Use of Computed Axial Tomography to Diagnose Vascular Ring in an Infant

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Computed axial tomography was performed in an infant with severe respiratory distress. A right aortic arch and paratracheal density was visualized, suggesting a vascular ring. Angiography confirmed a right aortic arch, mirror-image branching, and a left patent ductus arteriosus.

VASCULAR abnormalities, foreign bodies, infections, papillomas, laryngomalacia, and neoplastic diseases have been recognized as causes of stridor in infants.[1] Noninvasive evaluation of acutely ill infants has been limited to the use of chest roentgenograms and barium esophography, followed by bronchoscopy, esophagoscopy, and angiography when vascular or mass lesions are suspected. Improved resolution and data acquisition times have recently permitted application of computed axial tomography (CAT) to the assessment of infants with suspected structural abnormalities of the mediastinum. The present report communicates our experience with CAT scanning in an infant whose vascular ring produced severe stridor.

Case Report

Our patient, the 4.3 kg product of a full-term gestation, was admitted to the hospital at 11 weeks of age with his second episode of respiratory distress and fever. The infant weighed 6.2 kg and had a temperature of 100.4°F, respiratory rate of 80 per minute, and a heart rate of 200 beats per minute. Supracostal retractions were noted, and on auscultation, bilateral wheezes and rales were evident. There was no cardiac murmur detectable. A chest roentgenogram (Fig. 1) indicated a right lower lobe infiltrate with anterior bowing of the trachea. The patient was treated for bacterial pneumonia. A barium swallow suggested bilateral esophageal compression. A CAT scan was

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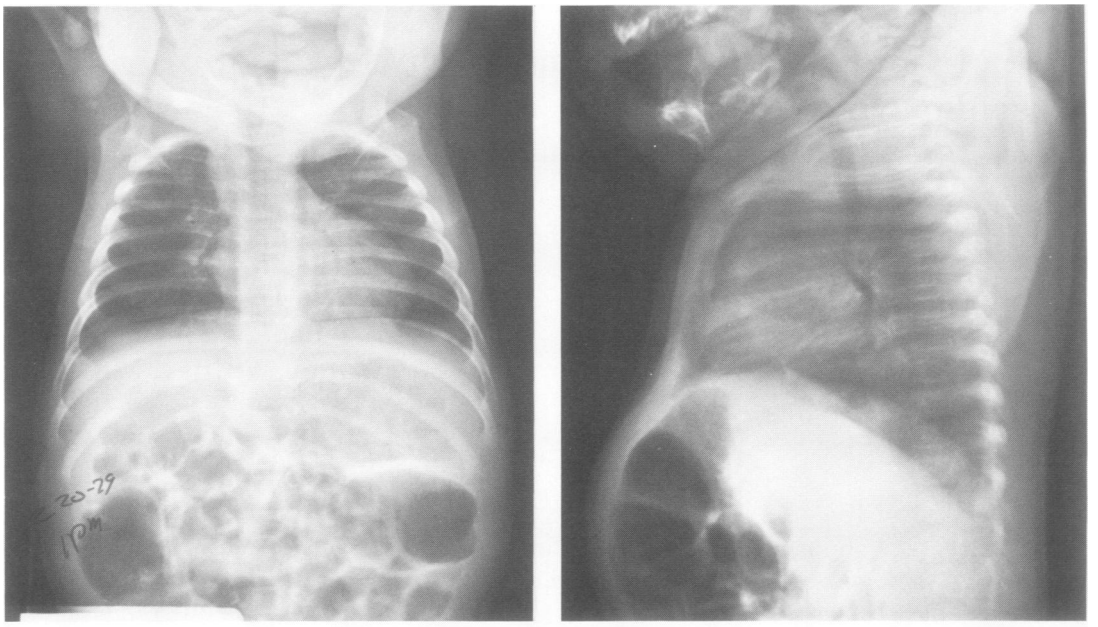

Fig. 1 (A and B) Posterior and lateral chest films show anterior bowing of the trachea in the lateral projection. The aortic arch and descending thoracic aorta cannot be identified.

performed on a Pfizer 450 scanner with a time of 5 seconds. Because of the patient's size, a head scan circle was used. Inability to suspend respiration detracted from the scan's quality. Magnification showed an abnormal density surrounding the trachea and esophagus and a right-sided descending aorta, compatible with a diagnosis of vascular ring (Fig. 2). Cardiac catheterization disclosed normal right and left heart pressures, with an oxygen step-up in the main pulmonary artery. A right aortic arch with mirror-image branching was seen on angiography. A small left patent ductus arteriosus connected a remnant of the left dorsal aortic root with the left pulmonary

