Clinical Reports

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Intraoperative Monitoring of Left Temporal and Right Radial Arterial Pressures during Aortic-arch Surgery

NANCY L. DAVIS, M.D.,* WILLIS WILLIAMS, M.D.,† DOLORES F. TAMER, M.D.‡
HENRY GELBAND, M.D.‡

Coarctation of the aorta occurs in approximately 10 per cent of children and adults who have congenital heart disease. This lesion usually presents no problem in surgical resection. However, in specific cases the aortic lesion may be strategically located so that the surgical management may be difficult.[1,2]

We recently operated on a 4-year-old boy in whom the aortic constriction was located

* Assistant Professor of Anesthesiology.
† Assistant Professor of Surgery, Division of Cardiovascular Surgery.
‡ Associate Professor of Pediatrics, Division of Pediatric Cardiology.
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Address reprint requests to Nancy L. Davis, M.D., Department of Anesthesiology, University of Miami, School of Medicine, P.O. Box 520875, Biscayne Annex, Miami, Florida 33152.

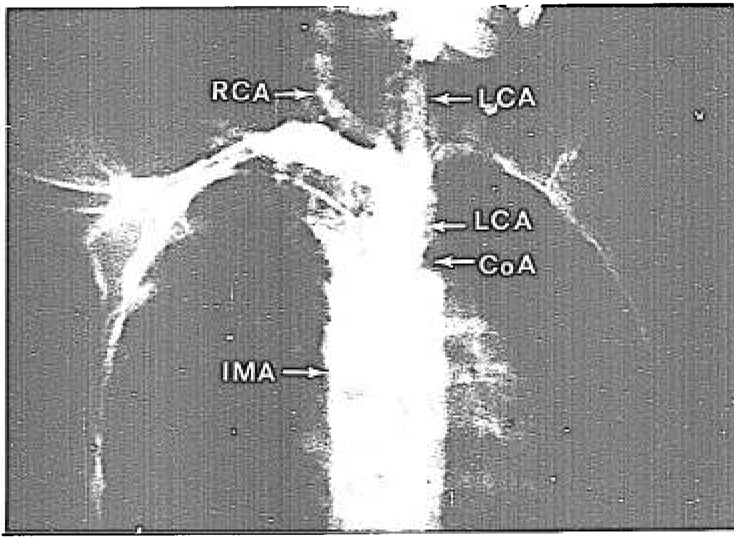

FIG. 1. Selected angiographic view detailing anatomy of great vessels. Contrast material was injected via a catheter placed in the ascending aorta. Note the branching of the great vessels. The first branch is the innominate artery, which immediately bifurcates into the right carotid and right subclavian arteries. The left carotid artery (LCA) takes its origin at the site of the coarctation. The left subclavian artery (not shown) originates immediately below the coarctation. RCA = right carotid artery; LCA = left carotid artery; IMA = internal mammary artery; CoA = coarctation of the aorta.

TABLE 1. Intraoperative Arterial Blood Pressures and Gases

	Phenylephrine Drip	Blood Pressure (torr)	$F_{I_{O_2}}$	$P_{a_{O_2}}$ (torr)	Per Cent Saturation	pH	$P_{a_{CO_2}}$ (torr)	Base Excess (mEq/l)
Pre-clamp								
Right radial artery	No	110/50	.4	127	98	7.40	33.1	−3.3
Left temporal artery	No	110/50	.4	134	99	7.39	32.1	−4.5
Left carotid artery and aorta clamped 1 hour								
Right radial artery	Yes	145/80	1.0	354	>99	7.47	24.2	−4.2
Left temporal artery	Yes	90/55	1.0	346	>99	7.47	22.1	−5.8
Left carotid artery and aortic clamp released								
Right radial artery	No	120/60	1.0	346	>99	7.40	34.2	−2.9
Left temporal artery	No	120/60	1.0	344	>99	7.39	36.0	−2.[illegible]

just distal to the origin of the left common carotid artery. This anatomic relationship made it necessary to clamp the left common carotid artery during surgical resection of the coarctation. To ensure adequate cerebral perfusion during this period, a technique was devised to maintain and monitor blood pressure and gases in the left cerebral arterial system.

REPORT OF A CASE

The patient was a healthy child, small for his age. He had no cardiovascular symptoms. Hypertension had been found on a routine physical examination at 2 years of age. The child was 15 cm tall and weighed 15.7 kg. The blood pressure in the right arm was 130/70 torr; in the left arm, 90/60 torr. The heart had a regular rhythm, with a rate of 86 beats/min; a grade IV/VI ejection systolic murmur could be heard along the upper left sternal border. A suprasternal thrill was found. The right radial pulse was stronger than the left. Femoral pulses were absent.

