COARCTATION OF THE AORTA — REVIEW OF SURGICAL EXPERIENCE IN HONG KONG

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SYNOPSIS

Twenty patients underwent surgical correction of their coarctation in the Hong Kong University Cardiothoracic Centre since 1970. An analysis of these patients and the results of surgery are presented, with a brief review of the literature on this subject.

INTRODUCTION

Coarctation of the aorta is an important congenital cardiovascular defect and its incidence among Caucasian patients has been reported to range from 4% (Stuckey 1956) to 11% (Carlgren 1959). Isolated coarctation of the aorta is uncommon among the Asians (Ongley 1966, Loh 1969, Shann 1969, Walloppillai 1970). Ng et al (1976) reported an incidence of 'complicated' coarctation of 8.6% in Hong Kong. A similar figure was reported by Muir (1960) for Singapore. 'Complicated coarctation is a common cause of heart failure in infancy. Only twenty patients with coarctation of the aorta were treated in the Hong Kong University Cardiothoracic Centre, at the Grantham Hospital since 1970. This is a small number compared to other reports (Chiariello et al 1976, Tawes et al 1969).

PATIENTS STUDIED

Between June 1970 and October 1978, twenty patients underwent surgery for coarctation of the aorta, in the Hong Kong University Cardiothoracic Centre of the Grantham Hospital, eighteen of them since 1976. Eighteen were male and two females with a M: F ratio of 9: 1. Ages ranged from 17 days to 39 years. The age distribution is given in Table 1.

TABLE 1

AGE DISTRIBUTION AND MORTALITY

Age	No. of Patient	Operative Death	Late Death
1 mon. or less	5	1	
6 weeks	2		
4-5 mon.	2	1	
11½ mon.	1	1	
8-18 years	8		1
20 years	2	1	
Total	20	4	1

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CLINICAL PRESENTATION (Table 2)

All ten patients under the age of one year presented with heart failure, feeding problems and growth retardation. In all these infants the femoral pulses were either absent or delayed. Electrocardiographic changes of left ventricular or biventricular hypertrophy were present in all. Seven of these infants had pulmonary hypertension, which varied between 60 over 20 to 110 over 95 mmHg (Table 2). Among the ten patients over the age of eight years, absent or decreased femoral pulses were present in 9 instances. Moderate or severe hypertension of the arms was present in 6 patients. Three patients presented with palpitation and dyspnoea; and chest pain occurred in one patient. Four patients were asymptomatic. Electrocardiographic abnormalities consistent with left ventricular hypertrophy, strain or ischaemia were observed in four patients.

TABLE 2
CLINICAL FEATURES

Features	Age	
	1 Year	8 Years
Heart failure	10	
Cyanosis	3	3
Palpitation and Dyspnoea		1
Precordial pain		
Absent or decreased femoral pulses	10	9
Upper limb hypertension		6
Pulmonary hypertension	7	1
Asymptomatic		4

ASSOCIATED ANOMALIES (TABLE 3)

Associated cardiac anomalies, which profoundly influence the mode of presentation were commoner in infants (Table 3). Six infants had associated atrial and ventricular septal defects together with a patent ductus arteriosus; in two infants the coarctation was associated with a patent ductus arteriosus while in the other two there was an associated atrial septal defect.

In the over eight year group three patients had an associated small ventricular septal defect, two had small atrial septal defects and a patent ductus arteriosus was present in two patients, one patient had congenital aortic stenosis associated with coarctation of the aorta. Two patients had evidence of rheumatic aortic regurgitation, while rheumatic mitral stenosis and regurgitation was observed in two different patients. Only three patients in the group had isolated coarctation of the aorta.

In relation to the ductus arteriosus or the ligamentum arteriosum, the coarctation in seven patients was preductal, juxtaligament in five patients, postligament in three, postductal in two, and juxtaductal in one patient (Fig. 1). In two infants the narrowed segment was found to lie between the left subclavian and the left common carotid arteries. These two cases appeared to be milder form of Type B interrupted aortic arch (Celoria and Patton 1959).

