Surgical Treatment of Coarctation of the Aorta in a Ten Week Old Infant: Report of a Case

By John W. Kirklin, M.D., Howard B. Burchell, M.D., David G. Pugh, M.D., Edmund C. Burke, M.D., and Stephen D. Mills, M.D.

Although most patients with coarctation of the aorta survive to early adult life, it has been adequately demonstrated that some patients die in infancy and early childhood as a result of their coarctation. In selected cases, then, operation is advisable at a very early age. Cardiac failure in a 10 week old infant necessitated operation at this age in the case reported.

It is our opinion that the optimal age for surgical treatment in cases of coarctation of the aorta is between the ages of about 12 and 20 years; however, if a patient with coarctation of the aorta begins to evidence a complication of coarctation before the age of about 12 years, surgical treatment may have to be undertaken at an earlier age.

Marked cardiac enlargement occurring in an infant or child with coarctation may be regarded as the forerunner of heart failure and is a valid indication for operation as soon as the diagnosis is made, regardless of the age of the patient. Bacterial aortitis may occur at any age in patients with coarctation, although it is less common in coarctation than in subacute bacterial endocarditis on an associated bicuspid valve. Preferably, the bacterial infection should receive adequate treatment prior to consideration of surgical intervention. Should intra-arterial hemorrhage occur before a patient with coarctation reaches the ideal age for operation, surgical treatment for the malformation is to be recommended 6 to 12 months after the patient has recovered from the acute episode.

Although most patients born with coarctation of the aorta live through infancy and childhood, it is apparent from the experience which is accumulating that death may be caused by the malformation at an extremely early age. The exact mechanism underlying the appearance of left ventricular enlargement, pulmonary congestion and heart failure in the first few weeks of postnatal life in certain individuals with coarctation has not been entirely elucidated. Bahn, Edwards and DuShane have recently reviewed the problem of coarctation of the aorta as a cause of death in infancy and reported three of the cases seen at the Mayo Clinic.

It is mandatory, therefore, that coarctation of the aorta be considered in all cases of otherwise unexplained cardiac enlargement, or cardiac failure, in infancy. This is particularly true, since surgical correction of the malformation is possible even at this early age. Indeed, it is necessary that it be carried out promptly in such cases; else a fatal outcome seems assured. This diagnosis may be suspected when the femoral pulsations cannot be palpated. Accurate evaluation of these pulsations may seem difficult at this age; however, with a little practice, one can acquire skill in detecting femoral pulsations in an infant. The vessel is usually a finger's breadth medial to the anterior superior spine of the ilium. The pulsations can usually be found with ease in the sleeping normal infant by the fifth day after birth. A precise method of determining this malformation exists, namely, aortography, which can be employed in the smallest infant.

It may be mentioned that the main differential diagnoses in such cases are patent ductus arteriosus and endocardial sclerosis of the large ventricle type. When pulmonary edema is prominent, pulmonary venous obstruction such as may occur in anomalies of the pulmonary veins (for example, cor triatriatum) may be considered, but in such cases the left ventricle will not be enlarged.

As an illustration of the feasibility of surgical
repair of this malformation at an early age, should it prove necessary, a case report is presented.

**REPORT OF CASE**

An 8 weeks old infant was admitted to the Mayo Clinic on March 29, 1951, because of an enlarged heart. The baby, which was delivered by cesarean section, weighed 10 pounds and 2 ounces (about 4.6 Kg.) at birth. The baby cried shortly after birth. Although the baby seemed quite normal during the first few weeks of her life, she began to have some difficulty with her feedings. During the course of the examinations, the physician caring for the baby noted a markedly enlarged heart on roentgenographic examination of the chest.

On admission to the clinic, the baby appeared well developed and well nourished. Development was normal for the child's stated age. Physical examination disclosed no abnormalities save for the cardiovascular system. There was evidence on physical examination of a greatly enlarged heart. No murmurs were heard. Femoral pulsations could not be felt. A roentgenogram of the chest showed the lung fields to be normal. There was, however, evidence of marked cardiac enlargement (fig. 1a). The electrocardiogram was consistent with hypertrophy of the right ventricle (fig. 2).

It was believed that coarctation of the aorta was the basic difficulty and the cause of the cardiac enlargement, and aortograms seemed indicated for confirmation. These were taken on April 9, 1951. The left brachial artery was exposed, and a small polyethylene tube was threaded through it into the aorta. The patient was placed on the radiologic table, 5 cc. of 75 per cent solution of sodium iodo-methamate (Neo-iopax) were injected rapidly, and two views were taken at one-half second and one second. Then, during the injection of 3 cc. of the same solution two oblique views were taken at one-half second and one second. Following this, the tube was withdrawn and the artery was ligated.

