Azygous Vein Flap Is a Good Alternative for Bronchial Stump Reinforcement

To the Editor:

We read with great interest the case report by Wilson and colleagues [1] of a patient in whom the right inferior pole of the thymus was used to prevent bronchopleural fistula after upper lobectomy. Bronchopleural fistula is 1 of the most important causes of mortality after lung resections. The bronchial stump can be supported by various tissues such as intercostal and latissimus muscles, parietal pleura, diaphragm, pericardial fat pad, thymus, and azygous vein flap to prevent bronchopleural fistula.

An azygous vein flap is a good alternative for this purpose when other tissues are useless, especially after right upper lobectomy because the azygous vein is just above the right upper lobe bronchus, and its dissection and preparation is very easy [2].

The authors’ report has provided an important contribution to the literature about bronchial stump reinforcement. Although a thymic flap seems a good alternative for bronchial stump reinforcement after lobectomy, it usually has been used after pneumonectomy [3]. In this case, we think that an azygous vein flap is a better option than the thymic flap because its preparation is simpler, and the tissue closest to the upper lobe bronchus is the azygous vein. Furthermore, we have some concerns about whether this tissue is completely thymic tissue. Because thymic tissue is largely replaced by adipose tissue in elderly individuals, the bronchial stump may be supported by mediastinal adipose tissue rather than thymic tissue.

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Reply
To the Editor:

In response to the letter from Dr Altuntas and colleagues [1], we are grateful for their interest in our original article [2]. As they note, there are multiple alternatives for covering an at-risk bronchial stump. The correspondents seem to have a predilection for the use of an azygous vein flap, which was, in fact, mentioned in our article as another option. Indeed, the azygous vein flap has been one of many possible local mediastinal tissue coverage alternatives for the airway, as described previously in the thoracic surgical literature by Weisel and colleagues [3] and detailed by Anderson and Miller [4]. It has the advantage of proximity to the carina and right mainstem bronchus. In contradistinction to the thymic flap described in our report, the azygous vein flap is ligated proximally and distally and therefore receives, like its parietal pleural alternative, its blood supply more diffusely and nonspecifically. Its further limitation is that, often in extensive resections around the carina, the azygous vein has already been sacrificed as part of the index resection. Our original article was not meant to promote one option over another but rather to present, in a well-documented fashion, the viability and technical considerations that are important when the pedicled thymic flap is used as an alternative. The ultimate decision of which coverage option to use will depend on the particular clinical characteristics of the patient, the specific details of the operative field, and the surgeon’s judgment and technical abilities.

In further response to our colleagues, we can reassure them that the flap used for covering the bronchial stump in the reported case was indeed the right lower pole of the thymus gland. The persistently substantial thymus gland, supplied by its native vascular pedicle, as demonstrated in the figure accompanying our report, was in this situation our best option for effective bronchial stump coverage. As an update, the patient described remains healthy, without evidence of local tumor recurrence, distant metastasis, or bronchopleural fistula at a recent 24-month follow-up examination.

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To the Editor:

We read with great interest the article by Boezeman and colleagues [1] regarding regional spinal cord (SC) surveillance by near-infrared spectroscopy (NIRS) during thoracoabdominal aortic aneurysm (TAAA) repair. Although the feasibility of SC surveillance with the use of NIRS technology during TAAA repair has been demonstrated previously [2], the authors are to be congratulated for demonstrating a potential association of NIRS measurements and motor-evoked potentials in 15 patients. To detect potential SC ischemia, the authors placed their NIRS optodes directly above the vertebral and distally to the spine processes to avoid erroneous measurement of underlying bone...
However, this method may have relevant clinical limitations because of (1) the limited light penetration depth of conventional NIRS optodes (approximately 12 to 20 mm), (2) an undefined “optically interrogated region” for the SC, and (3) a reduced/punctiform surveillance by “direct” spinal NIRS (above the respective vertebra) [1, 3].

