

CHAPTER 1

INTRODUCTION

Background

The modern era of heart transplantation began in December 1967 when Barnard reported a successful transplantation of human heart at Cape Town, South Africa (Barnard, 1968). Present technology and pharmacology have led to an improved rate of survival and quality of life, making cardiac transplantation a therapeutic procedure for patients with end-stage heart diseases. The goal of heart transplantation is to return person who would otherwise die or be severely disabled by end-stage heart diseases of any case to a functional life style (Schroeder, et al 1987).

Since December 1967, more than 20,000 patients have undergone cardiac transplantation in the world. The results have improved with time. The actuarial survival rate of the patients, operated in the last five years, is 80% at one year and 70% at five years after surgery. Today, newborn infants as well as elderly persons of more than 70 years of age undergo this surgery (Kawashima, 1993).

In Asia before 1980, there were four countries, namely China, India, Israel and Japan, performing heart transplantation. Their patients did not live long after transplantation and each program was eventually suspended (Sakornpant, 1994). The first successful heart transplantation was performed in Thailand in December 1987 at Chulalongkorn Hospital (Ongcharit, 1987). By 1993, there were 20 centers in 9 Asian countries performing 189 intrathoracic organ transplantation; of these 165 were heart transplantation. The age of patients varies from 5 months to 70 years. There were 70% survivors among 165 heart transplant patients (Sakornpant, 1994).

Heart transplantation has become established as a standard procedure in heart surgery. Improvement in immunosuppressive therapy and diagnosis of graft rejection have been crucial. The criteria for transplantation have been broadened for recipients and donors. Newborns, pediatric patients, diabetic patients with impaired renal function will be no longer excluded from transplantation due to improved postoperative therapy (Hetzer, et al, 1992). The success of heart transplantation is directly related to careful donor and recipient selection criteria and improvement in the immunosuppression (Smart, et al, 1993).

Cardiac Transplantation at Chulalongkorn Hospital

Chulalongkorn Hospital constitutes a working division under Thai Red Cross Society, a charity institute with an aim of providing a comprehensive medical care, including disease prevention, promotion, treatment and rehabilitation. The Stated objectives of the hospital are as follows:

- 1) To provide medical treatment to the sick irrespective of race and nationality;
- 2) To provide medical education and training;
- 3) To provide nursing education and training;
- 4) To be well-equipped and well-prepared to operate in time of national emergency or disaster arising during peace or war time;
- 5) To initiate investigation and/or research procedures to uncover the cause of an epidemic wherever the latter arises.

With the objective and philosophy of the hospital, and also as being a university hospital, it is reasonable for the hospital to provide operations like heart transplantation which are technologically complicated and very expensive service to the patients with end-stage of heart disease.

The cardiac transplant program was established at Chulalongkorn Hospital in 1987, the first successful cardiac transplantation was performed in December 1987 by the team of cardiothoracic surgery. Up till December 1994, 30 patients had undergone orthotopic heart transplantation at Chulalongkorn Hospital with one year survival rate of 70%, Two year survival rate of 61% and five year survival rate of 35% .

Table 1.1 Characteristics of 30 patients transplanted at Chulalongkorn Hospital (1987-1994).

Age (Years)	Mean \pm SD	41 \pm 13
	Median	41
	Mode	48
	Range	12-60
Males		21
Females		9
Ratio of male:female		7:3
Diagnosis		
-Cardiomyopathy		21 (70%)
-Ischemic heart disease		7 (23%)
-Others		2 (7%)
Survival		
-1st year		70%
-2nd year		61%
-5th year		35%

1. Recipient selection criteria

Suitable cardiac transplantation patients suffering irremediable cardiac disease with a prognosis for survival of less than 6-12 months.

2. Donor population

The average age of donor is 27 years and 93 % were male. The most common cause of donor death is cerebral trauma, often as a result of a road traffic accident. Acquisition of donor from other hospital is 40% and 60% of the donor were admitted in Chulalongkorn Hospital.

