Cardiac catheterisation and coronary angiography in a private hospital setting: The first 24 months at Subang Jaya Medical Centre

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Summary

This report is based on the results of 300 patients undergoing cardiac catheterisation and angiography studies in the first 24 months of operation of Subang Jaya Medical Centre. Sixty-nine percent of patients underwent coronary arteriography and 31% had investigation for congenital and valvular heart disease. A large number of patients had triple vessel (50.7%) and left main (10.6%) coronary artery disease. Major complication noted was low (2%) and it is concluded that catheterisation can be done safely and with good results in a private hospital in this country.

Key words: Cardiac catheterisation, Complications.

Introduction

"The decision to perform any diagnostic procedure should be based upon the physician's weighing the relative benefits likely to accrue from the resulting information, as opposed to the potential hazards involved. While it is not too difficult to assess the potential value to an individual patient of the data obtained by means of cardiac catheterisation and angiography, it has been far more difficult to estimate the risks to which the patient is exposed".[1] Generally, cardiac angiography is considered a low-risk procedure, but published complications rates of 18%[2] and mortality rates of 2%.[3,4] are relatively high. Subsequent reports[5,6,7,8] reflect the trend towards lower risk presumably due to changing and improving technology. Some studies[6,9] have shown that small case-loads need not result in higher incidences of complications although some reports indicate otherwise.[10,11]

Cardiac catheterisation was first performed in Malaysia in 1968 at the University Hospital, Kuala Lumpur. In July 1985 the first private hospital in the country with a fully equipped diagnostic angiography laboratory was established. The purpose of this paper is to report the commissioning and development experience in a private setting for such a laboratory during the initial 24 months of operation.

Faculty profile: Subang Jaya Medical Centre is 244 bedded private acute care general hospital. An invasive cardiac diagnostic and open heart surgery programme is an integral feature of the facility. The programme receives referred patients for cardiac catheterisation and angiography. The cardiac catheterisation room is currently one used by a full-time hospital based cardiologist and three hospital affiliated cardiologists.

Laboratory staffing profile: Catheterisation laboratory staff consists of three radiographers, two cardiopulmonary technologists, two catheterisation and special-procedure nurses. All are trained professionals and joined the hospital having had previous cardiovascular experience from either the Government General Hospital or the University Hospital Kuala Lumpur.

Equipment profile: Radiological equipment includes a Philips' double C-arm Poly Diagnostic-C unit with biplane and lateral cine-camera attachment, and an Optimus M20 control panel. It is fully equipped with an AOT. The angiography injector used is the Angiomat 3000. Instant review of angiogram is through a Umatic video recorder. Agfa-Gevamatic R10 is used for the processing of cinefilm. The developed film is viewed with a single lens Targano 35CX cine projector. The haemodynamic and physiological recorder system is the Hewlett Packard 8890B Cath Lab System.

A Radiometer OSM-2 Hemoximeter is used for oxygen saturation estimation and the Waters Instruments MRM-2 monitor for oxygen consumption measurement when required.

Situated in the laboratory itself is a cardiovascular emergency cart and standby pacemaker unit. Should an emergency arise, the hospital has a Medical Emergency Team (Code Blue) which is called to support the regular members of the catheterisation team. All participants are trained in cardiopulmonary resuscitation. Adjacent to the main laboratory is the control area, equipment room, scrub room, preparation room and supply room. The total working space covers 80 sq. m of which 40 sq. m is the angiography procedure area.

Infection control: All personnel not involved with the sterile procedure and observers wear surgical mask and remove their street shoes before entering the procedure area. The operating team are fully gowned. All drapes and surgical gowns used are disposable. The Hospital Infectious Control Committee policies are adhered to in the maintenance of sterility in this area.

Materials and methods

On the first July 1985 the hospital opened and within ten days of operation, the first cardiac catheterisation and coronary angiography was performed. During its first 24 months a total of 300 procedures have been done. For the purpose of this paper, patients having pacemaker insertions, aortograms and vasculature studies are excluded.

