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Uniportal Left S1+2 Segmentectomy

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Abstract

The left upper lobe is one of the largest lobes of the lung; left upper segmentectomy is well established among thoracic surgeons. In uniportal left S1+2 segmentectomy, dissection of the vasculature, bronchus, and intersegmental plane can be performed anteriorly. Given that the fissureless technique is commonly used in uniportal video-assisted thoracoscopic surgery, S1+2 segmentectomy exhibits high affinity with the unidirectional approach. We have frequently performed left S1+2 segmentectomy for early non-small cell lung cancer located in the apical segment, since this procedure has the potential to preserve pulmonary function over tri-segmentectomy. Herein, we introduce our approach to uniportal left S1+2 segmentectomy as a minimally invasive alternative for preserving lung function.

Introduction

With the global trend towards minimally invasive surgery, the uniportal approach has gained popularity among general thoracic surgeons. Although only one incision is involved with limited procedure, increasing evidence has suggested that the uniportal approach yields surgical and oncological outcomes comparable to those of other approaches [1, 2]. Lung function-sparing surgeries such as segmentectomy are also gaining popularity as minimally invasive approaches. Recent randomized trials have revealed that segmentectomy is a viable alternative to lobectomy as a standard treatment for small-sized non-small cell lung cancer [3]. Thus, a combination of the uniportal approach and segmentectomy may prove to be the ultimate minimally invasive approach, and warrants interest from thoracic surgeons.

The left upper lobe is one of the largest lobes in the lungs, and its segmentectomy is well established. In cases where a tumor is located in the apex of the left upper lobe and the tumor margin is secured, S1+2 segmentectomy is highly recommended over upper division segmentectomy. Our previous study also suggested that S1+2 segmentectomy preserved pulmonary function better than upper division segmentectomy [4]. In this report, we describe a surgical technique for uniportal S1+2 segmentectomy based on our experience and expertise.

Technique

A 3-cm utility port was created in the 5th intercostal space posterior to the anterior axillary line. Representative images and procedures for thoracoscopic left S1+2 segmentectomy are shown in Fig. 1 and Video 1. First, by retracting the lung with a thoracoscopic grasper, the segmental vein (V1+2) was exposed and detached toward the periphery, enabling the identification of V1+2a,

which is the border between S3c and S1+2a. Once the ventral intersegmental plane between S1+2 and S3 was identified, V1+2 was dissected using a stapler at the root. The main trunk of the pulmonary artery (PA) was then denuded while identifying the branches from the PA. When the major cranial fissure was separated, the pulmonary arterial branch was exposed and dissected from the interlobar side. Note that if the major cranial fissure is incomplete, the pulmonary artery and bronchus can be exposed and dissected anteriorly without diving fissure incompleteness. After ligation of the segmental artery (A1+2), we then identified the accurate bifurcation of B1+2/B3 behind the stump of the PA branches and detached the bronchus to allow dissection with a stapler. Generally, we identify and remove the hilar lymph nodes around B1+2 using the grasping technique, whereby the surgeon holds a grasping forceps instead of a curved suction tube; the grasping forceps allows the surgeon to grasp the lymph node membrane easily (Fig 2). We occasionally dissected the bronchus (B1+2) after lung inflation on the operating side to check for inflation of the remaining lobe. Regarding the dissection of the bronchus, the 'suction-guided stapling technique' was used [5]. The inserted curved body provided space for the stapler to be inserted safely. This procedure prevented injury to the pulmonary artery behind the bronchus to be dissected. Besides cutting the intersegmental plane along the intersegmental veins and inflation-deflation line, the systemic injection of indocyanine green (0.3 mg/kg) helped to identify the demarcation line in some cases. The pulmonary parenchyma was dissected from the anterior towards the posterior with a stapling device in a line, ensuring that the surgical margin from the tumor was sufficiently secured. Since uniportal video-assisted thoracoscopic surgery provides a single angle, the lung was moved so that the mechanical stapling line corresponded to the thoracoscopic angle. In particular, the mechanical stapling line should be in a straight line to

minimize the number of junctional points, which helps to avoid postoperative fistula of the bronchioles. After the removal of the resected S1+2, we performed pneumostasis using thin-type (0.15 mm) polyglycolic acid mesh (Neoveil; Gunze, Osaka, Japan) and fibrin glue (Beriplast; CSL Behring, Tokyo, Japan) after lung resection to prevent air leakage.