3. Donor selection criteria

- Younger than 35 years of age for males (40 years for females)
- No preexisting heart disease
- No history of cardiac arrest, cardiopulmonary resuscitation, cardiac trauma or intracardiac injection
- Compatible blood type match with recipient
- Compatible size match with recipient
- Absence of transmissible disease (negative HIV, VDRL, HBsAg)
- No systemic disease that may involve the heart
- Absence of systemic infection
- Without malignancy (except primary brain tumors)
- Statement of brain death from attending physician
- Consent from legal next of kin

At the beginning of the program, there were some problems about morality, ethics and religion on organ acquisition, because people do not accept organ donation especially cadaveric heart. As Chulalongkorn Hospital is a University hospital and with the objective and philosophy of the Thai Red Cross Society mentioned above, it should take up the responsibility to undertake such complicated and high technology operation to save the people life. So in 1990, the Organ Donation Center of the Thai Red Cross Society has been established, with the roles of disseminating information and knowledge to the public about organ donation, including kidney, liver, heart and lung, and also coordinating with other hospitals in Bangkok if there is a donor available. Because of this, there is a trend of increasing organ donation and heart transplantation in the future.

4. Heart transplantation process

When there is a donor available for heart transplantation available in Chulalongkorn Hospital or other hospitals, the transplant coordinator will inform the team of heart transplantation which consists of cardiac surgeon, anesthetists, perfusionist and operating room nurse. Potential cardiac donors are usually victims of head injuries, resulting from motorcycle accidents. The majority of these patients were sent to the hospital emergency departments and is often the neurological physician to reorganize a potential organ donor. Complete assessment of the potential organ donor should include a medical history to assist in establishing the presence of underlying diseases. The cardiac donor must meet several conditions. Irreversible destruction of the brain must be determined, the ABO blood groups and general weight range of the donor should be match that of the recipient, and there should be no contraindicating factors. If the donor has been located at the other hospital, a transportable team with consisting of surgeon, two operating room nurses, perfusionist and transplant coordinator have to go out for donor heart acquisition. The heart/lung instrument set required for the harvesting procedure are packed and ready to leave the hospital at any time. This instruments includes special instruments, solution and supplies necessary for the donor operation. They spend as much time as necessary to preserve the donor heart, because the heart is the organ least tolerant to prolonged anoxia.

A prospective recipient who has been evaluated and selected for heart transplantation is called for admission in the hospital if the patient stay at home. Or the patient is transferred from the medical department to the surgical department if the patient is admitted in the hospital. Soon after admission, cyclosporine is administered to the recipient with a proper dose which has been adjusted by the physician. Donor and recipient are taken to the operating rooms simultaneously. Both donor and recipient are managed appropriately by the anesthesia team before surgery is commenced. While the OR nurses set up the two operating suits and prepare instruments for donor and recipients surgery. And the perfusionist manages the heart lung machine. There are two teams of personnel involved in the heart transplantation procedure which includes the surgeon, anesthetist, scrub nurse, circulating nurse and perfusionist. The surgical procedure for the recipients take about four to five hours, while for the donor take only two to three hours.

5. Post operative management

After the surgery, the patient is taken directly from the operating room to the intensive care unit (ICU) and placed in reversed protective isolation (hand washing, gown and mask). Routine procedure for postoperative cardiac surgery is listed in table 1.2. which shows typical post transplantation requirement. Mechanical ventilation are weaned and discontinued as early as possible. All invasive measures are kept at a minimum. Indwelling catheters or tubes are removed when their function is not absolutely essential. Urinary catheters are removed

when urine output is stable. Extubation may be performed in most recipients within the first three post-operative days. Nutritional support is begun when extubation has been performed. With stabilization of oral feeding, cyclosporine is given by mouth twice a day in proper doses adjusted by the physicians. Impending rejection and infection must be carefully observed. Rejection is treated by short course of prednisolone. The patient is transported to the surgical ward for routine care of cardiac surgery patient after their condition is stabled. Postoperative hospitalization has varied between 27 days and 113 day.

