Vascular rings: To scope or not to scope

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Central Message

VATS works well to divide the ligamentum in select patients with vascular rings, is rarely used for *patent* aortic arches, and is not used at all for complex causes of tracheoesophageal compression.

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The first series of patients with vascular rings who were successfully treated with video-assisted thoracoscopic (VATS) division was reported by Redmond Burke and colleagues in 1995.¹ The conclusion from that abstract was that “Video-assisted thoracoscopic techniques can be safely applied to pediatric patients with...vascular rings...” At the time of this publication, I suspect that many believed that 20 years later nearly all vascular ring operations would be performed with thoracoscopy. Now those 20 years have passed, and Herrin and colleagues² have updated the Boston Children's Hospital experience. In a 24-year period, 115 patients have received the VATS procedure for a vascular ring (5 patients/year). However, only 4 of those patients had VATS division of a *patent* aortic arch. Furthermore, the overall percentage of vascular ring patients undergoing VATS over this time period has actually gone down, not up (55% 1991-2005, 45% 2006-2015). It does not appear that VATS has “caught on” as the procedure of choice for patients with vascular rings. I believe there are 2 key factors that have precluded VATS becoming widely adapted for patients with vascular rings. The first revolves around the word “vascular” and its implications. The second is the use of advanced medical imaging that now precisely defines the actual multifactorial anatomic causes of tracheoesophageal compression from “vascular rings.”

The *true* patients with vascular rings are those with patent right and left (double) aortic arches. Surgical division of these patent arches can be treacherous because the arch is always under tension and the oversewn stumps retract when divided, often into the posterior (difficult to access) mediastinum. The known open thoracotomy surgical experience and the occasional anecdotal reports of catastrophic hemorrhage during attempted VATS division have discouraged surgeons from using VATS techniques for patent arches. The fact that the surgeons in Boston have used the thoracoscopic approach in only 4 patients with a patent arch in 25 years seems to corroborate this.

The second key element precluding widespread adoption of thoracoscopic techniques is the paradigm shift

in patient management based on the precise anatomic details now revealed by advanced medical imaging.³ With the spectacular detailed assessment provided by computed tomography and magnetic resonance imaging, we can now understand the importance of compression from not only a ring completed by a ligamentum but also other important structures in the mediastinum. These include a Kommerell diverticulum (which is an aneurysm-like *vascular* structure) and more complex vascular rings such as a circumflex aorta, in which the descending aorta itself is the cause of the tracheoesophageal compression. These patients are better served by open techniques that address all of the vascular compression locations, not just the ligamentum. In our experience, this requires in some instances resection of the Kommerell diverticulum with transfer of the left subclavian artery to the left carotid artery or in the case of the circumflex aorta an aortic uncrossing operation performed on cardiopulmonary bypass.^{4,5} Ligamentum division alone is not adequate to treat these patients.

The word “vascular” in “vascular rings” is an important descriptor. VATS, as shown by Herrin and colleagues² in the current study, certainly is a safe and effective method of dividing a ligamentum in patients with a right aortic arch. However, standard surgical techniques continue to be extremely important in the management of patients with *patent* double aortic arches and more complex vascular rings, with precise preoperative imaging charting the course for the most appropriate and complete surgical intervention.

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