

## Case 10

# Sub-millisievert Assessment of Thoracic Vascular Ring in an Infant

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## History

A 13-day-old infant boy, born with Trisomy 21, presented with poor feeding, weight loss, and stridor. A post-natal echocardiography had shown a right-sided aortic arch and a diverticulum of Kommerell, suspicious for a vascular ring that may constrict the trachea and the esophagus. CTA was performed to evaluate the vascular anatomy, its relationship with the trachea and the patency of the airways.

the scan time for an infant chest CTA is less than half a second, rendering breath-hold unnecessary. Although not strictly necessary, the use of sedation may help ease the discomfort from intravenous catheter puncture and contrast injection and helps immobilize the patient during the scan. Vascular rings that constrict the trachea come in many forms. The most constrictive one is a double aortic arch.

In this case, the vascular ring formed by a right arch and a diverticulum of Kommerell is typically more relaxed and may not require treatment. The severity of symptoms in this patient ultimately drove the decision to surgically divide the ligamentum arteriosum, to translocate the left subclavian artery and the left vertebral artery to the left common carotid artery and to remove the diverticulum. ■

## Diagnosis

CTA confirmed a right-sided aortic arch and a diverticulum of Kommerell which form the right and posterior borders of a vascular ring (Figs. 1 and 2). The anterior border consisted of the ascending aorta, the right pulmonary artery and the pulmonary trunk. A ligamentum arteriosum, a remnant of the closed patent ductus arteriosus, connecting the pulmonary trunk to the diverticulum was depicted. This ligamentum itself was not visible on the CTA, due to the lack of contrast material; however its presence was suggested by the “beaks” at the pulmonary trunk and the diverticulum which marked the two ends of the ligament forming the left border of the vascular ring. The ring surrounded the trachea and the esophagus, however both structures were patent without any seen obstruction.

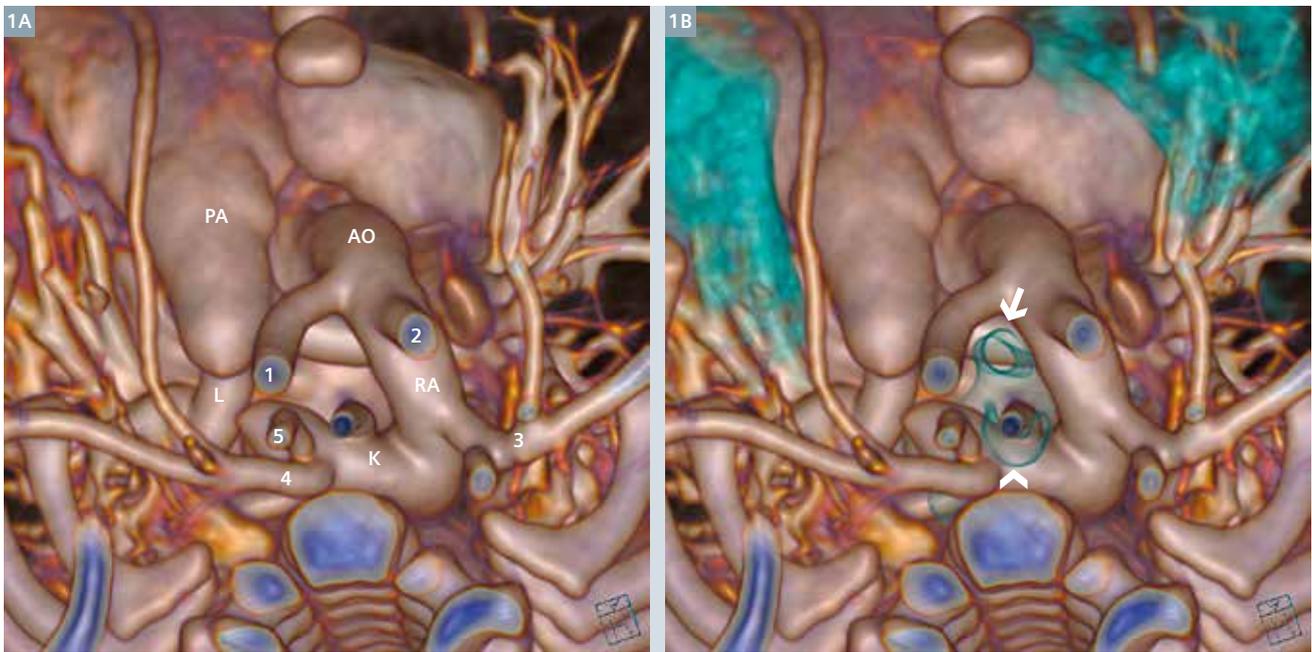
## Comments

The traditional imaging for vascular rings is a fluoroscopic esophagram, in which abnormal indentations in the barium column suggest compressing vascular structures. Today, the preferred imaging test to directly evaluate the airways and the vascular structures is CT angiography. Using Flash mode,

