Coronary artery bypass graft (CABG) surgery: Current University Hospital (K.L.) experience

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Summary

A personal series of 163 patients who underwent coronary artery bypass surgery (CABG) in the University Hospital, Kuala Lumpur between March 1988 and December 1990 were reviewed retrospectively to determine factors affecting hospital morbidity and mortality. One hundred and thirty eight were elective cases while 25 patients underwent emergency CABG surgery. Of these, 15 patients had recent myocardial infarction, with unstable haemodynamics or post infarct angina; six had failed angioplasty procedures and four patients immediately following coronary angiogram. The elective hospital mortality rate was 2.2% (three cases) and there were two deaths in the emergency group.

Pre-operatively 20 patients (13%) had very poor left ventricular function of less than 30% ejection fraction. Significant improvement in ejection fraction was observed following surgery. The follow-up periods were between three months to three years. Ninety eight percent of patients showed improvement in their functional status (NYHA classification) in relation to angina and exercise performance.

Key words: Coronary artery bypass surgery (CABG), left ventricular function, myocardial infarction.

Introduction

University Hospital, Kuala Lumpur was the pioneering hospital for open heart surgery in Malaysia since the 1970's. Congenital heart and valvular operations were performed with good results. However coronary artery bypass surgery was not started until 5th October 1983 when the first CABG patient was operated. Unfortunately, this patient died following the 11 hour operation. Since then, 55 other patients were operated on over a period of four years (1983–1987) with rather poor results. There were 14 hospital deaths resulting in an operative mortality of 27.3%. The average mortality rate in other major centres in the world and General Hospital Kuala Lumpur was less than 5%.[1,3,7] The CABG programme was discontinued temporarily until the author returned from his cardiothoracic training in United Kingdom in late 1987. In early 1988, the author restarted the programme following discussion and consultations with local and foreign cardiothoracic surgeons.

Material

A total of 163 CABG operations (elective and emergency) were performed by the author between March 1988 to December 1990.

The main indications for surgery were:
(i) Unrelieved angina despite medications
(ii) Tripple vessel disease with impaired left ventricular function for prognostic improvement
(iii) Post myocardial infarction
(iv) Failed angioplasty

There were 138 elective cases while 25 patients underwent emergency CABG operation. The male to female ratio was 5 : 1. Seventy-eight patients were Indians, 48 were Chinese, 30 Malays and seven patients belonged to other ethnic groups.

The majority of patients were in the 40 to 70 year age groups (Table 1). Six patients were in their late 20's. One patient was a 28 year old fireman with an anteroseptal and inferior infarct. He had no past history of ischaemic heart disease. His unstable condition while in the Coronary Care Unit prompted an urgent coronary angiogram which revealed severe tripple vessel disease and a very poor left ventricular function of ejection fraction 17%. This was confirmed by MUGA Scan. In view of his worsening condition he underwent an urgent CABG operation during which three saphenous veins were grafted on the left anterior descending circumflex and the right coronary arteries. He required intra-aortic balloon pump and high inotropic support following weaning off bypass. His post-operative LV function improved to an ejection fraction of 33% (MUGA Scan).

Six patients were older than 70 years. One of them was an elderly Indian woman who suffered an anteroseptal myocardial infraction but subsequently developed unstable angina. Her LV function was poor with an EF of 23%. Four saphenous veins were grafted. She was discharged well on the seventh post-operative day. The other four patients had uneventful CABG operation and post-operative periods. One died of subendocardial infarction on the first post-operative day.

Table 1
Age of patients (CABG)

Age range (yrs)	No. of patients
25 – 30	6
31 – 40	26
41 – 05	44
51 – 70	81
> 70	6
Total	163

Preoperatively 55% of the patients were in functional class III and IV following angina or myocardial infarction (Table 2). Thirty five percent of these patients had a past history of myocardial infarction and 75% of these patients had one or more risk factors such as smoking, diabetes, hypertension, hypercholestrolemia or a strong family history of ischaemic heart disease.

