How to clamp the main pulmonary artery during video-assisted thoracoscopic surgery lobectomy

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Abstract

We sometimes run across difficulty in dissection of the pulmonary arteries due to dense pleural adhesions and bleeding from the pulmonary artery during the video-assisted thoracoscopic surgery (VATS) lobectomy. In these cases, conversion of the VATS approach to open thoracotomy is a requisite. The presence of an easy and safe technique for pulmonary artery clamping will make the switch of the surgical procedure unnecessary. We developed the new technique for pulmonary artery clamping using 1-0 silk suture. This may become one of the standard techniques for pulmonary artery clamping not only in VATS but also in open thoracotomy, as well.

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1. Introduction

Video-assisted thoracoscopic surgery (VATS) lobectomy is gradually adopted for the management of clinical stage I lung cancer or central pulmonary nodules [1]. The long-term outcome after VATS lobectomy for stage I lung cancer is similar to that after lobectomy by open thoracotomy [2–4]. However, it is very difficult to control sudden bleeding from the pulmonary artery, which may sometimes cause catastrophic condition if the pressure hemostasis is ineffective [5] and the bleeding point is close to the pulmonary artery trunk. Most general thoracic surgeons, when there is uncontrolled sudden bleeding in the patient or a risk of sudden bleeding because of severe adhesions between the pulmonary artery and tissues surrounding it (especially the hilar nodes), opt to convert VATS approach to open thoracotomy. We have performed 402 VATS lobectomies with mediastinal node dissection for stage I lung cancer since 1997 and have undergone 17 (4.2%) conversions of the approach to open thoracotomy due to bleeding (n = 13), adhesion (n = 3), and intraoperative cardiac event (n = 1). We have performed pulmonary artery dissection under a suture clamp of the main pulmonary artery when it is difficult to dissect the pulmonary arteries since 2003. This technique reduces intraoperative bleeding and may extend the inclusion criteria of VATS lobectomy.

2. Technique

General anesthesia with selective lung ventilation was performed by the use of a double lumen endotracheal tube. The patients were placed in a decubitus position on the operating table. Two thoracoports (1.5–2.0 cm) were placed in the sixth or seventh intercostal space (ICS) on the anterior axillary line and seventh or eighth ICS on the posterior axillary line. An anterolateral mini-thoracotomy (3–6 cm, average 5 cm) was made in the fourth ICS for an upper lobectomy or in the fifth ICS for a middle or lower lobectomy. Pulmonary vessel management was performed by using forceps or scissors for conventional surgery. These vessels were divided following double ligation with a silk suture or clipping at the proximal and distal portions without the use of end stapler devices. In upper or middle lobectomy, the main pulmonary artery and intermediate pulmonary artery were exposed and isolated at the proximal level of a first pulmonary artery branch and at the proximal level of a superior segmental artery of the lower lobe, respectively. In lower lobectomy, the main pulmonary artery was exposed and isolated at the same level as in upper or middle lobectomy.

We placed a 1-0 silk suture around the main pulmonary artery twice in order to clamp the main pulmonary artery. Another 1-0 silk suture was threaded through the circle and traction was applied in order to release the suture clamp easily when the pulmonary artery clamp became unnecessary (Fig. 1). The suture for the pulmonary artery clamp was gently retracted bidirectionally toward orthogonal direction of the pulmonary artery stream and the bilateral edges of the...
Suture were pulled out of the thoracic cavity and fixed to the chest wall after confirming the disappearance of the pulmonary artery pulsation (Fig. 2, Video 1).

In each upper (middle) lobectomy, the upper pulmonary vein was clamped using the same technique or dissected immediately before clamping of the pulmonary artery. On the other hand, in each lower lobectomy, the upper and lower pulmonary veins were simultaneously clamped. We seldom use systemic heparinization if the clamp time is 10 min or less. Pulmonary arteries were dissected and ligated (or sewed up) during the clamping. Pulmonary angiorrhaphy is performed if it is difficult to expose and isolate the pulmonary artery branches at the origin level. The suture clamp was then released by the traction of the suture after completion of the pulmonary artery dissection (Video 2).

3. Comment

Patients with lung cancer sometimes have a history of pulmonary tuberculosis or a concomitant disease of pneumoconiosis. Usually, severe adhesions between the pulmonary artery and surrounding tissues can be found in these patients. VATS lobectomy for patients with severe adhesions or intraoperative bleeding is very risky because controlling the sudden bleeding by VATS can be a surgical crisis. On such cases, VATS approach is converted to open thoracotomy because of the lack of adequate device or technique for pulmonary artery clamping during VATS lobectomy. What is the adequate device or technique? We think that it should not disturb thoracoscopic view and additional incision in order to clamp the artery would not be needed. Furthermore, it is better unless the device or technique requires any technical or financial cost. Considering these points, our technique is very adequate because most general thoracic surgeons have experiences of main pulmonary artery ligation during pneumonectomy without developing pulmonary artery injury. Moreover, silk sutures do not disturb thoracoscopic view and are inexpensive. On the other hand, suture clamp might induce injury on the intima of the pulmonary artery because of excessive clamping force. Although we did not perform anticoagulant therapy after operation, in our series of nine patients who underwent suture pulmonary artery clamping, chest computed tomography on the 3rd or 6th postoperative month showed no pulmonary artery stenosis, aneurysmal formation, or pulmonary thromboembolism. The suture clamp does not cause at least any critical injury of the pulmonary artery. Hence, we recommend the technique for the patients with difficulty on pulmonary artery dissection during VATS lobectomy.

References


Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ejcts.2006.10.017.