Pre-catheterisation: Normally, the patient who been informed to eat only a light breakfast is admitted on the morning of the procedure. The operating cardiologist sees the patient in the inpatient unit. After obtaining signed consent, the patient is prepared for the procedure. One hour prior to the procedure routine premedication consisted of 50 mg pethidine and 25 mg phenergan or 10 mg valium tablet are given. General anaesthesia may be given for infants depending on the cardiologist's opinion. The basic workup for the patient includes hepatitis-B and screening for syphillis.

During catheterisation: Infants not receiving general anaesthesia were sedated with intravenous valium during the procedure and then they were placed on a specially-designed splint and their limbs restrained. During the procedure, a scrub nurse assists the cardiologist. The two technologist record proceedings, manage blood saturations, monitor electrocardiograph, and record haemodynamics and physiological data. One radiographer was involved in operating the radiological instrument and angiography recordings. Systemic heparinisation is applied to all patients studied.

Post-catheterisation: Blood pressure, pulse and temperature and catheterisation site are constantly observed in the inpatient after the procedure. Patients usually remain in the hospital for 24 hours following catheterisation. On patient's discharge, the post-catheterisation observation chart is returned to the Cardiopulmonary laboratory for evaluation. It contains specific information such as (1) duration of procedure (2) screening time (3) catheterisation site (4) identified complications (5) type of catheters used.

Methods: Prophylactic antibiotics and antiarrhythmic drugs are not given to the patient. Local anaesthesia is applied at the catheterisation site. Pecutaneous entry of catheter is preferred for access to the right side of the heart via the femoral vein. However when a suitable vein is not available an antecubitall or femoral vein cut down is performed.

Retrograde approach is the preferred practice for left heart studies. Coronary angiogram may be performed via the femoral route by Judkins' technique and via the brachial approach by the Sone's technique. Depending on circumstances, both femoral and brachial approaches may be necessary in certain patients.

Table 1

Catheterisation Entry Sites

Sites	No.
Femoral percutaneous	256
Femoral cutdown	11
Brachial cutdown	23
Total	290

Dacron (USCI, Division of Bard International) and polyurethane (USCI Division of Bard International and Cordis, Cordis Corporation) catheters are commonly used. Dacron catheters were used until they are technically unsuitable, such as uneven or softened texture, inappropriate configurations, poor torque. With adequate care the Dacron catheters have been reused up to eleven times. As for polyurethane catheters, they may be reused up to four times. All catheters for reuse are thoroughly checked before they are sent through the process of cleaning and gas sterilisation. All catheters and guidewire used on patients with hepatitis-B positive and positive serology for syphylis were discarded after the procedure.

During the procedure the routine studies performed are pressure recording, blood oximetry and angiography. Special tests are done when necessary. Especially when flow data is required the Fick's method is applied. For left ventricular function parameters such as systolic and diastolic volumes and ejection fraction, they are calculated by the method described by Rackley.[1,2]

Results

Three hundred patients have undergone diagnostic cardiac catheterisation and coronary arteriography during this period. Seventy-one percent were male with ages ranging from five months to 73 years (mean 41.2 ± 15 years). The investigations were normally completed within one to two hours. One exception was a five month old child whose systemic artery 'collapsed' after the right heart studies and the procedure had to be completed the following day.

The coronary arteriography procedures rarely required more than an hour. Table I shows that the femoral approach was the choice of preference and brachial arteriotomy was done mainly due to atherosclerotic femoral arteries. Eleven of the femoral cutdown approaches were done on infants and children. A total of 13 children were subjected to general anaesthesia during the procedure. When general anaesthesia was not given, the child's limbs were secured onto the splint and the child was sedated with valium.

The pre-catheterisation workup revealed five patients as being hepatitis-B positive, two had hepatitis antibodies and two with positive serology for syphillis.

