Thoracoscopic anterior segmentectomy of the right upper lobe (S3)

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Abstract: S3 segmentectomy is a challenging procedure for three reasons: the anatomy of vascular elements is complex, the segment is comprised between S1 and the middle lobe, and the minor fissure is most often fused. The key for accessing the bronchovascular pedicle is two-fold: (I) achieving a sufficient exposure of the bronchial trifurcation and (II) opening of the minor fissure between S3 and the middle lobe. Once done, this maneuver helps exposing the vessels and greatly eases the procedure.

Keywords: Sublobar resection; segmentectomy; video-assisted thoracic surgery (VATS)

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S3 segmentectomy can be indicated for solitary metastases, cT1a non-small cell lung carcinomas and ground glass opacities (Figure 1). At first sight, it looks as a challenging procedure as the anatomy of vascular elements is complex, the segment is comprised between S1 and the middle lobe and, in addition, the minor fissure is most often fused. A sufficient exposure of the bronchial trifurcation must be achieved. Creating a tunnel between S3 and the middle lobe greatly eases dissection of the vessels.

Anatomical landmarks

Bronchi

B3 is the anterior branch of the upper bronchus. In 14% of the cases, it is independent from the apicoposterior truncus (B1+B2), and in 40% of the cases it is a branch of a trifurcation B1-B2-B3 (1). It is usually easily recognized by its anterior direction, while B1 and B2 have a cephalad direction. Lymph nodes are frequently found at the origin of B3. Even for benign conditions, removal of these nodes is required for an optimal disclosure of the B3 root.

Arteries

A3 is the lowermost branch of the truncus anterior. In 48% of the cases, S3 receives its 2 branches (A3a and A3b) from the truncus anterior (TA). In the other cases, there is also an ascending A1 artery from the arterial truncus intermedius (TI) which raises close to the ascending A2 and is recognized from its anterior direction (Figure 2).

Veins

Variations of the venous pattern are numerous (2). There are two types of veins: (I) a large V3 that is the lowermost branch of the central vein and (II) 1 or 2 small ascending veins branching from the central vein that are easily recognized as they come directly from the anterior segment (Figure 3).

Technique

We used a fissure-based technique and multiple ports access, as described by our team (3) and by others (4). The anterior portion of the major fissure, between S3 and the middle lobe is usually fused, or even inexistant. First opening of this fissure is the key for an easy vascular dissection. When incomplete, the fissure can be opened by a tunnel technique, as follows:

The fissure is opened at the junction of the transverse and oblique fissures as for an apicoposterior segmentectomy.
Once Asc.A²—and Asc.A¹ if present—is identified, the edge of the middle lobe is lifted up and a path is created with a blunt tip dissector and/or an endo-peanut, keeping close to the vessels (Figure 4). The course is pursued in an anterior direction (Figure 5). The upper and middle lobes are then retracted backward to expose the upper vein in a usual manner, so that the middle lobe vein and V³ are clearly seen. In a second step, the hilum is exposed and a path is done with a dissector between the venous branches and an endo-peanut permits dissection in a posterior direction.

The instrument is gently manoeuvred and pushed so that it meets up with the already dissected posterior opening of the fissure. A curved tip 60 mm endostapler can then be inserted in the tunnel and fired. The middle lobe and
Figure 6 Creating a tunnel for separation of S\(^3\) from the middle lobe in a patient with a thin minor fissure (5).
Available online: http://www.asvide.com/article/view/26799

Figure 7 Creating a tunnel for separation of S\(^3\) from the middle lobe in a patient with a thick minor fissure (6).
Available online: http://www.asvide.com/article/view/26801

Figure 8 Opening of the posterior part of the major fissure for better exposure of the segmental bronchi (7).
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S\(^3\) are now separated, giving access to the vessels. Figure 6 illustrates a rather straightforward case with a thin and short fissure (Figure 6) and Figure 7 demonstrates a more difficult case with a thick and long fissure (Figure 7).

Control of the B\(^3\) bronchus requires a large exposure of the upper lobe bronchus so that a sufficient retraction of the segmental bronchi can be exerted. The posterior aspect of the fissure is opened as for an upper lobectomy, in order to expose the ascending A\(^2\) (Asc.A\(^2\)) and the bronchus (Figure 8). Once these two elements have been dissected, both are looped (Figure 9). The upper lobe bronchus is then retracted backward and the Asc.A\(^2\) forward, thus exposing B\(^3\). Lymph nodes are frequently present at the origin of B\(^3\) (Figure 10) (1,3). They are dissected and removed (Figure 11). If the patient is operated on for a malignant disease, these nodes are sent for frozen section. If positive, the procedure should be transformed into a lobectomy (8). B\(^3\) is dissected, taped and then stapled (Figures 12,13). In some patients, even after
an extensive dissection, the space is very limited and does not permit passage of a stapler, even with a curved tip. In these cases, B³ must be cut with a scalpel blade and its stump sutured (Figures 14, 15).

The large central vein runs in an anteroposterior direction. The two most anterior tributaries, V³a and V³b, drain S³. These are clipped and dissection of the central vein and V³ is pursued (Figure 16).

Dissection of the veins helps exposing A³ artery whose 2 branches are dissected (Figure 17) and then clipped or
As the fissure has already been opened at the beginning of the procedure, S\textsubscript{3} is now fully mobile and the intersegmental plane S\textsubscript{2}–S\textsubscript{3} can be divided, according to the predetermined demarcation line, whatever the method used. We favor near-infrared imaging with systemic injection of indocyanine green (12). The stump of B\textsubscript{3} is gently pushed away using blunt dissection, so that it cannot be caught into the staple line. A large clamp is applied on the intersegmental plane to compress the parenchyma and ease application of the stapler (Figures 18,19). The viability of the remaining segments 1 and 2 is checked by reventilation (Figure 20).

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None.

Footnote

Conflicts of Interest: D Gossot is consultant for an instrument manufacturer (Delacroix Chevalier). The other authors have no conflicts of interest to declare.

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