In total, three patients underwent uniportal left S1+2 segmentectomy. The average operation time was 202 min, and the blood loss volume was 22 mL. The postoperative course was uneventful in all patients.

We obtained written informed consent for use of data for research purposes from all patients. In addition, the institutional review board approved this study on the condition that an "opt out" consent approach was implemented via the website as an alternative to acquisition of informed consent from each patient.

Comment

Herein, we described our approach to uniportal left S1+2 segmentectomy. Fissureless techniques have been commonly used via a uniportal approach. In particular, regardless of separation of the minor fissure, fissureless uniportal lobectomy has been performed in the right upper lobe. Likewise, this approach is also applied to left S1+2 segmentectomy because unidirectional dissection of the vasculature, bronchus, and inter segmental plane is easily performed from the anterior angle. Thus, S1+2 segmentectomy is well suited to the uniportal approach. In addition, from a technical viewpoint, S1+2 segmentectomy could avoid the dissection of A3, which may cause catastrophic bleeding. To our knowledge, this is the first report to describe the detailed procedures and recommendations for uniportal left S1+2 segmentectomy.

S1+2 segmentectomy has a functional advantage over trisegmentectomy and left upper lobectomy. The anatomy of the left upper division (S1+2+3) is similar to that of the right upper lobe, and it has been reported that deviation of the right middle lobar bronchus affects the mechanism of pulmonary aeration after right upper lobectomy [6]. The same is true for the remaining lobe after removal of the tri-segments. Left S1+2 segmentectomy could avoid this upward displacement of the residual lobe, eventually leading to the preservation of more pulmonary function than expected preoperatively, as compared to tri-segmentectomy.

Left S1+2 segmentectomy is anatomically similar to tri-segmentectomy or lingulectomy; all these procedures split the left upper lobe, creating one linear intersegmental plane. Several reports have demonstrated that split-lobectomy approaches such as tri-segmentectomy and lingulectomy yield equivalent oncological clearance to that obtained by left upper lobectomy [7, 8]. Along with tri-segmentectomy, S1+2 segmentectomy could be an alternative to left upper lobectomy in early non-small-cell lung cancer located in the apical segment.

In summary, in the era of minimally invasive surgery, left S1+2 segmentectomy exhibits high affinity with the uniportal approach. This procedure enables surgeons to treat apically located early NSCLC safely, while offering comparable oncological curability and preserving lung function compared to tri-segmentectomy.

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Conflict of Interest:

Authors declare no conflict of interest.

Figure legends

Fig. 1 The procedure of uniportal left S1+2 segmentectomy

(A) The intersegmental vein is identified and exposed, and detached toward the periphery.

(B) The pulmonary arterial branches to S1+2 are exposed and dissected from the anterior side.

(C) B1+2 is dissected by the stapler using the 'suction-guided stapling technique'.

(D) The operative view after left S+2 segmentectomy. V1+2d※, which runs between S1+2c and S3a, can be identified.

Fig. 2

A grasping forceps with a 45° curved tip (VALVE XS DeBakey forceps; Aesculap AG, Tuttlingen, Germany) is used to dissect the hilar lymph nodes.

