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Operative anatomy of the arch

Ludwig K. von Segesser*

Department of Surgery, CHUV, Lausanne, Switzerland

* Corresponding author. Department of Surgery, CHUV, Rue du Bugnon 46, CH-1011 Lausanne, Switzerland. Tel: +41-21-3142279; e-mail: lk@segesser.com (L.K. von Segesser).

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OPERATIVE ANATOMY OF THE ARCH

Aneurysmal disease of the aorta carries the risk of an ongoing progression in the long term, and, thus, it comes as no surprise that the number of publications dealing with extended aortic aneurysm repair is increasing. In 2011, there have been, in the *European Journal of Cardio-Thoracic Surgery* alone, numerous reports on aortic aneurysm repair, including, among others the ascending aorta and root [1–4], the descending thoracic and thoraco-abdominal aorta [5–8], the arch in-between [9–12] and also more general issues [13–18].

Ascending aortic aneurysm repair is familiar to most cardiac surgeons from the aortic root to the proximal part of the aortic arch and the same holds true for the descending thoracic aorta, be it with or without the distal aortic arch. However, if the aortic arch is also diseased in between the proximal and the distal part, usually requiring total arch repair in addition to ascending and descending aortic cures, the battlefield may be somewhat less familiar to many of us.

In this issue, Hino *et al.* [19] report their experience with the extended replacement of the thoracic aorta, including a consecutive series of 29 patients with total arch replacement; out of whom about half had already undergone Bentall de Bono procedures, TEVAR and/or hemi-arch repair previously. This is indeed a complex group of patients. The preferred surgical approach of Hino *et al.* was a left postero-lateral thoracotomy with femoro-femoral cardiopulmonary bypass using additional venous drainage in six of 29 patients versus other drainage sites in 13 of 29 patients (right atrium and pulmonary artery) and additional arterial inflow in seven of 29 versus other sites in seven of 29 in moderate-to-deep hypothermia. Brain protection was realized with antegrade cerebral perfusion using balloon-tipped catheters from the inside of the aortic arch. The outcome in the series was outstanding with a 30-day mortality of two of 29 patients and a 5-year actuarial survival of 80.6 + 9.0% and freedom from subsequent aortic events of 96.0 + 3.9%. Only one patient suffered from reversible right forearm paralysis and one patient suffered from transient paraparesis. The authors do not report any transient or permanent brain nerve lesions although several, i.e. n. vagus, n. recurrens and n. phrenicus, are within the surgical field at various levels. Considering hard endpoints, like mortality and stroke, this aspect may seem to be a minor issue and, therefore, appears to be somewhat underreported in the current literature. Symptoms of laryngeal nerve fatigue either due to an overstretched recurrent nerve or a transsected one

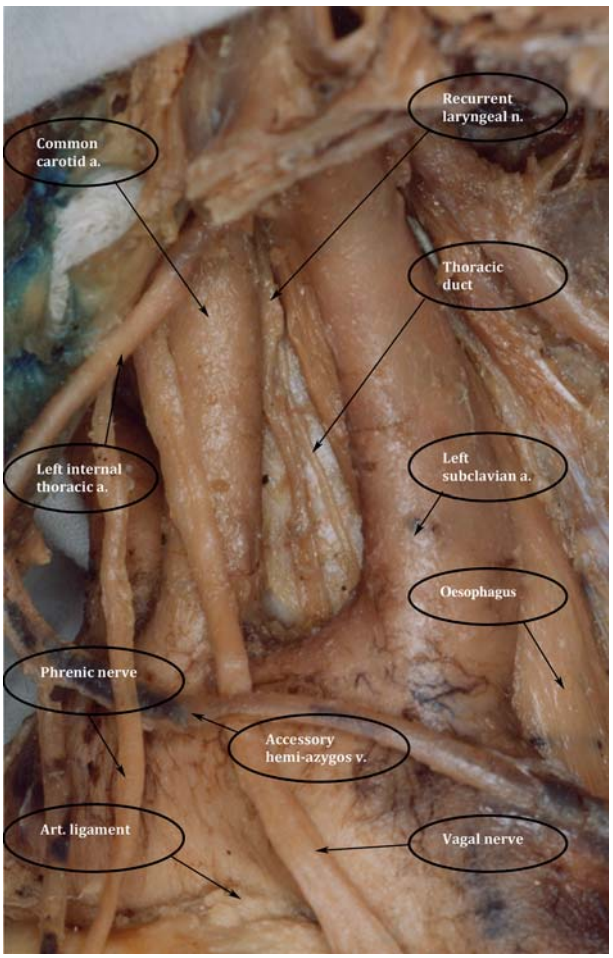

Figure 1: Operative anatomy of the arch seen from the left side with its interwoven noble structures which are to be preserved: courtesy of Berdajs and Turina [20].

can be handled quite well, by the injection of (re-absorbable or not) deposits for the medialization of the respective vocal cords; however, this is less the case for two. Postoperative problems can also be expected if one or both phrenic nerves are touched severely enough to require a breathing pacemaker and/or other adjuncts.

As a matter of fact, the aortic arch and its branches are still fairly simple structures from the inside, where there are three main orifices of the supra-aortic vessels and there are variations to be identified and reconnected. However, the outside of the aortic arch within the mediastinum and, more cranially, its effluents are in somewhat lesser known territory, where several noble structures are crossing that deserve to be identified and preserved whenever possible. It was recognized a long time ago that thorough knowledge of the anatomy and its variations is key to success in surgery. Fortunately, major efforts have been made in the past to study the surgical anatomy. Figure 1 displays the aortic arch seen from the left side. Its relationship with the nerves and other noble structures close by are just one example of the interwoven structures of the human body, where no empty space exists. More about the operative anatomy of the arch and how to get there can be found in a recent publication by Berdajs and Turina [20] with the self-descriptive title 'Operative Anatomy of the Heart'. This masterpiece with >1000 illustrations deserves to be visited prior to the next operative journey into known and less well-known territories.

Conflict of interest: none declared.

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