Cardiac catheterisation: During the 24 months following laboratory opening 93 patients underwent cardiac catheterisation for congenital, valvular and other organic disease. The age ranged from five months to 70 years (mean 35 ± 21.5 years). Table II lists the major anatomical diagnoses with ventricular septal defect and atrial septal defect being the most frequent congenital lesions identified. Two post-operative studies on children were performed to assess the conduits in a Waterson shunt and repair of a truncus arteriosus done some four years earlier.

The mitral valve appeared to be the commonest valve affected. Two patients with prosthetic mitral valves were studied. During the cardiac catheterisation, 23 adult patients with valvular and six with congenital heart disease were also subjected to coronary arteriography.

Coronary arteriography: Sixty-nine percent (207/300) of the catheterisation procedures were for coronary arteriography. Table III shows a total of 236 coronary ateriograms of which 23 underwent coronary arteriography because of completed correction of valvular heart disease and six for congenital heart disease.

Table II

Anatomical diagnosis in 93 patients undergoing cardiac catheterisation

Diagnosis of major lesions	No.
Ventricular septal defect	11
Atrial septal defect	11
Tetralogy of Fallots	5
Patent ductus arteriosus	1
Endocardial cushion defect	1
Double outflow right ventricle	1
Pulmonary atresia	1
Patent foramen ovale	1
Pericardial disease (all forms)	2
Primary pulmonary hypertension	3
No anatomical lesions	5
Post operative studies*	2
Pulmonary stenosis	5
Aortic stenosis	14
Mitral stenosis	12
Mitral regurgitation	11
Aortic regurgitation	3
Mitral & aortic stenosis	1
Prosthetic valve dysfunction	2
Total	92

**Waterson shunt and truncus arteriosus*

There were 35 females (mean age 57 years) and 172 males (mean age 51 years) in the coronary artery disease group. 9.7% (20/207) were found to have normal coronary arteries, 16.4% (34/207) double vessel disease and 50.7% (105/207) triple vessel disease. Twenty-two (10.6%) patients had left main stem disease.

One patient who had bypass surgery performed 12 months ago was found to have patient graft vessels and demonstrated progression of disease in his native vessels. Left ventricular aneurysm was noted in eight of the patients with severe triple vessel disease and two had thrombi in the left ventricle.

Table III

Selective angiography of the coronary arteries in 236 patients.

	CAD	Valvular	Congenital
n	207	23	6
Age (years)	52 (9.4)	48 ± 11.6	47 ± 5.7
Normal coronaries	20 (9.7%)	21	6
Minor disease	4 (2.0%)	1	–
Single vessel disease (SVD)	21 (10.1%)	–	–
Double vessel disease (DVD)	34 (10.4%)	1	–
Triple vessel disease (TDV)	105 (50.7%)	–	–
Left main stem disease (LMSD)	7 (8.4%)	–	–
LMSD + TVD	15 (7.2%)	–	–
Post-CABG	1 (0.4%)	–	–

CAD = coronary artery disease
CABG = coronary artery bypass grafting

Complications

Table IV lists the complications observed in the 300 procedures. During the catheterisation procedures there were four major complications. One patient demonstrated profound hypotension with a systemic systolic pressure of 40 mm.Hg., one had transient ventricular asytole and one patient went into ventricular fibrillation during right coronary arteriography. All three had their studies completed without further event and were transferred to intensive care following the procedure for recovery. One patient was subsequently transferred to the intensive care due to a myocardial infarction.

There were no deaths during catheterisation procedures. However, two patients died within 12 hours of the procedure despite the procedure itself being uneventful. The first post-catheterisation death was considered to have died as a result of severe coronary artery disease and acute worsening of the left ventricular function following the procedure. This 53 year old male suffered diffuse triple vessel disease with an ejection fraction of 34% and left ventricular end-diastolic pressure of 32 mm. Hg. The second death was unexpected and was probably a result of acute myocardial infarction. This 59 year old female patient had a left ventricular end-diastolic pressure of 13 mm. Hg. and 64% ejection fraction. She had severe triple vessel disease together with left main stem disease.