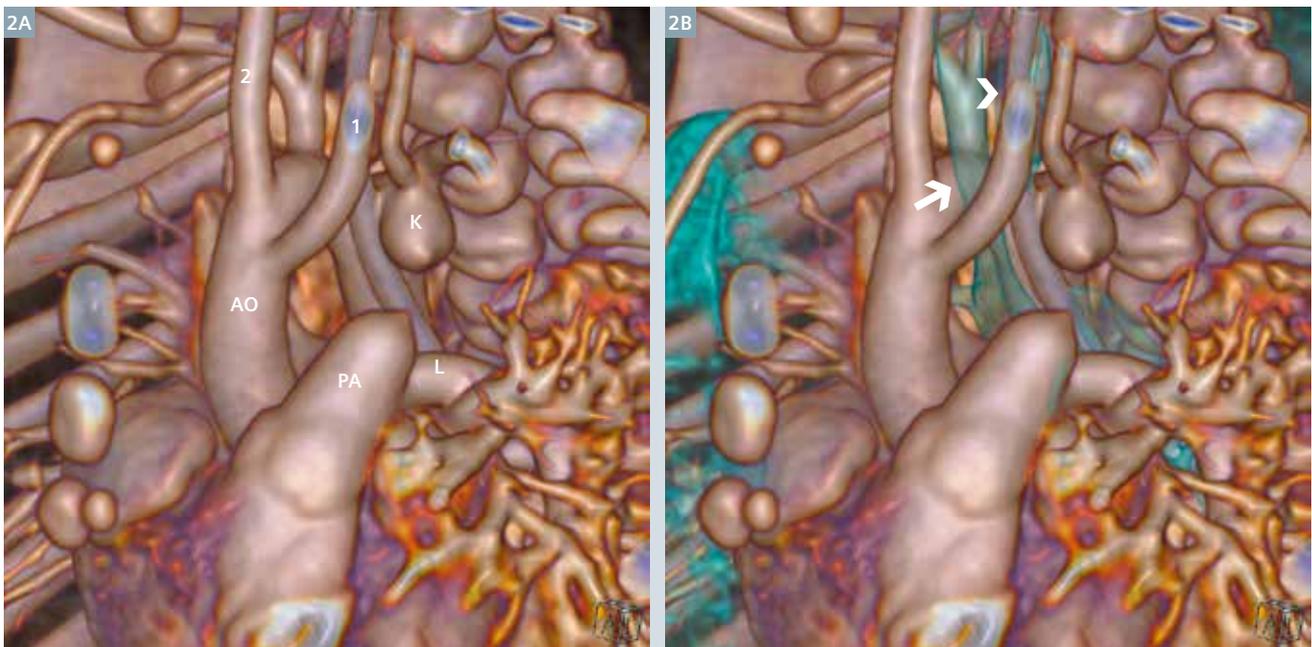
## Examination Protocol

Scanner	SOMATOM Definition Flash
Scan area	Thorax
Scan length	82 mm
Scan direction	Cranio-caudal
Scan time	0.2 s
Tube voltage	70 kV
Tube current	70 mAs
Dose modulation	CARE Dose4D
CTDI <sub>vol</sub>	0.68 mGy
DLP	10 mGy cm
Effective dose	0.94 mSv
Rotation time	0.28 s
Pitch	3
Slice collimation	128 × 0.6 mm
Slice width	1 mm
Reconstruction increment	0.5 mm
Reconstruction kernel	B26f
Heart rate	NA
<b>Contrast</b>	350 mg / mL
Volume	15 mL (60%) + 10 mL saline
Flow rate	1 mL/s
Start delay	Bolus tracking

The outcomes by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no “typical” hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.



- 1** Volume rendering images of the upper chest viewed from the top show the vascular structures (Fig. 1A) and the airways (Fig. 1B). A ring is formed around the trachea (arrow) and the esophagus (arrowhead). There is a feeding tube within the esophagus. The anterior border of the ring consists of the pulmonary trunk (PA), the right pulmonary artery (hidden), and the ascending aorta (AO). The right border consists of the right-sided aortic arch (RA); the posterior border consists of the diverticulum of Kommerell (K) and the left border consists of the left pulmonary artery (L) and the ligamentum arteriosum. The ligamentum arteriosum is invisible but its two ends are marked by the “beaks” from the pulmonary trunk and the diverticulum of Kommerell. The branch arteries to the neck are left common carotid artery (1), right common carotid artery (2), right subclavian artery (3), left subclavian artery (4), and left vertebral artery (5).



- 2** Volume rendering images of the upper chest viewed from the left-anterior position show the vascular structures (Fig. 2A) and the airways (Fig. 2B). The trachea (arrow) and the esophagus (arrowhead) are surrounded by various vascular structures explained in Fig. 1. Labels are the same as in Fig. 1. The invisible ligamentum arteriosum is suggested by the two “beaks” from the pulmonary trunk (PA) and the diverticulum of Kommerell (K).