with poor matches than in those with average or good matches, and immunosuppressive drugs were most effective in those with good matches.\textsuperscript{14}

In another group of experiments, we investigated graft preservation, transplanting hearts that had been stored for 12 or 24 hours. Of the storage methods we evaluated, the most successful was simple cooling with Tyrode's solution, followed by "dry" storage at 3–4 atmospheres absolute pressure. This method led to a maximal period of graft function of 35 days. On the 35th day, the transplanted puppy died of pneumonia. At autopsy, the heart showed no signs of rejection.\textsuperscript{15}

We described the experimental work we had done through 1967 in numerous talks and publications.\textsuperscript{16–23} In July, 1964, we presented a paper at the meeting of the American Heart Association: "Orthotopic Homotransplantation in Puppies: Long Survival Without Immunosuppressive Therapy." It was later published in *Circulation.*\textsuperscript{16} In September, 1967, Vallée Willman, Professor and Vice Chairman of Surgery at St. Louis University School of Medicine, solicited our data for his presentation to the American College of Surgeons on the state of the art of cardiac transplantation. In 1968, at the meeting of the American College of Surgeons, our 1964 film documenting our surgical procedure: "Orthotopic Homotransplantation of the Heart in Puppies," was honored with the an award at the Symposium on Spectacular Problems in Surgery.

**The Start of Clinical Application: 1966**

By 1966, we believed our group was prepared to perform a heart transplantation in an infant who had no chance to survive without the operation. The surgical procedure we had developed in puppies was highly reliable. Donor hearts could almost always be resuscitated, and although denervated, maintain satisfactory perfusion. We had evolved criteria for assessing the compatibility of donor and recipient tissues; immune reactions could, for the most part, be mitigated pharmacologically.

In early 1966, the hospital's medical research committee approved the protocol we planned to follow in our first transplantation. Cardiac catheterization with angiography was a prerequisite, to confirm that no standard intervention was possible. In addition, recipients could have no evidence of other severe systemic disease that might jeopardize survival. Potential donors had to be histocompatible with the prospective recipient and free of transmissible disease. The donor's death had to be diagnosed by a cardiologist or pediatrician and an anesthesiologist—a matter to which I shall return.

After developing donor and recipient consent forms, we were ready to begin recruiting donors. In May, 1966, our chief of obstetrics, William J. Pomerance, and our chief of pediatrics, Howard Joos, sent letters to chiefs of obstetric and pediatric services at hospitals throughout the country (Figure 1).

On May 11, 1966, a cyanotic male infant was delivered at Maimonides Medical Center. Physical examination, catheterization, and angiography revealed conditions consistent with pulmonary atresia with patent ductus arteriosus, ventricular and atrial septal defects, and corrected transposition. Surgical treatment was not possible. We considered this infant to be a potential heart transplantation recipient. A donor—a male anencephalic infant born on June 27, 1966—was found in Oregon. The parents gave consent, and the infant was flown to Maimonides the next day. When spontaneous and reflex motor activity ceased, mechanical ventilation was used to sustain myocardial contractions. Early in the morning of June 30, the infant's heart stopped beating. The recipient had been prepared for surgery but the chest had not been opened. Our attempt to perfuse and resuscitate the donor heart was unsuccessful and we did not continue with the procedure. The intended recipient awoke from the anesthesia and died of congestive heart failure a month later. Over the next 16 months, three more donors were found, but we were unable to match them to recipients.

By the time our next recipient was identified, in November, 1967, several other groups had announced their readiness to attempt human heart transplantations. The success of human kidney transplantations and the promise of Thomas Starzl's first successful liver transplantations in humans in the summer of 1967 had created optimism about the potential for transplanting hearts.\textsuperscript{25}

"After 8 years of laboratory experience," said Richard Lower in October, 1967, "we are now quite convinced that cardiac transplant is a perfectly feasible procedure from the technical as well as from the physiological standpoint."\textsuperscript{26}
We are prepared to study the problem of orthotopic cardiac transplantation in human beings, and I hope that we will want to help in locating the case material which we will require. I am confident that the technique is possible, but before it can be applied, the problems of surgical correction of heart disease must be solved by an orderly and logical approach. The surgical technique involves the use of a mechanical pump to assist in the extraction of the heart from the thorax of the patient. The pump is then connected to the heart, and the blood is directed to the lungs and back through the systemic circulation. The mechanical pump is then removed, and the heart is transplanted into the chest of the recipient. The procedure is then repeated, and the process is repeated until the donor heart is functional and the recipient heart is no longer needed.