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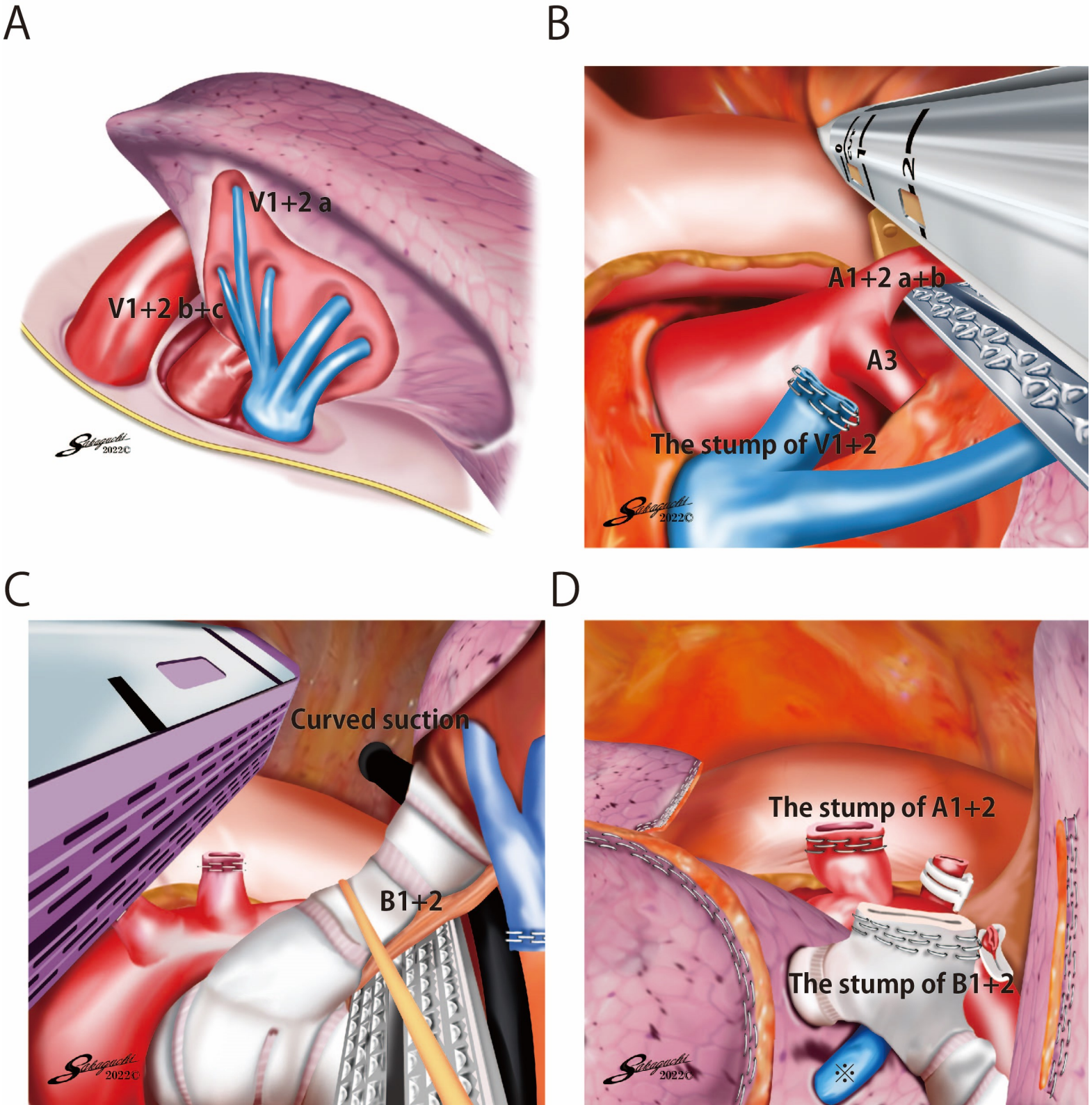
A
V1+2 a
V1+2 b+c
B
A1+2 a+b
A3
The stump of V1+2
C
Curved suction
B1+2
D
The stump of A1+2
The stump of B1+2