Cardiac catheterization and angiography (fig. 1) revealed a marked narrowing of the aorta just distal to the left carotid artery. The left subclavian artery did not appear on angiography until after opacification of the descending aorta. The innominate, right and left carotid arteries were in normal position. No right-to-left shunt was found. Roentgenograms of the chest showed notching of the ribs with extensive development of internal mammary and intercostal collateral vessels.

Premedication was atropine, 0.3 mg, meperidine, 20 mg, and phenobarbital, 30 mg, im. Induction with nitrous oxide–oxygen and halothane was uneventful. Intubation of the trachea was accomplished with a number 5.5 clear Portex endotracheal tube. A 16-gauge Jelco needle was placed in the left external jugular vein. The *right* radial and *left* temporal arteries were cannulated and the arterial catheters attached to two Statham strain-gauge transducers and displayed on an Electronics for Medicine recording device. These arterial pressures prior to the surgical incision were 110/50 torr.

Following surgical exposure of the aorta and its branches, via a left thoracotomy, test occlusion of the left carotid artery resulted in a decrease in left temporal arterial pressure (from 100 to 50 torr) while the right radial arterial systolic pressure remained 110 torr. Because of this decrease in perfusion pressure to the brain, a vasopressor drip containing 4 mg phenylephrine was initiated. This total amount was infused over a period of one hour and 45 minutes at the rate necessary to maintain the systolic pressure in the left temporal artery above 100 torr. The right radial arterial systolic pressure was increased to 150 torr by this maneuver. This differential between the left temporal and right radial arterial systolic pressures continued throughout the period of occlusion of the left common carotid artery and phenylephrine infusion. Blood-gas values in samples taken simultaneously from the left temporal and right radial arteries were within normal limits throughout the procedure, including the period of vascular occlusion (table 1).

At the completion of the surgical procedure, pressures in the graft, the left temporal artery, the right radial artery, and the descending thoracic aorta below the anastomosis were equal.

Following the operation, the patient was transferred to the intensive care unit in good condition. The postoperative course was uneventful.

Discussion

Though complete atresia at the site of coarctation was not diagnosed from the preoperative angiograms, its anatomic proximity to the left common carotid was apparent. Therefore, it was considered best to test-occlude the left common carotid artery and measure left temporal arterial pressure in an attempt to estimate cerebral perfusion through collateral vessels before proceeding with resection. The fall in blood pressure in the left temporal artery was severe, but blood pressure was easily elevated and maintained by the phenylephrine infusion. No ill effect such as reflex bradycardia or cardiac arrythmias occurred during the prolonged phenylephrine administration.

If temporal arterial pressure and blood-gas monitoring had indicated the cerebral perfusion was inadequate during occlusion of the left common carotid artery, hypothermia and cardiopulmonary bypass were alternative plans. An additional clinical tool that could have been utilized in the management of this case was electroencephalographic monitoring.

This case of surgical correction of coarctation of the aorta in close proximity to the left carotid artery with complete interruption of the aorta is presented to illustrate the usefulness of monitoring the left temporal arterial pressure[3] when perfusion to the brain might be compromised by occlusion of the left common carotid artery. Temporal arterial pressure monitoring gives an accurate, reliable index of both the pressure and oxygen tension of the blood perfusing the brain.

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Relationship of Right Bundle-branch Block and Marked Left Axis Deviation to Complete Heart Block during General Anesthesia

Sharon-Marie Rooney, M.D.,* Paul L. Goldiner, M.D.,† Elizabeth Muss, M.D.‡

In 1934 Wilson and associates[1] recognized the pattern of right bundle branch block (RBBB) and marked left axis deviation (MLAD) as an abnormality seen in many routine screening electrocardiograms (ECG). Subsequent investigations into this pattern, including those of Lasser in 1968[2] and Scanlon[3] in 1970, showed that extensive abnormalities of both the right and left bundle branches of the conducting system are responsible for this abnormal pattern. Much work has been done and much has been written about the clinical significance of this pathologic condition. Interest has centered on the incidence of complete heart block (CHB) in these individuals, with a particular view towards prophylactic placement of a demand pacemaker unit to avoid the extreme consequences of an episode of complete

* Associate Attending Anesthesiologist.
† Attending Anesthesiologist.
‡ Assistant Attending, Department of Medicine.
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