Table 1.2 Typical post-operative orders for cardiac transplantation patient

Nasogastric tube connected to gravity drainage
 Nasotracheal suctioning every 2 hrs and as occasion requires
 Chest physiotherapy every 4 hrs
 Ventilation rates, pressure limits, PEEP-CPAP setting individualized
 Fluid therapy

- Total IV fluid
- Blood loss replaced with fresh frozen plasma or packed red blood cells

Medications

- Antibiotics
- Azathioprine
- Calcium gluconate
- Cyclosporine
- Diazepam as occasion requires (restlessness)
- Isoproterenol
- Methylprednisolone
- Methylprednisolone sodium succinate (Solu-Medrol)
- Morphine
- Nystatin orally, three times a day
- Phenobarbital

X-ray examination

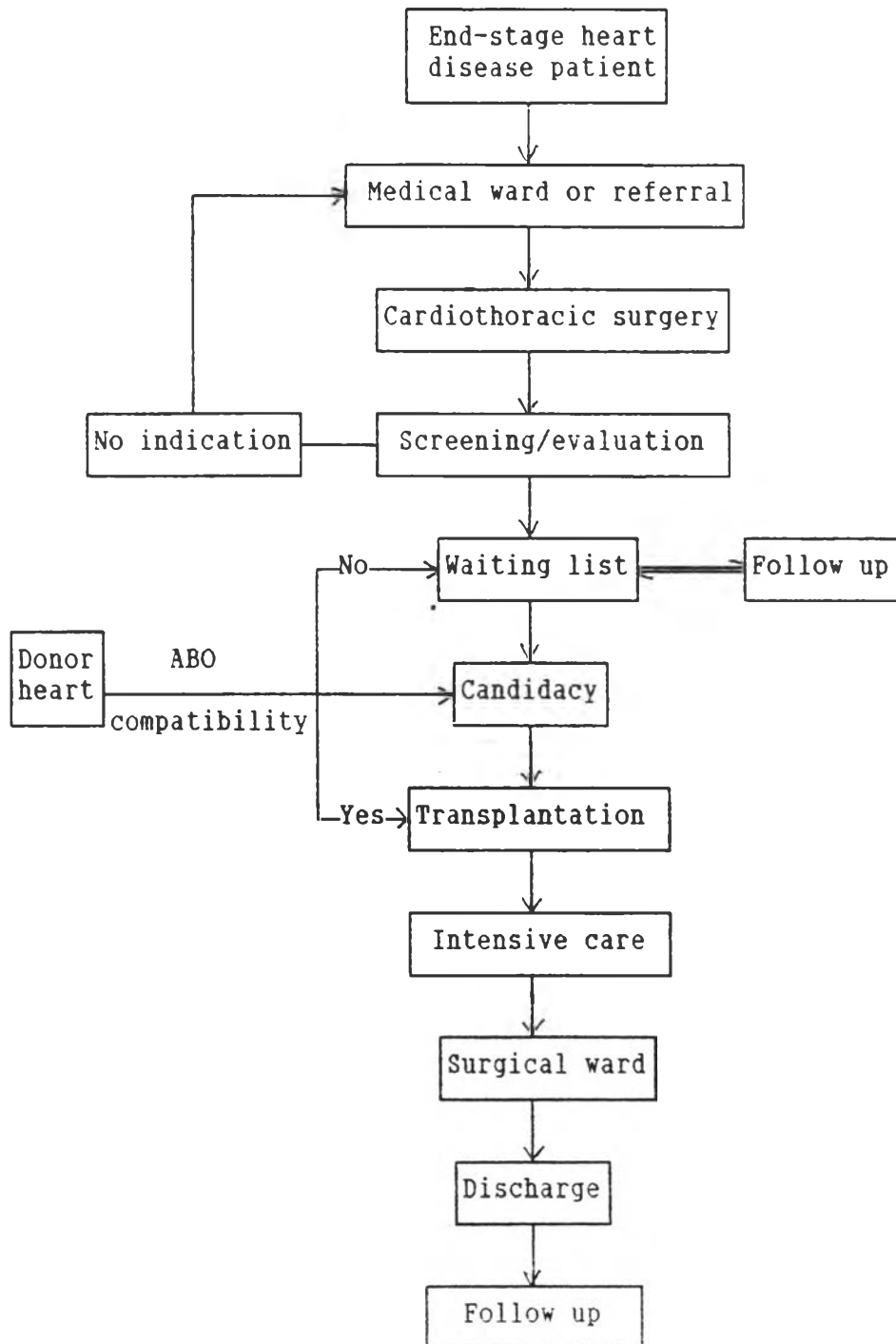
- Chest x-ray examination on return from operating room and daily for 7 days, then twice weekly