TABLE 3
ASSOCIATED CARDIAC DEFECTS WITH COARCTATION OF THE AORTA

Defects	1 Year	8 Years	No.
Patent ductus arteriosus	8	2	10
Ventricular septal defect	6	3	9
Atrial septal defect	8	2	8
Aortic Stenosis		1	1
Aortic Insufficiency		2	2
Mitral Insufficiency		1	1
Mitral Stenosis	1	1	2
None		3	3

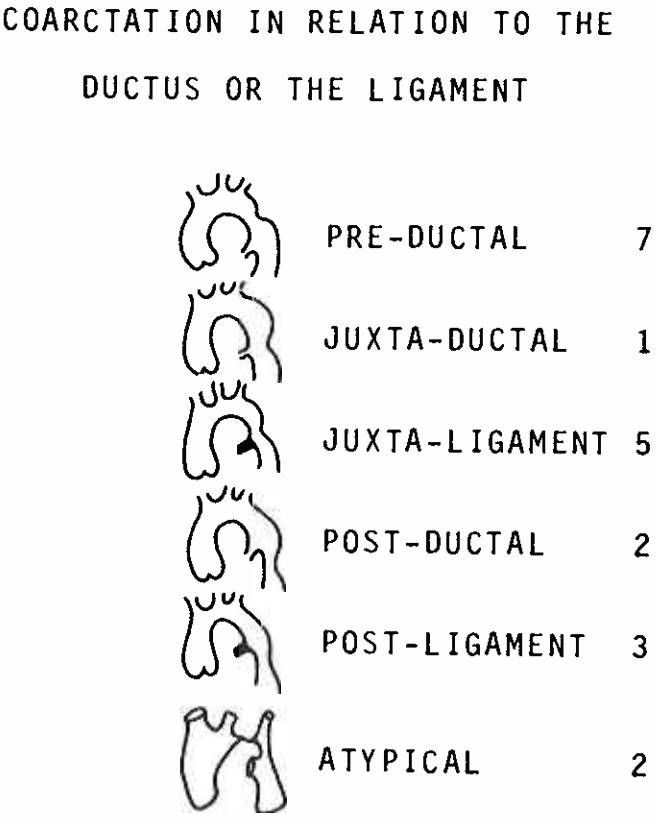

Fig. 1 Coarctation in Relation to the ductus or the ligament

SURGICAL TECHNIQUES

The operation was performed through a left posterolateral thoracotomy, and the chest was entered through the third or fourth intercostal space. In twelve cases the operation performed was resection of the coarctation and in eleven of these, primary end to end anastomosis was carried out. in the other patient the coarcted segment was too long for primary anastomosis and a dacron graft was used for restoring the continuity. The anastomosis was performed using a continuous suture in the posterior wall and interrupted stitches in the anterior wall. In four patients patch angioplasty as described by Vossschulte (1957) was carried out, utilising pericardium in two (2 cases of a typical coarctation, mentioned previously), and dacron in the other two; left subclavian artery was utilised to bypass the coarctation in two patients; in two patients dacron graft was anastomed end to side above and below the long segments of coarctation to bypass them. The patent ductus arteriosus was always divided and transfixed. Pulmonary artery banding was done in two patients at the time of correcting the coarctation.

RESULTS

There were four operative deaths giving a 20% mortality; one neonate, two infants and an adult (Table 1). All of them had associated cardiac defects or disease. The neonate and the infants that died had ventricular and atrial septal defects together with patent ductus arteriosus in addition to the coarctation. One 39 year old male died of myocardial infarction following resection of his coarctation. Preoperative studies showed this patient to have aortic regurgitation and left ventricular dysfunction in addition to the coarctation. In retrospect this patient should not have been subjected to surgery for his coarctation.

There was residual coarctation in two infants following surgery; one underwent patch angioplasty while the other had resection and anastomosis. Both had persistent hypertension of arms and some delay in femoral pulses. Both patients had successful reoperation for correction of residual coarctation. Two patients required evacuation of postoperative haemothorax due to leakage from the suture line; another patient developed wound haematoma in the latissimus dorsii muscle, which was evacuated.

LATE RESULTS

The follow up period ranged from 101 months to two months. There was one late death, a twelve year old boy with coarctation and mild aortic stenosis died one year after resection of coarctation due to bacterial endocarditis affecting the aortic valve. All surviving fifteen patients had palpable femoral arterial pulses. Four of the six patients with moderate hypertension of the arms required hypotensive therapy for three months. Subsequently, however, all remain normotensive without any medication.

