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Thoracoscopic Surgery using a Silicone Tube as a Guide for an Automated Suturing Device

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Abstract

Similar with posterolateral thoracotomy, video-assisted thoracic surgery should be performed safely for malignant lung tumors. Proper technique is required to guide an automated suturing device to the target site in a safe manner for the surgeon to perform the procedure in the small operating field without being under extensive stress. We report a case in which we used a silicone tube designed to guide the suturing device to the target site and discuss the usefulness of the device.

Keywords: Thoracic surgery; Invasive surgery; Tissue tunneler; Elasticity

Introduction

There are several recent reports on reduced port surgery, including single port surgery [1-3]. Our standard approach for major surgery for lung cancer is video-assisted thoracic surgery with the two-window method [4]. In the two-window method, 2-3 cm incisions are made on the postero-lateral incision line. One window is for the operator, and the other is for the thoracoscope and assistance. Unlike in abdominal surgery, the thoracic cavity does not have to be filled with carbon dioxide because the thoracic cage forms the thorax (Figure 1A). However, due to the presence of the thoracic cage, there are certain limitations with guiding instruments regardless of the number of access ports (Figure 1B). Similar with posterolateral thoracotomy, video-assisted thoracic surgery should be performed safely for malignant lung tumors [5]. In the present study, we report the usefulness of a novel device made of silicone (tissue tunneler, Fuji Systems Corporation, Tokyo, Japan) that can be used to guide instruments to the target site (Figure 1C).

Case Report

A 45-year-old female underwent left upper lobectomy for lung cancer. A 3 mm 30 degree thoracoscope (Karl Storz, GmbH & Co. Tuttlingen, Germany) and Endo GIA™ Curved Tip (Medtronic. Minneapolis, USA) were used. After exposure of the hilum, forceps were used to grasp the tip of the silicone tube (Figure 2) and it was inserted through the dissected interlobar lesion. An assistant grasped

Figure 1A: The silicone tube designed to guide the suturing device to the target site.

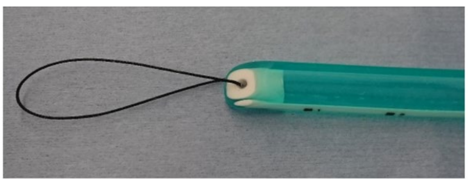

Figure 1B: The tip of the silicone tube.

Figure 1C: The mounting head of the silicone tube.

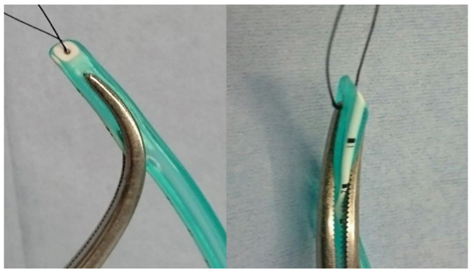

Figure 2: The tip of the silicone tube was grasped using forceps.

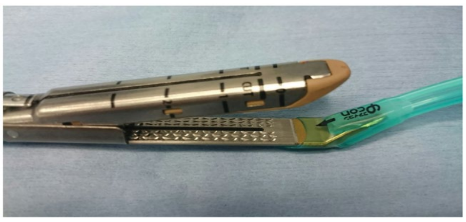

Figure 3: An anvil was placed onto the mounting head of the silicone tube.

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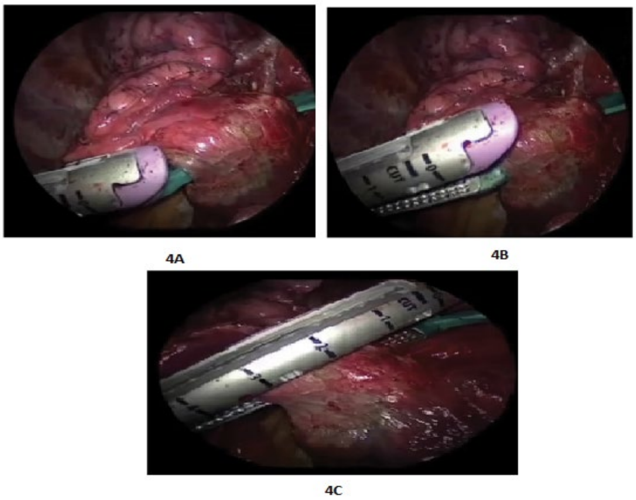

Figure 4: (**A**)Complete the interlobar fissure. (**B and C**) The suturing device was inserted without the anvil damaging the lung tissue.

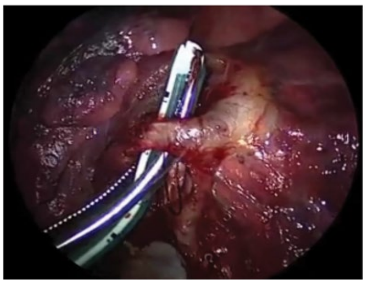

Figure 5A: Forceps were used to grasp the tip of the silicone tube.