The aortograms (fig. 3a and b) demonstrated clearly a coarctation of the aorta which was situated just proximal to the origin of the left subclavian artery. There appeared to be some narrowing of the left subclavian artery at its origin. There was no evidence of patent ductus arteriosus. This type o

**Fig. 1.** Roentgenograms of the chest. *a.* Before operation. Note the marked cardiac enlargement. *b.* Seven months after operation.

**Fig. 2.** Electrocardiograms showing findings consistent with hypertrophy of the right ventricle.
coarctation has been recently reviewed by one of us.\footnote{1}

Operation was performed on April 13, 1951, at which time the child was 10 weeks old. Anesthesia for the procedure was given by Dr. J. W. Fender of the Section of Anesthesiology, who also supervised the supportive care during operation. The contents of the left thoracic cavity were exposed by a left posterolateral incision, the chest being opened through the fourth intercostal space.

All the vessels in the area of the coarctation were carefully mobilized. The ligamentum arteriosum was doubly ligated and divided, as was the left subclavian artery. Clamps were appropriately placed and the coarctated area was excised along with the aortic end of the ligamentum arteriosum and the origin of the left subclavian artery. An end-to-end anastomosis was then effected, utilizing interrupted,

![Fig. 3a and b. Aortograms. Note the constriction of the aorta and slight dilatation of the aorta distal to the constriction.](image)

![Fig. 4. Coarctation of the aorta in case reported, before and after surgical repair.](image)

The anatomic arrangement of the aortic arch is indicated in figure 4. There was a typical coarctation of the aorta located just proximal to the left subclavian artery. There was a mild narrowing of the left subclavian artery at its origin. The left common carotid artery was normal. The ligamentum arteriosum attached to the aorta just distal to the strictured area and there was no evidence of patency of this structure. The intercostal and internal mammary arteries did not appear enlarged.

![Fig. 5. Retouched photomicrograph of operative specimen.](image)
evertin mattress sutures of 5-0 silk. The lumen at
the suture line possessed a diameter equal to that
of the aorta proximal to it. A retouched photomicro-
graph of the specimen is shown in figure 5 through
the courtesy of Dr. J. E. Edwards.

The baby tolerated the procedure well and the
convalescence was uneventful. After the operation,
the femoral pulsations were readily palpable. At
the time of dismissal, a systolic murmur could be
heard over the precordium. This is no longer present.
The child's growth and development have been good
to date. A roentgenogram of the chest, taken on
November 15, approximately seven months after
operation, revealed a marked reduction in the size
of the heart, relative to the child's size, as con-
tasted with the preoperative condition (fig. 1b).

When the child was re-examined on August 1,
1952, at 18 months of age, the heart was of normal
size and the child was developing normally.

COMMENT

This case emphasizes that coarctation of the
aorta may be associated with a serious degree
of cardiac enlargement in early infancy. The
diagnosis of the malformation by aortography
is feasible. A case of successful surgical treat-
ment of the coarctation in such a patient 10
weeks old is reported.

REFERENCES

1 CALODNEY, M. M., AND CARSON, M. J.: Coarcta-
tion of the aorta in early infancy. J. Pediat. 37:
46, 1950.

2 OLNEY, M. B., AND STEPHENS, H. B.: Coarcta-
tion of the aorta in children. Observations in

3 BAHN, R. C., EDWARDS, J. E., AND DUSHANE, J.
W.: Coarctation of the aorta as a cause of death

4 KEITH, J. D., AND FORSYTH, C.: Aortography in

5 BURCHELL, H. B., TAYLOR, B. E., KNUTSON, J. R.
B., AND WAKIM, K. G.: Coarctation of the aorta
with hypotension in the left arm. Physiologic
observations on direct intra-arterial pressures
and flow of blood. M. Clin. North America. 34:
1177, 1950.

6 —: Medical aspects of coarctation of the aorta.
Surgical Treatment of Coarctation of the Aorta in a Ten Week Old Infant: Report of a Case
JOHN W. KIRKLIN, HOWARD B. BURCHELL, DAVID G. PUGH, EDMUND C. BURKE and STEPHEN D. MILLS

Circulation. 1952;6:411-414
doi: 10.1161/01.CIR.6.3.411

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1952 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/6/3/411

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/