DISCUSSION

Isolated coarctation of the aorta has been reported to be rare among Asians (Ongley 1966, Loh 1969, Shann 1969, Wallopillai 1970). However, coarctation of the aorta associated with major congenital cardiac lesions form an important group of congenital heart disease. Ten out of fifteen cases of Muir (1960) had other associated cardiac anomalies. In an autopsy study of 116 infants and children, Ng et al (1976) found that 8.6% had coarctation of the aorta and 60% of these had other major cardiac or great vessel anomalies. These figures are similar to those reported for the Caucasian patients (Tawes et al 1968, Shirebourne et al 1976). The associated cardiac anomalies profoundly influence the mode of clinical presentation and the outcome. Ten of our patients below one year of age presented with heart failure and all had associated major cardiac anomalies. Physicians and surgeons should be aware of this condition when faced with an infant or child presenting with early heart failure.

The overall operative mortality rate in this series was 20%. However, the operative mortality in our infant group (under one year of age) of patients was high at 30%, as it is in other series — 21 to 56% (Chiariello et al 1976, Shinebourne et al 1976, Glass et al 1960, Mortenson et al 1959, Tawes et al 1969, and Sinha et al 1969). Such high mortality in infants seem to be mainly related to the almost consistently associated cardiac anomalies and the poor preoperative condition of these patients. All ten infants in this series when presented were in severe heart failure. The three infants that died initially had severe congestive heart failure, all had moderate to severe pulmonary hypertension (60 — 100 mmHg) and all had associated ventricular septal defects, patent ductus arteriosus and atrial septal defects; in addition one infant had a hypoplastic mitral valve. The high incidence of deaths in the first weeks or months of life, although explained by the previously mentioned complicating factors, is nevertheless disturbing; however, surgical results have been superior to nonoperative management, even in the infant group (Glass et al 1960, Cooley et al 1962, Shinebourne et al 1976) and hence appear to justify surgery.

Resection of the coarctation and end to end anastomosis would appear to be method of choice for correcting coarctation. However, in atypical coarctation e.g. milder form of Type B interrupted aortic each (Celoria and Patton 1959), a patch angioplasty, using pericardium or dacron as advocated by Vossschulte (1957) would appear to be technically easier and safer.

At follow up between 101 months and two months after surgery, all patients remain normotensive. The present series is too small to draw any conclusion as to the effect of correction of the coarctation on hypertension. Simon and Zloto (1973) and Chiariello et al (1976) report the salutory effects of resection of coarctation on hypertension, which are in contrast with the experience of Maron and co-workers (1973), which however, was observed in older group of patients. Shinebourne and coworkers (1976) suggested coarctation of aorta, especially 'complicated' coarctation should be diagnosed and operated on in the first year of life, since delay in operation may result in the development of persisting systemic hypertension. Although there is a high mortality

in infants in the first months of life because of the associated cardiovascular anomalies, surgical correction is nevertheless indicated because of an even higher risk with nonsurgical management. In a review of 108 infants by Glass et al (1960), 90% of the fatalities under one year of age were due to preductal coarctation, usually in association with cardiac defects i.e. 'complicated' coarctation.

Adults with coarctation of the aorta have an abbreviated life expectancy. Abbott (1928), in the 142 postmortem cases, found the average age of patients to be 32 years. It has been reported that patients with corrected coarctation have an elevated incidence of cardiovascular death, especially when surgery is performed after the age of 30 there is some increase in the operative risk, and although statistics are not available, this almost surely rises with increased age. It should be emphasised, however, that there is no more specific treatment for arterial hypertension than excision of a coarctation of the aorta, and the operation should be seriously considered at any age. Successful results have been obtained in the fifth and sixth decades.

In adults certain conditions greatly increase the operative risk (Schumacker et al 1968). Mild to moderate aortic insufficiency may be present, either due to rheumatic heart disease or to a congenitally bicuspid valve. The risk is greater when there are significant heart condition e.g. rheumatic mitral valve disease or myocardial damage. In almost all such cases the burden on the heart would be decreased if the hypertension due to coarctation could be relieved, but the risk may be prohibitive and operation inadvisable.

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