Single-Incision Thoracoscopic Surgery Using an Anchoring Suture of the Lung Parenchyma for Two-Directional Traction

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Single-incision thoracoscopic surgery (SITS) is difficult to perform because of an increased likelihood of collision between surgical instruments; moreover, the use of all the instruments through a single incision requires the creation of a relatively large incision. Therefore, a new SITS technique needs to be developed to reduce the likelihood of collision between surgical instruments and the incision size to a cosmetically acceptable one. In the present study, we aimed to perform SITS to easily avoid collisions between instruments through small-incision sites by means of a novel two-directional traction method using anchoring lung sutures.


Single-incision thoracoscopic surgery (SITS) has recently gained attention as an alternative surgical technique for conventional three-port video-assisted thoracoscopic surgery in wedge resection because of its advantages of circumventing additional skin incisions—except those for thoracic tube insertion—and reducing postoperative pain, chest wall paresthesia, and hospital stay duration [1–3]. However, because SITS is not only difficult to perform owing to the risk of collision between surgical instruments but also requires a relatively large incision, it has not yet been generally accepted as the preferred surgical technique over the conventional three-port video-assisted thoracoscopic surgery [4].

To facilitate the broad use of SITS, we need to reduce the likelihood of collision between surgical instruments, as well as the incision size for better cosmetic acceptability. We developed an SITS method to easily avoid collisions between the instruments through a two-directional traction technique using anchoring lung sutures.

Technique
The proposed surgical technique was performed in patients with a peripheral solitary pulmonary nodule, interstitial lung disease, and a primary pneumothorax. A double-lumen endotracheal tube was inserted, and surgery was performed in the lateral decubitus position. Based on the chest computed tomographic findings, the incision and anchoring suture locations were determined accordingly.

We performed a skin incision at the sixth intercostal space midaxillary line in cases of target lesions located in the upper, middle, or lower lobe anterior basal segment, and at the sixth or seventh intercostal space anterior axillary line in cases of lesions located in the lower lobe superior segment or lateral and posterior basal segment. After creating a 2-cm skin incision, an extra-small size wound protector was inserted. Using a 5-mm thoracoscope, the resection lesion was located through the incision, and a 1-0 Prolene suture (Ethicon, Somerville, NJ) was passed through from the outside of the chest wall above the lesion to the inside of the chest cavity. The thread for the anchoring suture was passed through at the chest wall just above the lesion after identifying the location of the target lesion. Anchoring sutures were then placed in front of the lesion resection site, and the needle was pulled out through the incision site (Fig 1). After making the two-directional traction sutures, the resection lesion was lifted by pulling the thread on the chest wall side to create an angle that enables a stapler to excise the lesion. First, stapling was performed by inserting the scope and endostapler (Ethicon, Cincinnati, OH) in parallel (Figs 2A, 2B). After the first stapling, a second stapler was inserted toward the previous resection surface. A maximum possible resection was then performed by pushing the stapler as the lesion was pulled to the center of the chest cavity by pulling the thread on the incision side (Figs 2C, 2D). In cases in which a complete resection was not performed even after the second stapling procedure, additional stapling was performed in the
same manner. Once the resection was completed, the tissues were removed by pulling the thread on the incision side.

Comment

To overcome the disadvantages of SITS, new techniques of SITS have recently been developed. To minimize the collision of surgical instruments and reduce incision size, studies have described a modified SITS that facilitates the pulling of the target lesion without the need for making an incision in another site—using percutaneous hook wire—and reduces the incision size to less than 2 cm by circumventing collision between instruments through parallel insertions of scopes and staplers [5].

Generally, at least two movements of the target lung lesion are required to resect the lesion. First, the resection angle between the lesion and stapler should be created by lifting up the lesion and positioning the lesion close to the upper chest wall. Second, when additional stapling is required, the lesion should be pulled and moved to the center of the chest cavity. The additional stapling site is present in a more distal location from the incision, considering the length of the first stapling. When the lesion to be excised is close to the chest wall during the second stapling, a complete resection can be difficult because the stapler might touch the chest wall. In such cases, if the resection surface is pulled to the center of the chest cavity, a complete resection is achieved without the stapler touching the chest wall. When stapling is required more than three times, the lesion should be further pulled to the center.

However, new SITS methods facilitate the lifting of the lesion, but not the pulling of the lesion toward the center of the chest cavity. Consequently, except for simple pneumothorax or lung biopsy of the apex areas, resection becomes difficult in cases of lesions located in the lower lobes or close to the chest wall. We introduced the anchoring suture technique with two-directional traction to overcome the disadvantages of modified SITSs and to enable the pulling of the lesions to the center of the chest cavity to facilitate the excision of the lesions at various sites, similar to three-port video-assisted thoracoscopic surgery.

We performed SITS in 48 patients who required simple wedge resection. Conversion to the three-port video-assisted thoracoscopic surgery was not necessary, and no complications were observed. The patients were discharged at a mean of 4.5 ± 1.1 days after surgery (range, 2 to 6 days). The mean Wong-Baker Pain score obtained in an outpatient setting 2 weeks after surgery was 1.3 ± 0.5 (range, 0 to 2). Thus, our two-directional traction method
using anchoring sutures could resolve the disadvantages of SITS.

References


