Editorial

Anatomic variations for right sided lobectomies

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Although lobectomy remains the "gold standard" for resectable non-small cell lung cancer, the technical challenges to this operation rely on a sound knowledge of arterial and bronchial anatomy, as well as their variations. One study of 140 patients undergoing thoracic anatomic resections found abnormalities of vasculature in 23 patients, contributing to an observed frequency of 16.4% (1). In 1986, a separate radiographic study in 107 right and 113 left lower lobes (2) demonstrated variation of segmental venous tributaries of the inferior pulmonary vein in as many as 20% of cases. We wish to congratulate the authors for their intricate and detailed description of right upper, middle and lower lobectomies. We applaud their attention to anatomic detail and would highlight the following points.

In accordance with the National Comprehensive Cancer Network (NCCN) guidelines, it is our standard practice to obtain bronchoscopy, either pre-operatively in conjunction with endobronchial ultrasound for staging the mediastinum, or at the time of resection. This serves the purpose of (I) clearing secretions to better facilitate single lung ventilation for the duration of the operation; (II) re-confirm surgical margins for large, central tumors; (III) determine variation in bronchoscopic anatomy which may be of utmost importance in more complex segmentectomy and sleeve resections.

Similar to Bertolaccini *et al.* (3), we dissect the inferior pulmonary ligament to the level of the vein and identify the lymph node located within this bed. We often do this first to facilitate mobility of the lung and to identify the lower vein as a separate entity from the superior pulmonary vein, given that common pulmonary venous trunks have been identified in the literature (2). We then agree with the described technique to open the anterior mediastinal pleura and dissect station 10R, as this facilitates periadventitial dissection around the pulmonary artery, preserving the right middle lobe vein. Especially for VATS (video assisted thoracoscopic surgery), we often isolate and divide the superior pulmonary vein first, as this allows the surgeon to visualize the inferior border of the truncus anterior branch. We have sometimes used the chest tube site to insert the stapler and provide a safe angle for vessel ligation. The dissection of the posterior ascending artery can be from an anterior approach by skeletonizing distally along the main pulmonary artery, fissure approach with identification of the right middle lobe artery, or retrograde approach with identification of the bronchus, all of which are well described by the authors. Some studies have reported that a totally anterior, fissure less technique may reduce the duration of air leak and reduce hospital costs (4).

For middle and lower lobe resections, we agree with Bertolaccini *et al.* (3) that the right middle lobe vein can potentially branch off the inferior pulmonary vein, therefore dissection of the inferior and superior pulmonary vein should be performed to ensure appropriate anatomy is preserved. Second, the right middle lobe may branch directly off the main pulmonary artery or from a lower lobe segment (1,5). Inadequate dissection in this case may potentially lead to inadvertent stapling of the middle lobe artery when unintended. The medial and lateral branches of the right middle lobe and in others, a common trunk may arise and branch very distally. Uncommonly, three separate trunks are seen as a third pulmonary artery branch to the right middle lobe (6,7).

In cases of aberrant anatomy and difficult dissection,

intraoperative bronchoscopic guidance can be used to guide dissection. This is often routinely in minimally-invasive operations where clamping the bronchus in question and insufflating the lung can preclude the surgeon's view. 3D and 5D modeling technology can also be used to pre-operatively navigate cases of anomalous arterial branching (8,9).

Lastly, we would add that in the current era of thoracic surgeries, many of these operations have changed. Lobectomies are being performed via a minimally invasive route, either thoracoscopic or robotic. Despite lack of a large, multi-institutional randomized controlled trial, multiple meta analyses have demonstrated safety and similar oncologic outcomes with a reduced length of stay (10). A national query of the Society of Thoracic Surgeons database, thoracotomy in patients with poor lung function independently predicted pulmonary complications (11). In addition, doing less than a lobectomy may no longer be considered a compromise, and in certain patients with borderline function or small nodules less than 2cm, sublobar resections may be appropriate (12). As thoracic surgery evolves with available technology, so must the surgeon; however, the standard open lobectomy should remain a valuable tool in every thoracic surgeon's armamentarium.

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