

Status of Cardiac Anaesthesia in Singapore

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Introduction

Anaesthesia for cardiac surgery in the Republic of Singapore was established in 1967. From that historical event, there has been an exponential development of the workload and status of cardiac anaesthesia. Singapore has evolved through the last three decades into a modern metropolis. The resulting changes in socioeconomic status and lifestyle have altered the spectrum of diseases prevalent in this island state. Degenerative diseases have overtaken infectious diseases to become the predominant cause of morbidity and mortality. Over the same period of time, we also noted a change in the spectrum of cardiac diseases. Rheumatic, syphilitic and hypertensive heart diseases are less frequent problems. Degenerative atherosclerotic coronary artery disease have become not only the predominant cardiac problem but the main cause of illness in our community¹.

Facility, manpower and training

Presently, there are four hospitals offering cardiac surgery to a population of 2.8 millions, two government structured (Singapore General Hospital and National University Hospital), and two others being private corporations (Mount Elizabeth Hospital and Gleneagles Hospital). The present manpower status of the cardiac teams include cardiothoracic surgeons ($n = 19$), cardiothoracic anaesthetists ($n = 25$), cardiologists

($n = 51$), perfusionists ($n = 11$) and nurses working in the operating room and the cardiothoracic intensive care unit ($n = 90$). The cardiac anaesthesiologists can now be trained entirely in Singapore. The training period will cover six years. The first three years of basic training will include two examinations leading to the degree of Master of Medicine (Anaesthesia). This will follow by another three years of advance training, during which time, the prospective cardiac anaesthesiologist will spend up to 30-40 % of his time working in the cardiac operating room. Anaesthesiologist undergoing the advance training will usually spend one year in overseas leading cardiovascular centres for "fine tuning".

The cardiac surgical workload² of the four hospitals in 1992 include coronary artery bypass graft (CABG, $n = 1042$); cardiac valves replacement ($n = 184$); paediatric cardiac cases ($n = 295$) including BT shunting. Eighty one% of the total cardiac surgical workload performed in 1992 were adult cases. The remaining 19% being paediatric cases. Further detail of the proportion/types of cases performed are shown in Figure 1 and Table 1. The first CABG was performed in 1975, however, the number of CABG performed increase drastically after 1985 when more trained cardiothoracic surgeons returned back to Singapore (Fig. 2). The number of valvular heart disease and congenital heart disease patients being operated on over the last 11 years remains around 200 cases per year (Fig.3, 4).

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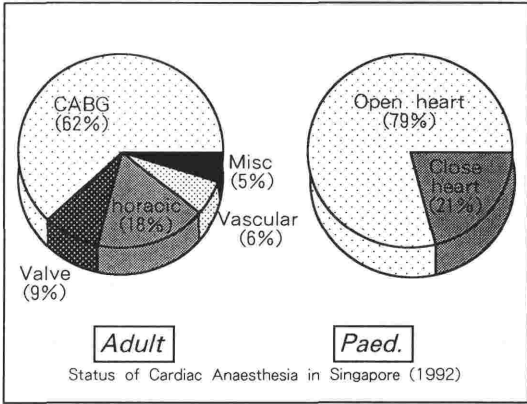


Fig. 1 Types of cardiac surgical workload in 1992

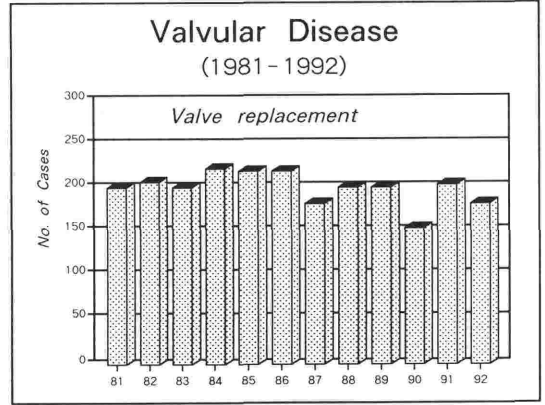


Fig. 3 Number of valve replacement performed from 1981-1992

Table 1 Types of Congenital Heart Disease performed in NUH in 1992

Congenital Heart Disease	
ASD	PA + VSD (Homograft)
VSD	Fontan operation
Tetralogy of Fallot	Ebstein abnormality
ASD + VSD	PDA
VSD DORV	VSD + PS
TGA switch	Hemitruncus
VSD + PDA	Subaortic membrane
RVOT reconstruction	Open aortic valvotomy
AVSD	Mitral valve cleft
TAPVD	Cortriatriatum
ASD + VSD + PS	Ao-LV tunnel