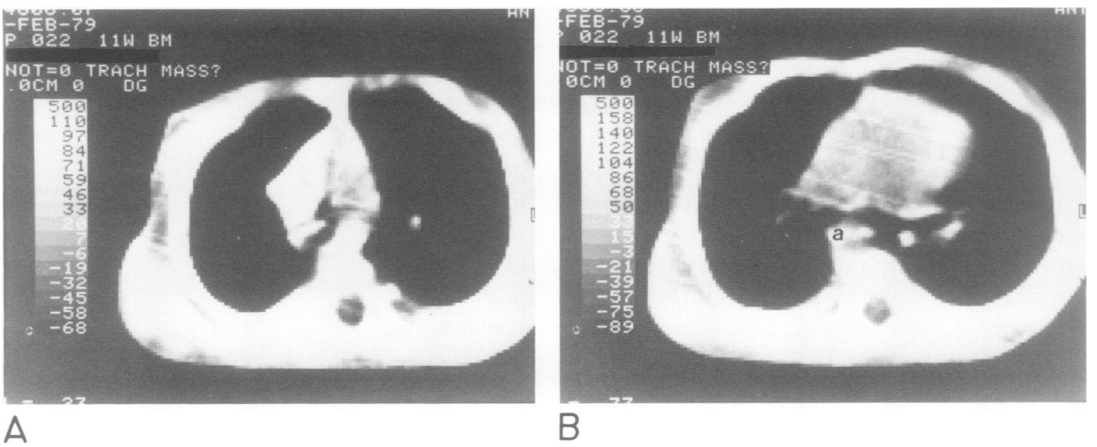

Fig. 2 (A) Computed axial tomography scan of the upper chest shows abnormal density surrounding the trachea. (B) Computed axial tomography scan at the carina shows a right-sided descending aorta. The soft tissue density with a right-sided aortic arch suggested a vascular ring, which was confirmed by angiography.
a = aorta

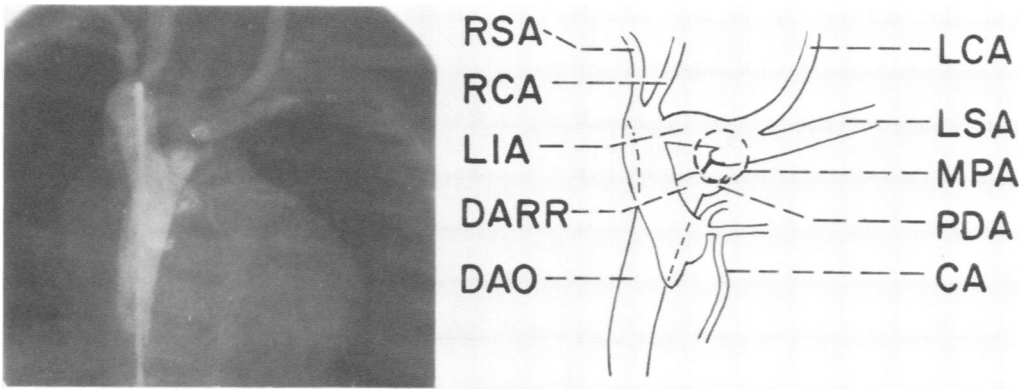

Fig. 3 Ascending aortogram in AP projection (left) and line diagram indicates a right aortic arch, mirror image branching, a left dorsal aortic root remnant, and left patent ductus arteriosus. Shown on the next frame is the "blush" of dye filling the MPA (drawn in).
RSA = right subclavian artery; LIA = left innominate artery; LCA = left carotid artery; MPA = main pulmonary artery; CA = coronary artery; RCA = right carotid artery; DARR = dorsal aortic root remnant; LSA = left subclavian artery; PDA = patent ductus arteriosus; DAO = descending aorta.

artery to form the vascular ring (Fig. 3). The above findings were confirmed at operation, and the patent ductus arteriosus and atresic left aortic arch connecting the remnant of the aortic root to the left subclavian artery were ligated and divided. The operation was successful, and the infant has remained asymptomatic after 1½ years of follow-up.

Discussion

Computed axial tomography (CAT) of the chest has been indicated for diagnosing occult pulmonary nodules, evaluating mediastinal and lung parenchyma, and investigating abnormalities of bone and muscle. Recently, the decrease in scan times and the improved resolution offered by current scanners have extended the indications to include evaluation of the major blood vessels.[2-5] In the case presented here, the history of episodic respiratory difficulty and abnormal plain chest radiography suggested the usefulness of a limited CAT scan to define the descent of the aortic arch and to establish the diagnosis of a right aortic arch. Preoperative angiography was undertaken to fully define the anomalous aortic arch and to permit planning of the surgical approach.

Right aortic arch with mirror image branching, as seen in this case, is an uncommon anomaly associated with intracardiac abnormalities, usually tetralogy of Fallot.[6,7] Thus, detailed cardiac evaluation and angiography are necessary to exclude major associated defects. Right aortic arch alone rarely causes symptoms, but a persisting remnant of the left aortic arch or left patent ductus arteriosus may form a vascular ring, causing tracheal and/or esophageal compression.

Infants with vascular compression of the airway may be subject to severe respiratory compromise. Computed axial tomography offers rapid, noninvasive assessment of the great vessels and helps to determine the necessity of further diagnostic and therapeutic intervention.

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