Table IV

Specific types of complications or adverse effects observed in 300 catheterisation procedures

Types of Complications	No. of Patients During CATH	Post CATH
MAJOR		
Cerebrovascular accident	0	0
Cardiac arrest (ventricular fibrillation)	1	0
Profound hypotension	1	0
Transient ventricular asytole	1	0
Myocardial infarction	0	1
Death	0	2
MINOR		
Transient arrhythmias (bradycardia)	11	0
Haematoma	2	1
Bleeding (at insertion site)	0	1
Fever (rigor/nausea)	4	7
Equipment failure	2	0

Other minor complication experienced during or after catheterisation included site bleeding which could have been avoided in one of the patients if he had observed post-angiography instructions. Fever, rigor or nausea were normally related to angiographic contrast reaction rather than infection as these occur very shortly after the procedure and no patient was subsequently admitted with endocarditis or other systemic infection. Eleven patients experienced transient arrhythmias and bradycardia which was usually the result of the patient being tense and frightened by te procedure. None of the patients with post-catheterisation haematoma required surgical evacuation or prolonged hospitalisation. Twice during the procedure there was an electricity breakdown, which resulted in one of the cases being re-studied the following day. This situation was subsequently remedied with the povision of emergency power supply support to the catheterisation laboratory.

Comments

This paper represents the total experiences with 300 consecutive patients who underwent coronary arteriography for assessment of coronary artery disease and cardiac catheterisation for congenital, rheumatic valve and other organic heart abnormalities.

We note that during our first 24 months, we studied very few patients with congenital and rheumatic heart disease despite the high prevalence of such disease in this country. Sixty-nine percent of the cases referred to us for angiography were for coronary artery disease. This no doubt is largely due to the pattern of patient referral to the cardiology services of our hospital and no way should it be seen as reflecting the prevalence of such diseases in this country. We are however optimistic that as our services become better known more congenital and valvular heart disease patients will be seen in our hospital.

None of the patients who underwent procedures acquired any infection at the insertion sites or required to be hospitalised within one month of procedures for infective endocarditis. In this series, there was a 9.3% minor complication rate that did not necessitate any intervention or therapy and patients were discharged as scheduled the day after the procedure.

The incidence of normal coronary arteries studied was 9.7% which is far less than reported in several studies[6,7,14,15] ranging from 16.5% to 27%. A 10.6% left main stem disease and 50.7% triple vessel disease in our series was much greater than most published literature.[6,16] This indicates that we performed studies in a population with severe and high-risk coronary artery disease. Despite this we only experienced two (0.66%) deaths which occured within 12 hours post procedure contributing to a 2% major complication rate. There was no way of determining whether death was due to the procedure or to the nature of the disease itself, although the study may precipitate such events. Comparison of results in this setting is usually difficult as the definition of complications are not consistent in all reports and study sample sizes vary.

Our complication rate appeared to be low compared to other reports.[4,11,17] It was noted[8] that the complication rate is decreasing in recent years, but would increase in patients with severe disease. The risk of death during and after catheterisation is undoubtedly higher in subsets of patients with left main stem disease, triple vessel disease, severe hypertension, congestive heart failure and severe dysfunction of left ventricle.[6,7,8]

In the Collaborative Study of Coronary Artery Surgery (CASS)[6,9] an analysis of 7553 coronary angiography procedures showed no relationship between the number of catheterisations per year and the rate of complications. One important factor in catheterisation safety strongly emphasised by Judkins[13] is the availability of stable, well-qualified nurses and technologists in the cardiac catheterisation team, which was the case in our centre.

Conclusion

It is concluded that cardiac cathetrisation and coronary angiography can be done safely and with good results in a private hospital in this country. The availability of good equipment and a highly skilled nursing, technological and radiographic team ensure such safety and high quality data being available for the pre-operative evaluation of these patients with severe disease of the heart.

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