As recipients, we will select newborn infants with lethal congenital heart defects, where surgery is not feasible. In these infants, the heart is not operating on until and unless the viability of the homograft or perfusion is improved. We have been testing histocompatibility recently, using a laboratory method and by in vitro injection of antigens into umbilical cord blood. The results of these tests are not yet complete, but we have found that some of the antigens are not detected and that some are not found in all cases. We also have been testing the compatibility of the umbilical cord blood with the homograft. The results of this study are not yet available. I am writing this letter to request your cooperation in determining the viability of the homograft in these patients. I would be very grateful if you could make your results available to us.

William Pomerance, M.D.

Figure 1. Letter sent by William Pomerance to recruit donor infants. Letters sent by Howard Joos were similar in content.

A November 20, 1967, article in the news section of JAMA pointed out that the surgical technique of transplantation "has been thoroughly worked out in the laboratory and technical difficulties are not anticipated." In fact, the author added, transplantation in a human patient "probably will be a less difficult technical procedure than it is in the dog, where the fragile nature of the canine supravalvular aorta presents a problem in anastomosis to challenge any surgeon's skill." Interviewed for the JAMA article, Norman Shumway said he was waiting only for the right donor and recipient and noted that although "animal work should and will continue, we are nonetheless at a threshold of clinical application. "We think the way is clear," said Shumway, "for trial of human heart transplantation."27

The same week that Shumway's remarks were published, we were searching for a donor for our second heart transplantation attempt. On November 18, 1967, a baby with a lethal heart defect had been born at Maimonides Medical Center (Figure 2). The infant was cyanotic and in moderate respiratory distress. Cardiac catheterization 2 days later led to the diagnosis of tricuspid atresia with atrial communication. At 63 hours of age, an ascending aorta to right pulmonary anastomosis was constructed.

Subsequently, the baby had tachycardia, tachypnea, dyspnea, and hepatomegaly, and appeared to be in congestive heart failure. He was digitalized, but his condition continued to deteriorate. For the next 3 days, we took steps to control congestive failure. By the fourth day, the infant's heart rate and respiratory rate had improved. However, the infant did not respond well to stimulation, did not suck well, and remained at his birth weight of 5 lbs, 11 oz. A chest radiograph indicated progressive cardiac failure.

Our Pediatric, Pediatric Cardiology, and Cardiovascular Surgery groups met jointly to consider what we could do for the child. The infant's life expectancy was limited, even though we had prolonged it to some extent by performing the aortopulmonary shunt. It seemed extremely unlikely that conventional treatments could help, so we decided to suggest a heart transplantation to the family. We stressed that what we were

Figure 2. The recipient in the 1967 transplantation.
11/24/67

TO THE DIRECTOR OF OBSTETRICS:

WE ARE AGAIN URGENTLY SEEKING AN ANENCEPHALIC MEMBRAN FO
LIFE SAVING PURPOSES. IF YOU HAVE SUCH AN INFANT (OR A PATIENT
AT TERM WITH SUCH A LIVE FEET) WITHIN THE NEXT WEEK, WRITE OR
CALL COLLECT IMMEDIATELY. WE ARE PREPARED TO TRANSPORT BABY AND
NURSE (OR DOCTOR) AND MOTHER. BE ASSURED THAT ALL MEDICAL
CONSIDERATIONS WITH REGARD TO THE BABY WILL BE OBSERVED. PLEASE
ACCEPT OUR THANKS FOR YOUR COOPERATION LAST FALL IN A SIMILAR
SITUATION.