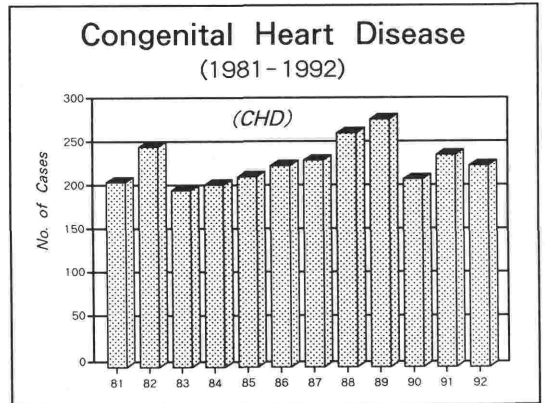


Fig. 4 Number of operations performed on congenital heart from 1981-1992

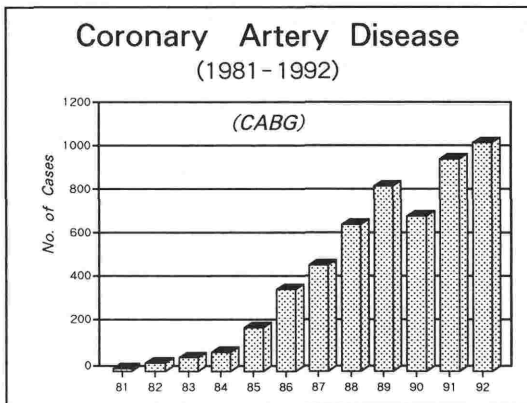


Fig. 2 Number of CABG performed from 1981-1992

Impact of PTCA on cardiac anaesthesia practice

Recent advances in intervention cardiology such as percutaneous balloon angioplasty (PTCA), though not directly involving the anaesthesiologist unless in the event of failed angioplasty, has made anaesthesia for CABG more challenging. Since its introduction in 1977, PTCA is currently accepted as the initial procedure of choice in selected patients with obstructive coronary artery diseases. The first PTCA was performed in Singapore in 1985, to date, more than 1500 cases of PTCA have been performed. Over the last 5-6 years, PTCA

has redefined the candidates for elective CABG, the average age of patients undergoing elective CABG increased from 56 to 63 years. The number of grafts implanted increased from 2.5 to 3.6 grafts per patient and the average preoperative ejection fraction declined from 56 to 50 %. In short, the cardiac anaesthesiologist now faces an older patient population with more diffuse coronary artery disease and decreased left ventricular function.

Anaesthetic equipment and agents

The anaesthetic equipment has been made "state of the art" with computerised documentation of physiological parameters and invasive monitoring techniques. The critical care unit is similarly equipped with compatible equipment. The monitors that are routinely used for all cardiac patients include ECG (II, V 5), non-invasive and direct arterial pressure, central venous pressure, pulse oximetry, end-tidal CO₂, temperature, urine output, arterial blood gases and electrolytes (ionised calcium, potassium) analysis. We believe that low risks patients such as those with good left ventricular function can be safely managed without pulmonary artery (PA) catheterization. PA catheter with ability to monitor the saturation of mixed venous blood (S $\bar{V}O_2$) continuously is increasingly being used. Transoesophageal echocardiography is not routinely used.

Anaesthetic Technique Agents

A list of anaesthetic agents available to the cardiac anaesthesiologists in the department of anaesthesia, that of NUH is shown in Table 2. We feel that no single anaesthetic agent (including isoflurane) or technique will greatly affect the postoperative outcome. The most important determinants of outcome are likely to be the severity of the disease process and surgical technique. The ability of the cardiac anaesthesiologist to avoid additional detrimental changes in myocardial energetics (eg. tachycardiac in patients with IHD), is more important than the specific anaesthetic technique

Cardiac Anaesthesia

Premedication

Cardiac drugs

Scopolamine, morphine

Anaesthetic agents

Opioids - fentanyl, sufentanil, morphine

Muscle relaxants - pancuronium, vecuronium

Inhalational agents - halothane, isoflurane

Intravenous anaesthetic - thiopentone, ketamine
etomidate, propofol

Table 2 List of anaesthetic agents used for cardiac surgery

used to this end. A good understanding of the pathophysiology each specific cardiac condition couple with an in depth knowledge of the effect of each anaesthetic agent on the cardiovascular system, are required to minimise perioperative haemodynamic changes.

Cardiopulmonary bypass

Membrane oxygenator has been in routine use since 1985. Since 1990, we routinely use in-line PO₂ monitor and arterial blood filtration. Catecholamines is the most widely used group of drugs employed in the management of post-bypass cardiac dysfunction. The recently introduced phosphodiesterase III inhibitors (eg. amrinone, enoximone) are usually used in combination with the catecholamines. We do not routinely administer calcium during weaning from bypass. Correction of proven hypocalcaemia, and the reversal of hyperkalaemia-induced atrioventricular block are the main indications for the drug in cardiac surgery.

Postoperative management

Most of the patients who underwent open heart surgery were mechanically ventilated overnight. The patients are sedated with i.v. midazolam or low dose propofol infusion, analgesia is provided for by morphine infusion. All patients underwent

CABG will receive a continuous nitroglycerin (1μ g/kg /min) infusion, any hypertensive episodes will be treated with sodium nitroprusside and/or ketanserin.

Heart transplantation —

Heart transplantation is an accepted therapeutic modality for end stage cardiac failure. Seven patients underwent heart transplantation in Singapore from June 1990 through February 1993³. The indications for transplantation were dilated cardiomyopathy in 3, ischaemic cardiomyopathy in 3 and one for adriamycin induced cardiomyopathy. The age ranged from 14-59 years, and 5 were males. There was no perioperative mortality. The follow-up period ranged from 7 months to 2 years. Late mortality occurred in one patient 7 months after transplantation due to coronary graft disease. The rest are in NYHA class 1. The LV function at 12 months in 5 patients ranged from 58-75 %.

Mortality and morbidity for cardiac surgery is

monitored by the health authorities with indepth regular review leading to changes as part of quality assurance. The concerted efforts of the Ministry of Health along with the economic success and efficient communication has established Singapore as a regional centre for cardiac surgery.

Acknowledgement

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Reference

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