Table 2
Preoperative function class status

NYHA Functional Class	No. of patients
I	30
II	45
III	60
IV	28
Total	163

A high proportion of the operated patients (62%) had some form of left ventricular impairment due to the ischaemic heart disease, out of which 20 patients had severely impaired LV function with ejection fraction ranging between 17% and 30% (Table 3). Thirty eight patients had significant left main stem narrowing either in combination with or without tripple vessel disease.

Of the 25 patients who underwent emergency coronary artery bypass graft surgery:
(i) six were following failed angioplasty
(ii) four patients were unstable following coronary angiogram
(iii) fifteen patients had recent myocardial infarction with unstable haemodynamics or persistent angina

One patient had infarcted during coronary angiogram and despite with inotropics and intraaortic balloon pump (ABP) support, he had a peak perfusion of less than 50 mmHg. External cardiac massage was maintained during transfer from the Coronary Care Unit to the operating theatre

Table 3
LV function by ventriculogram/MUGA Scan

Ejection fraction (EF)	No. of patients
Good LV function > 50%	63
Moderately impaired LV function 30–50%	80
Severely impaired LV function < 30%	20
Total	163

for emergency CABG surgery. Three saphenous vein grafts were put in and he came off bypass with a moderate amount of inotropics and IABP support. He actually woke up on the second post-operative day after sedation was failed off. Unfortunately, he had already developed irreversible acute renal failure and he succumbed to septicaemia following peritoneal dialysis and haemofiltration.

Methods

The first 10 patients had saphenous vein grafts as conduits to bypass the blocked coronary vessel. Subsequently internal mammary arteries were used as conduits for proximal left anterior descending artery disease and on patients younger than 60 years with stable haemodynamics. Internal mammary artery (IMA) grafts have superior patency rate (90%) compared to saphenous vein grafts (70%) at 10 years.[6] A total of 35 patients had LIMA or RIMA grafts either to the left anterior descending or right coronary artery.

The standard route of cannulation using the 2-stage single venous cannulae with ascending aortic cannulation for the return of the oxygenated blood from the pump was used in the majority of cases. Crystalloid cardioplegia using the St. Thomas solution at 4°C was used to stop the heart at diastole.

Repeated infusion of cardioplegic solution was performed after every distal anastomosis and with intermittent tropical cooling, myocardial preservation was maintained at body temperature of 25°C. The right superior pulmonary vein venting is preferred now to decompress the heart during aortic cross-clamped period.

The average number of grafts per patient was 3.4. Twenty three patients had endarterectomy indicating the diffuse nature of atheroma affecting some of these coronary arteries. All patients with endarterectomised coronary vessels were maintained on warfarin for six months and then aspirin indefinitely.

Seventy-five percent of these patients did not require inotropic support in the immediate post-operative period. Extubation was carried out within 24–48 hours and they were discharged on the seventh post-operative day.

Results

In the elective group of patients, there were three hospital deaths, a mortality rate of 2.2%.

One patient could not be weaned off from the cardiopulmonary bypass following insertion of two grafts i.e. left internal mammary artery (LIMA) and a vein graft on the severely diseased LAD involving the first septal branch. There was no antegrade or retrograde filling of this completely occluded vessel on angiogram indicating very poor collaterals and small lumen size. The heart did not stop spontaneously following cardioplegic infusion but was fibrillating continuously, despite topical cooling, suggesting poor myocardial protection. In view of the extremely small lumen and multiple blockage two grafts proximally the LIMA and distally a vein graft were put on the LAD. Despite the relatively short cross clamp time of 30 minutes and high inotropic support, the irreversible pump failure suggested massive intraoperative myocardial infarction.

The second mortality was a patient who had four saphenous vein grafts. He developed cardiac arrest in CICU following the infusion of an old blood pack which contained a high level of potassium. His serum potassium prior to the arrest was 7.1 umol/L.