WILLIAM POMERANCE, M.D.
MAIMONIDES MEDICAL CENTER
BROOKLYN, NEW YORK
AREA CODE 212 FROM.
ULTRASON 3-1200

Figure 3. Telegram sent by William Pomerance on November 24, 1967.

posing was an experimental procedure carrying extremely high
risk. We explained that although we had begun and aborted
an attempt 1 year earlier, a heart transplantation had never
been done in humans, but that we had substantial experience
using the technique in animals. After weighing the advantages
and risks, the parents gave their consent. With our team on
24-hour alert, we began searching for a suitable donor on
November 24, 1967. This time, Dr. Pomerance sent telegrams
to 500 hospitals (Figures 3, 4).

Figure 4. The transplantation team. First row, left to right: Phillip Sechzer, MD, Director of Anesthesia; William Pomerance, MD, Di-
ger of Obstetrics and Gynecology; Adrian Kantrowitz, MD, Direc-
tor of Surgery; Howard Joos, MD, Director of Pediatrics; Jacques
L. Sherman, Jr., MD, Medical Director. Second row, left to right: Unknown; Robert Piepgr, Perfusionist; Alfred Butner, MD, Resident;
William Neches, MD, Chief Resident Pediatrics; Ehud Korngrad,
MD, Resident Pediatrics; Eugene Werner, Perfusionist; Giota Lane,
Nurse Research Associate; Alexander Fatine, Supervisor Surgical
Research Laboratory. Rear row, left to right: Steven Phillips, MD,
Resident Surgery; Fausto Marmoloco, MD, Resident Cardiothora-
surgery; Mario Cerutti, Attending Surgeon Thoracic and Vascu-
lar Surgery; Unknown. Inset: Jordan Haller, MD, Director of Tho-
racic Surgery.

Figure 5. The donor infant for the 1967 transplantation.

From November 25 to December 5, the baby's condition
remained clinically stable. He tolerated oral feedings well, but
his weight remained in the 5 lb., 8 oz.-5 lb., 10 oz. range. Se-
rial chest radiographs disclosed progressive cardiomegaly.
A donor was found in Philadelphia on December 4, and
again we began preparing for a transplant operation.

On the morning of December 3, one of my daughters heard
a radio broadcast reporting that a doctor in South Africa had
just performed a heart transplantation. I tuned in to the reports
of Christiaan Barnard's operation, in which he had transplanted
a young female accident victim's heart into 54-year-old Louis
Washkansky. I was stunned. I would not have been surprised
to hear that Shumway or Lower had done the operation, but
I had never seen any heart transplantation studies published by
Barnard.

We considered whether to go ahead, realizing that in the
glare of media attention to the South African transplantation,
it might appear that we were racing to get into the act. How-
ever, our transplantation procedure, based on years of work
with experimental animals, had been planned 2 years earlier,
and there was a patient for whom there was no alternative.

On balance, to cancel our transplantation simply because Bar-
nard's was making headlines around the world would have
evacuated the negative effect of the press coverage. We pro-
ceeded.

The Transplant

Our donor was an anencephalic male born in Philadelphia
on December 4, 1967 and transferred to Maimonides Medical
Center the following day (Figure 5). The infant needed assisted
ventilation. The infant's poor condition precluded catheteriza-
tion, but physical examination, chest radiography, and an elec-
trocardiogram revealed no cardiac abnormality. The donor in-
fant, like the recipient, had blood type A, Rh positive. The
irradiated hamster test of lymphocyte compatibility disclosed
no major incompatibility.

Physicians in Philadelphia discussed the infant's prognosis
with his parents, who decided to donate his heart to save the
life of another child. On December 5, the parents signed re-
lease and organ removal forms. The father of the donor was
failed, and the baby was declared dead 6\frac{1}{2} hours after the operation. Autopsy showed diffuse atelectasis of both lungs. The transplanted heart appeared normal. The suture lines were intact, and there were no intracardiac thrombi or signs of leakage. The aortopulmonary anastomosis was reduced in caliber but still patent, and there was slight narrowing of the right main pulmonary artery.