Laboratory

- BUN, creatinine, random blood sugar (stat) and daily for 2 days, then twice weekly
 - Serum electrolyte stat, then every 2 hrs for two times, then every 4 hrs
 - Cyclosporine blood levels, daily, while receiving cyclosporine
 - Culture (urine, trachea, oropharynx) daily for 7 days, then twice weekly
 - Complete blood count, twice weekly
 - EKG and echocardiography twice weekly
-

Heart transplantation program is described as follows

Figure 1.1 Heart Transplant Program in Chulalongkorn Hospital
(Flow Chart)



Rationale

Chulalongkorn Hospital is a charity hospital with the financial support from the government, the Thai Red Cross and a part from cost recovery. In fact, nearly half of the heart transplantation in Thailand had been performed at Chulalongkorn Hospital. Among the 30 patients undertaken heart transplantation at this hospital during 1987 to 1994, only 9 of them were paid by the third party or government insurance. That means the hospital has to incur most of the cost for the operations. Of the nine patients paid by the third party, the roughly estimation from the medical bill is 150,000 Baht per person, which should be much lower than the actuarial cost because only part of the recurrent costs were taken into account, not including the personnel cost and other capital inputs.

As mention earlier, heart transplantation is technologically complicated procedure and the cost for operation is very high. There has been much debate about the cost of heart transplantation even in the more affluent societies where most of the operations have been done. Their discussions and arguments are always focused within the national health expenditures and what societies can afford to provide in terms of medical care for its citizens (Roger, 1987). In Chulalongkorn Hospital, although the financial support come from the government and from donation, it is still very necessary to understand the cost and practice cost containment as the costs for the operation is very high and there is an increasing trend to serve this kind of medical service in the future.

Benefit of the Study

Cost information will be very useful to estimate resource requirements for the delivery of the service. Accurate information about the cost of the operation will be used to adjust the reasonable rate of charging the patients who have the ability to pay. And identification of costs is an essential management tool, allowing the hospital to better predict and therefore contain costs. Furthermore, the cost information gathered will be very useful for the hospital administrators to understand the trend of cost for heart transplantation in Chulalongkorn Hospital, that is, to probe whether the resources of this procedure are being used more efficiently. Through this cost trend analysis, it would be possible to project the future resource requirement for heart transplantation. Cost component analysis will provide information about the resource utilization in the transplantation procedure. We can understand that which cost categories composite the biggest part and in what extent the importance is.

Because issues of cost will dominate discussions regarding transplantation, it is imperative that accurate data regarding the determinants of resource consumptions and the aggregate cost of heart transplantation should be obtained. Unfortunately, the studies related to the cost of heart transplantation in Chulalongkorn Hospital are not readily available up till now. It is therefore quite necessary to start

inquiring the resources consumed by the procedure.

Research Questions

1. How to calculate the total provider costs of heart transplantation from the day of surgery to the day of discharge?
2. What is the provider direct costs of heart transplantation from the day of operation to the day of discharge?
3. What are the components of the costs and what is its proportion?

Research Objectives

1. To design a model of costing for heart transplantation from the day of surgery to the day of discharge.
2. To examine the provider direct cost of heart transplantation from the day of operation to the day of discharge.
3. To identify the components of costs for heart transplantation and its proportion.