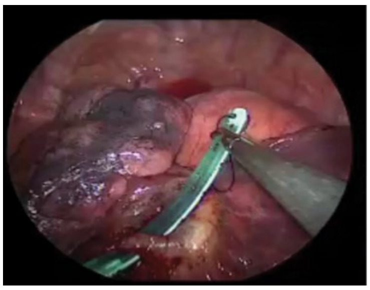

Figure 5B: An assistant grasped the tip of the tube.

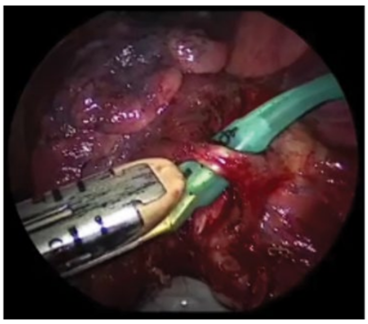

Figure 5C: Safety guide for vessels.

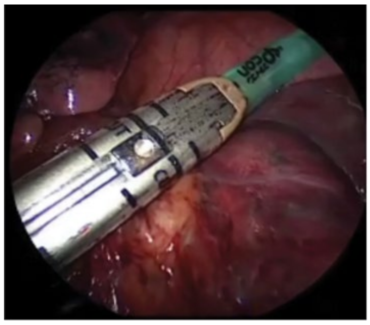

Figure 5D: Stapling was performed while the device was still attached.

the tip of the tube and slowly passed it through while the primary surgeon placed the tube at the tip of an anvil prior to insertion into the thoracic cavity (Figure 3). Then, A stapler was easily guided into the interlobar fissure and the fissure was completed (Figures 4A-4C). Similarly, the pulmonary artery (A4+5) can be cut using an endoscopic stapler. After the tube was inserted through the dissected pulmonary artery (Figure 5A) , an assistant grasped the tip of the tube and carefully passed it through (Figure 5B). A stapler was guided into the vessel (Figure 5C), which was stapled immediately (Figure 5D). Following the same procedure, the pulmonary arteries (A1+2, and A3), vein and bronchus were stapled, and the overall lobectomy procedure was completed safely.

Discussion

Drainage catheters made of silicone rubber, as well as nelaton catheters made of polyvinyl chloride, have been used to guide automated suturing devices. However, these catheters are not specifically designed for this purpose and may be inserted too deeply when attached to an anvil due to the resistance caused by guiding an automated suturing device. Thus, these catheters must be removed prior to stapling. On the other hand, the tissue tunneler is unlikely to be inserted too deeply because the structure is not hollow except for the mounting head. Thus, stapling can be performed without removing the device. In order to avoid damaging the vessels with the automated suturing device, the stapling procedure should be performed rapidly when an anvil is placed behind the vessels. However, the conventional method requires the catheter to be removed while the anvil is in position, potentially causing unnecessary force to be applied to the automated suturing device and the vessels. Furthermore, the mounting head of the tissue tunneler is much thinner than that of the nelaton catheter. Thus, the use of the tissue tunneler reduces the size of the vascular dissection required prior to guiding the suturing device to the size of the anvil. Collectively, use of the tissue tunneler has several advantages.

The elasticity and smooth surface of the silicone tube also make the tissue tunneler suitable for guiding an automated suturing device. The tube remains straight when there is no unnecessary force being applied and can be passed through without resistance if an automated suturing device is inserted in the right direction. This will enable young surgeons in training to acquire a proper sense of direction during thoracotomy.

Another advantage is that the silicone tube does not have to be removed. As the silicone tube moves the lung and mediastinum away from the area, the risk of inadvertently grasping and cutting tissues with the automated suturing device is reduced. This was particularly important because the automated suturing device is inserted without the anvil damaging the lung tissue when completing the interlobar fissure, and all contact with the lung was avoided when completing the procedure. With conventional devices, it takes longer until stapling can be performed because the primary surgeon or the assistant must move the lungs away from the area.

Another characteristic of the device is that the tip of the tissue tunneler is shaped like a spatula. This enables grasping procedures by holding the tip with forceps. With more experience using the device, we plan to confirm the feasibility of such procedures.

Conclusion

In this Case Report, we present great advantages of using a novel guiding device called the tissue tunneler. As this device does not have to be removed during the procedure, it may improve the safety.

Disclosure Statement

All authors declare that:

1. No support, financial or otherwise, has been received from any organization that may have an interest in the submitted work.
2. There are no other relationships or activities that could appear to have influenced the submitted work.

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