Examination of the recipient's natural heart (Figure 8) showed the right atrium to be markedly enlarged and its wall thickened. There was a severe deformity of the tricuspid valve, leaving a widely patent orifice. Displaced to the base of the right ventricle, the valve leaflets were fused with their rudimentary chordae tendineae, resulting in nearly complete membranous obstruction of the right ventricular outflow tract below the infundibulum. The right ventricular cavity was rudimentary. In addition, there was a large atrial septal defect. The final anatomic diagnosis was severe Elstein's malformation of the tricuspid valve with subvalvular right ventricular outflow tract obstruction.\\n
Reactions to the First Heart Transplantations

Because Barnard's transplantation had already captured the attention of the news media, the performance of a second transplantation so soon after evoked frenzied interest. We had resolved to say nothing to the press, but within minutes after our procedure began—at 4:00 in the morning—reporters and photographers from a New York paper descended on the hospital. Before the surgery was over, more than 200 reporters, photographers, and television people had gathered outside the hospital. They pressed hospital staff and employees for details and could not be persuaded to leave.

Under the circumstances, we felt compelled to issue a statement after the baby's death. After first sending a report to the King's County Medical Society, we held a press conference.

I told the assembled reporters that the operation had been an experimental procedure—an attempt to apply heroic measures to salvage the life of an infant. But I added: "I think it should be clear to you, and I think you should convey to your readers and your listeners and your viewers that we here consider that this procedure was a failure."

Over the next months, articles and editorials in the popular and medical press reflected the wide range of reactions to the first heart transplantations. By the time of these articles were written, Barnard's patient also had died, after surviving 18 days with a transplanted heart. American and European cardiologists surveyed for an article in Hospital Tribune praised the transplantations on technical grounds, but some voiced concerns that the trials were premature and worried that they might touch off a rash of similar attempts by inexperienced physicians.\\n
Transplant surgeons interviewed for the Medical News section of JAMA shared those reservations. "Human application is premature," said heart valve pioneer Charles Hufnagel of Georgetown University. "I don't see why we don't limit transplantation to non-fatal organs, or to organs for which we have alternate means of sustaining life in the event of failure, until further improvement in our knowledge."

In a commentary for JAMA, Lyman A. Brewer III, a clinical professor of surgery at the University of California, Irvine, wrote:
Because cardiac transplantation is technically no more difficult than some current operations, many cardiac surgeons may be tempted to perform this procedure. . . . This being true, it is hoped that the operation will never be performed as a status symbol to the surgical team or hospital embarking on this surgery. Nothing would cause more discredit to the procedure in particular and to surgery in general than the precipitous plunging of many surgical teams in the United States and throughout the world into this type of surgery with its high mortality and uncertain future.31

On the other hand, Medical World News quoted Jesse Edwards of the University of Minnesota School of Medicine, then president of the American Heart Association, who called the work "a courageous and exciting new advance in cardiology and a milestone in the history of medicine and surgery."

Other articles offered a more balanced view. The day after our transplantation, the Boston Globe addressed criticisms that our team had rushed to capitalize on the attention given to the Barnard transplant. The writer, medical editor Herbert Black, noted that our search for a donor had begun before we heard anything about Barnard's transplantation, and pointed out that our team had a reputation for first reporting its work to the medical profession and only then describing it to the news media.32 Indeed, we had sought no publicity while planning either our 1966 or 1967 attempts, and in 1966 we received none.

In a New York Times article published the following month, Owen H. Wangensteen, the venerable chairman of surgery at the University of Minnesota, defended the first heart transplants. They then numbered five. Recalling that the same sort of criticism had followed the first open heart surgery and other dramatic medical innovations, Wangensteen said, "I think only the people who are in the game know the problems and I think one should leave them alone."34

Aftermath

Dismayed by the media blitz and shaken by our failure to make one whole being out of two doomed infants, I still believe our procedure was sound. We continued our experimental work in dogs. In January, 1968, accompanied by C. Walton Lillehei, Barnard visited our laboratory and marveled at the long survival of our animals (Figure 9).