Previous analyses by magnetic resonance imaging have reported skin-to-epidural space distances of at least 47 mm at the thoracic level and 27 to 80 mm at the lumbar level [4, 5]. Therefore, direct spinal NIRS as reported by Boezeman and colleagues [1] most likely detects tissue oxygenation levels of extraspinal tissues (e.g., skin, bone, ligaments, and body fat). The authors suggest that accidentally measured extraspinal structures are perfused by the collateral network to underline their method. However, given that this region is likely to be less vascularized, we believe that it is much more prone to error compared with the rich paraspinal muscle vasculature [2].

The paravertebral muscles—directly supplied via the collateral network (overarching cervical, thoracic, and lumbar levels)—allow for more accurate detection of potential SC ischemia during TAAA repair by NIRS because of the reduced skin-to-muscle distance of (usually) less than 20 mm and the dense arteriolar network connecting directly to the intrathecal SC arteries [2]. Also, the longitudinal collateral network interconnections may indicate spinal ischemia more cranially or caudally to the paravertebrally positioned NIRS.

Boezeman and colleagues conclude that NIRS with optodes positioned directly above the vertebral column represents a “reliable noninvasive means for continuous surveillance of SC oxygenation.” By using conventional NIRS optodes (light penetration 12 to 20 mm) and the reasons discussed earlier, we believe that this statement does not accurately convey the underlying concept.

In our opinion, SC surveillance using conventional NIRS optodes represents a currently clinically readily available indirect monitoring modality [2, 3] and may be more reliably performed above the paravertebral muscles, rather than the spinal column itself.

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Reply
To the Editor:

We thank Dr Luehr and colleagues [1] for their valuable comments on our manuscript regarding oxygenation monitoring with near-infrared spectroscopy (NIRS) of the spinal cord region during and after thoracoabdominal aortic aneurysm (TAAA) reconstructions [2].

The arterial network of paraspinal muscles is extensively collateralized with the one of the spinal cord [3]. Therefore, it is a good suggestion of Luehr and coworkers [1, 4] to measure oxygenation of paraspinal muscles with NIRS at both sides of the vertebral column to obtain indirect information regarding oxygenation of the spinal cord. However, this type of optode positioning might have a technical limitation. The light detector of each NIRS optode might receive light not only from its own light source but also from the NIRS optode that is placed at the contralateral side of the vertebral column.

In our study, NIRS optodes were placed over the vertebrae instead of the paravertebral muscles. We do not claim that this type of optode positioning enables direct monitoring of oxygenation of the spinal cord, as stated by Luehr and coworkers [1]. In some patients NIRS does not measure neurologic tissue at all, hence, it would not be appropriate to use the terms direct and oxygenation of the spinal cord. Therefore, we have used the term oxygenation of the spinal cord region throughout the manuscript. The term oxygenation of the spinal cord region used in this manuscript reflects the oxygenation of the spinal cord or its surrounding tissue.

Similar to our study [2], other researchers have placed NIRS optodes over the vertebrae to measure the oxygenation of the spinal cord region, all with promising results [5–7]. In porcine models, Macnab and coworkers [5] and LeMaire and coworkers [6] both showed that surgically induced changes in oxygenation and blood flow to the spinal cord were detected immediately by NIRS optodes. Badner and colleagues [7] described a patient who exhibited paraplegia after TAAA repair with a significant intraoperative decrease in oxygenation at levels T8 through T10 (from 80% to 30%) measured with NIRS.

So far, both options of NIRS optode positioning seem promising to detect spinal cord ischemia in patients undergoing TAAA repair. However, larger NIRS studies with a significant number of patients with spinal cord ischemia are needed (1) to assess whether NIRS could play a clinical role in the detection of spinal cord ischemia during and after TAAA repair and (2) to examine the best option for optode positioning. Another challenge, which involves both options of optode positioning, is to make a correction for differences in thickness of overlaying subcutaneous adipose tissue between patients because adipose tissue might obscure NIRS curves during spinal cord ischemia.

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