The third mortality was a 70 year old Chinese man with preoperative subendocardial infarction. He had significant aortic incompetence which was not detectable preoperatively. Four saphenous veins were grafted and the aortic valve was replaced. Unfortunately he died of pump failure on the first post-operative day.

There were two deaths in the emergency group. The first mortality was the man who had infarcted during coronary angiogram. He died of irreversible renal failure on the fourth POD. The second patient was an elderly man who had acute aortic dissection following aortic cannulation and proximal graft anastomosis. The ascending aorta was very calcific, cheesy and abnormally thin-walled and atherosclerotic.

Four patients (about 2.5%) were reexplored for bleeding which was better than most world series of about 10%.[1] Except for chest infections there were no other significant major clinical complications in all these patients. Tracheostomy was performed on a patient who had chronic bronchitis and prolonged ventilating support.

Repeat echocardiogram done postoperatively, prior to discharge showed that the majority of patients with impaired LV function improved by at least 10 points ejection fraction when compared preoperatively.[8] The follow-up period is between three months to three years. Most of them showed marked clinical improvement. Their functional class status improved by at least 1–2 grades (NYH classification). One patient had recurrent angina on effort six months later. This particular patient had LV aneurysmectomy for left ventricular aneurysm as he presented with heart failure following myocardial infarction. Pre-operatively, there were no significant coronary vessel which could be grafted, and he had a large anterior apical LV aneurysm. He is currently being treated conservatively with medications.

There were two late deaths. One patient was the young fireman with an impaired LV function with ejection fraction of 17%. He came back five months later with congestive cardiac failure secondary to the irreversible ischaemic cardiomyopathy although he was free of angina.[8]

The second late mortality was an Indian man who had diffuse coronary artery disease. Despite four saphenous vein grafts he reinfarcted six months later and died of uncontrolled arrhythmia in CCU.

Discussion

Most world renowned cardiothoracic centres have an elective operative mortality rate ranging from 0.3% to 6.6% as shown from the CASS review.[2] There was a seventy-fold difference in the rate of observed operative mortality to expected operative mortality amongst the 15 participating institutions in the CASS study which indicates that the early surgical result is not uniform among major centres which is unexpected in the early phase of the learning curve as in our institution.

Certainly achievements or improvements in results is attributed to greater operative experience and technology, not the selection of easier cases[5] as experienced by the author whose operative mortality was confined only during the early phase of the programme i.e. within 1988 and early 1989. He had no operative mortality since then to the completion of this paper in early 1991.

In this paper we relate our local experience and concluded that factors governing operative mortality and morbidity[4,5] are the same as in other centres in the world. These are patient factors such as:

(i) poor LV function[3,8,9]
(ii) haemodynamic unstability due to major myocardial infarction
(iii) diffuse atherosclerotic coronary artery system
(iv) other associated pathology e.g. valvular disease and aortic dissection.

It is certainly reassuring that we have now overcome the initial setback and the present result is comparable to the General Hospital Kuala Lumpur experience on CABG.[7] The present total experience of CABG in UHKL is the author's personal experience series and this may explain the better results when compared to the earlier programme prior to 1987 when all the four variable cardiac surgeons were at their early learning curve when they started the CABG programme.

The present better experience has been the result of awareness of the fact that the surgery itself has very little room for any technical errors. With the aid of adequate microsurgical instruments, routine use of magnifying loupe and headlighting system, and the same surgical team, the procedure is performed very routinely now and at least two to three CABG operations are performed regularly per week.

All the patients operated on prior to 1987 were found to have good LV function with ejection fraction of at least 50%. This fact excludes the possibility of poor patient selection as a cause of the initial poor results. With plans for future expansion we hope to contribute further in the development of the coronary programme since coronary heart disease is a major cause of death in this country.

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