In the same month, on January 9, we performed one more transplantation. The patient was a 57-year-old man with a 9-year history of progressive cardiac disability. We gave him the heart of a 29-year-old woman who had suffered a massive intracerebral catastrophe. The donor heart, however, was unable to support the patient's circulation, and he died 10½ hours after surgery.37

Again we were chastised for what some thought was a reckless undertaking. Helen Taussig of Johns Hopkins Hospital, whom I revered, sent me a scathing letter the following week.
With our two transplantation attempts, she charged, we were “clearly trying to be first in this country and trying to make the press.” She criticized our choice of an infant with a tricuspid atresia as a recipient in the first operation and our use of a donor who was much smaller than the recipient in our second attempt. Delivering a final blow, she contended that we would “hurt the medical profession no end” by “taking unnecessary chances and playing for the gallery.” She said she planned to write a letter to a medical journal criticizing heart transplantations, which she did.1

Crushed, I responded privately to Tausig with a five-page letter that outlined our research in dogs and described the details of our two human transplantation operations. “I am as disturbed as you about the enormous and misleading press coverage that all of the heart transplants have received,” I wrote. “For myself, I don’t see how anyone could choose to create this kind of environment for an effort that is difficult at best.”

Tausig’s reply was gentler than her first letter. Although she still expressed reservations about infant heart transplantations, she ended by writing, “I do hope that all of you that are engaged in organ transplant can continue to work quietly and make advances, that the technique may be developed and all the problems solved, but that there will be no rush to be first in this country; and above all that the ability to do cardiac transplant will never become a status symbol.”

In the months that followed, our continuing experimental work in transplantation focused on three areas: extending the duration of donor heart survival through resuscitation and preservation; modifying the surgical technique used in infants to meet better the requirements of the growing heart; and increasing the survival time of dogs with transplanted hearts. At the same time, we expanded our research on mechanical methods of assisting the failing heart, which always had been our main focus.

Although we continued heart transplantation work in our laboratory, we soon realized that more reliable methods of preventing graft rejection were needed than were available at that time. Results of the 101 heart transplantations performed around the world in the first year after the Cape Town and Brooklyn transplantations were disappointing. Only a quarter of the patients lived longer than a few months.2 Our interest in heart transplantation waned, along with that of most of the rest of the world. By 1971—just 4 years after the first heart transplantations—an article in Medical World News carried the headline, “What ever happened to heart transplants?”23

Today we can answer that heart transplantation is alive and well, like most patients who now receive heart transplants. Improved surgical techniques, increased knowledge of the immune system, and especially the discovery of cyclosporine led to renewed interest in organ transplantation in the 1980s. Again, the news magazines made optimistic proclamations: “After many a disappointing false start, the era of the transplant may have finally arrived,” Newsweek ventured in 1983.24 This time, they were right. By 1988, Medical World News would write that heart transplantation had “gradually shed its experimental mantle to become the widely accepted therapy for end-stage heart disease that it is today.”25 Since then, methods of diagnosing and treating rejection have continued to improve, and so have success rates.

Ethical Issues

Looking back, I see two substantial sets of concerns that still have not reached a real resolution.

The Dilemma: Defining Death

In the early heart transplantation attempts, the challenges of surgical technique, rejection, and infection were the only obstacles. Ethical issues were a least as daunting. Foremost was the matter of when the heart could be taken from the donor. According to the definition of clinical death that was generally accepted at the time, the donor was not considered dead until the heart had stopped beating. Although our laboratory experiments showed that hearts could successfully be transplanted after they had stopped, I was concerned about potential damage from a period of anoxia. I felt that we could in good conscience remove the donor’s heart while it was still beating because an anencephalic infant has no chance of surviving. However, colleagues at Maimonides Medical Center insisted that we allow the donor’s heart to stop naturally before removing it. I believe that our first attempt might have succeeded if we could have taken the donor heart before it stopped beating. We learned only recently that the parents of the anencephalic infant would not have objected.26 Had we been able to do so, the metabolic acidosis, if it occurred at all, probably would have been manageable with the then available techniques.

The Anencephalic Infant as Donor

The Uniform Determination of Death Act, passed in 1980, cleared up confusion about the moment of death but shed

---

1 The letter appeared in JAMA a month later (Cardiac transplants. JAMA 203: 162, 1968).
no light on the unique situation of the anencephalic infant. The act specifies that brain death must encompass both death of the cerebral hemispheres and of the brain stem. But although anencephalic infants may have brain stem activity, they have no cerebral hemispheres. The legal criteria become meaningless in view of the anencephalic infant's tragic circumstances.

These infants never have experienced consciousness and never will. They have no chance of personhood, a fact which most parents of anencephalic infants fully understand. Just as they did 30 years ago, parents of live-born anencephalic babies still plead for a chance to donate their baby's organs, but they are denied the opportunity. We, in fact, had not anticipated the fervent desire of these parents of doomed infants to save the life of another child. Interviewed by Time shortly after our unsuccessful 1967 transplantation attempt, the donor's father said, "We thought we could turn our sorrow into someone else's hope. We're sorry it didn't work out—but we're not sorry we did it."41 That father—and the many anguished parents who later offered us their anencephalic infants' organs for donation—showed extraordinary courage, compassion, and enlightenment.

Recognizing the painful quandary, the Council on Ethical and Judicial Affairs of the American Medical Association recently revised its position on the use of anencephalic infants as organ donors. In 1994, after more than a year of deliberation, the Council issued a new opinion stating that it is ethically acceptable to transplant the organs of anencephalic infants even before the infants die, as long as the parents consent and certain other requirements are met.42

The Council's position reflects the opinions of leading experts in anencephaly and medical ethics who were polled in a 1992 survey. Two thirds of those surveyed said it was "intrinsically moral" to use organs from anencephalic infants before brain stem death, and more than half favored changing the law to permit such use.43

When Leonard Bailey transplanted a baboon's heart into a 12-day-old infant known to the world as Baby Fae in 1984, he claimed the controversial procedure was necessary because suitable infant donor hearts were unavailable. Since then, Bailey has become a strong advocate of the use of anencephalic infants as organ donors.43

In Perspective

In 1968, Sir Peter Medawar accurately predicted the future of organ transplantation. Speaking at the Second International Congress of the Transplantation Society, he had this to say:

"The transplantation of organs will be assimilated into ordinary clinical practice ... and there is no need to be philosophical about it. This will come about for the simple and sufficient reason that people are so constituted that they would rather be alive than dead."

The first heart transplantations undertaken by a handful of investigators, like so many other firsts, were simply stages in an ongoing process of biomedical investigation. In the popular press, some articles created exaggerated expectations, leading people to believe that transplantation was perfected and should soon be generally available. Few writers explained that heart transplantation represented an incremental step forward, based on years of experiments, and that much more research would be needed before it could be regarded as a clinical treatment. Media attention doubtless stimulated the flurry of transplantations in that first year. The world's outstanding cardiovascular surgeons underestimated the problems to be solved before the procedure could become routine. In the gloom of discouragement that followed the initial heated optimism, only the group headed by Shumway at Stanford Medical Center persisted. Their focused effort, coupled with the availability of drugs to control graft rejection, enabled transplantation to become a standard therapy.

The progression from animal experiments to human trials, as risky as they were, was necessary and inevitable. The 5-year patient survival rate for infants younger than 1 year of age now is almost 50%. For children aged 1–5 years, the rate is nearly 70%. After, unhappily, the first infant transplantation was not successful, it was a beginning.

Acknowledgments

The author thanks Nancy Ross-Flanagan, Michael Meyer, and Jean Rosensalt for their assistance in the preparation of the manuscript, and Dr. Jordan Haller and Dr. William Neches for their review of the manuscript.

Supported by grants from the David and Minnie Birk Foundation and the U.S. Public Health Service Grants HE-06510, HE11173, and HL13737.

References