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Original Article

Thoracoscopic Wedge Resection through a Single Incision Using a Thin Puncture Device

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Video-assisted thoracic surgery (VATS) has been enthusiastically used as a less-invasive diagnostic or therapeutic surgical procedure in recent years. VATS results in considerably less postoperative pain than traditional thoracotomy incisions. The current trend is to reduce the number of ports and minimize the length of incisions to further reduce postoperative pain, chest wall paresthesia, and length of hospitalization. Although several accounts of reduced port surgery, such as single-incision laparoscopic surgery (SILS), have been reported, there are few descriptions of single-incision thoracoscopic surgery (SITS) using a thin puncture device for a variety of diseases. Herein, we describe a minimally invasive SITS technique using a thin puncture device.

Keywords: single incision, wedge resection, VATS, puncture device, Mini Loop Retractor II

Introduction

Regarding abdominal surgery, many reports of the usefulness of single-incision laparoscopic surgery (SILS) for appendectomy, cholecystectomy, and inguinal hernioplasty have been published.[1)] Furthermore, many papers on urology and gynecology citing examples of SILS have been published.[2,3)] In contrast, in the case of single-port (or incision) thoracoscopic surgery, the technological gap is obvious. The use of a SILS port for thoracic surgery is unconventional, and the access window to the thoracic wall is narrow and less flexible because of the ribs. Previously, we developed a new retractor that is sufficiently useful to hold the large intestine during a colorectal resection to allow enter without a trocar port.[4)] In this study, we present a less invasive single-incision thoracoscopic surgery (SITS) technique using a new, modified retractor.

Materials and Methods

From November 2011 to November 2012, we performed SITS on 16 patients. Lung tumors were involved in the SITS approach if the diameter of the lesion was within 2 cm, and the distance from visceral pleura was within 1 cm as determined by careful interpretation of preoperative chest computed tomography. Written informed consent for each operative procedure was obtained from all patients. The technique involving a SITS wedge pulmonary resection was as follows: a 1.8-cm incision was made in the skin at the adequate intercostal space in the optimal axillary line. The pleural space was entered by blunt dissection, and a wound protector was tightly put in place (LAP PROTECTOR, HAKKO Co., Nagano, Japan). A 5-mm 30° video thoracoscope combined with a 5-mm thoracoscopic forceps or 6.4-mm Thoraco Cotton (KENZMEDICO Co., Saitama, Japan) was introduced in the thoracic cavity through the access window.

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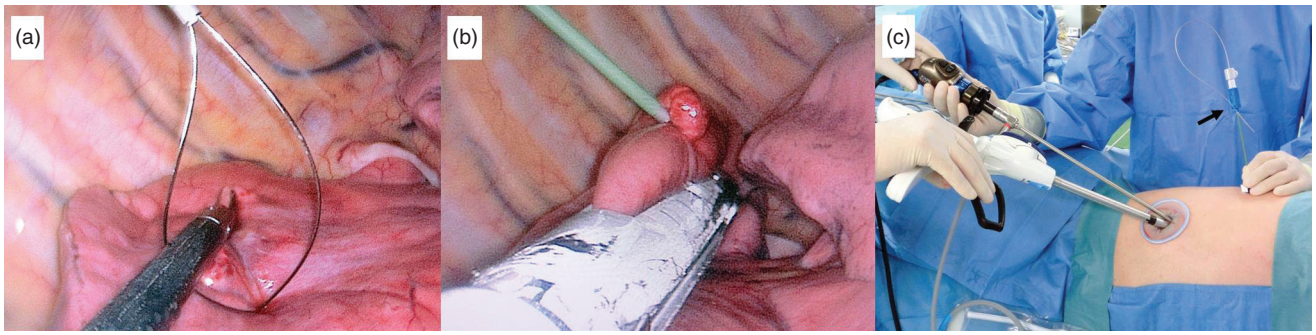

Fig. 1 Involved lesion is grasped by endoscopic forceps through a loop of the Mini Loop Retractor II followed by looping at the location (**a**). The target lesion grasped by the Mini Loop Retractor II is resected using an endoscopic stapler: Simultaneous endoscopic view (**b**) and outside view (**c**). Arrow indicates the Mini Loop Retractor II.

In the case of a lung tumor, after a nodule was identified by palpation with thoracoscopic forceps, a thin puncture device (Mini Loop Retractor II, COVIDIEN Japan, Tokyo, Japan) (MLR II) was inserted through an additional percutaneous route. If the lesion was not able to be identified by palpation, we converted to conventional three-port surgery. First, the lung parenchyma adjacent to the lesion was grasped by thoracoscopic forceps through the metallic loop of the retractor. The lesion was then carefully grasped by a metallic loop (**Fig. 1a**) and resected using a reticulated stapler (Endo-GIA Universal, USCC-Tyco Healthcare) (**Fig. 1b and 1c**). The specimen was extracted through an endobag, and a 15-Fr drainage tube was inserted through the same incision under thoracoscopic guidance (**Fig. 2**).

Postoperative pain was evaluated using a Visual Analog Score (VAS) on an outpatient basis on postoperative days 7 to 14.

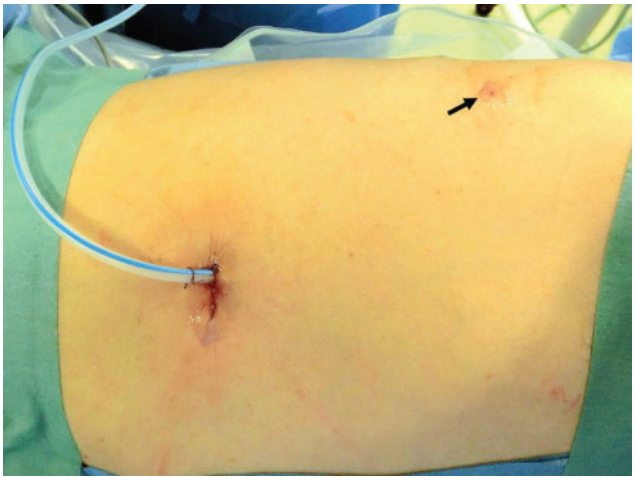

Fig. 2 Representative postoperative results of a 15-Fr tube placed in the posterior part of a 1.8-cm incision. The skin wound resulting from use of the Mini Loop Retractor II is a little scaring (arrow).

Results

Of the 16 patients in this series, 9 had lung tumors, 5 had primary spontaneous pneumothorax, and the remaining 2 had diffuse interstitial pulmonary diseases. Of these, 11 were male, and 5 were female. The median age of patients was 56.2 years (range, 22–78). The overall postoperative hospital stay was 3.6 days. Eighteen lesions in 16 patients were successfully resected, and in the case of lung tumors, a sufficient safety margin was maintained. The median follow-up period was 11.6 months, and no complications were observed. No local recurrence of tumors at the surgical site and no recurrence of pneumothorax have been observed up to this point. Postoperative pain was mild for all patients as indicated by an average VAS score of 13.4 (range, 0–24) and no use of analgesic drugs after postoperative day 7.

Discussion

Since video-assisted thoracic surgery (VATS) currently is recognized to be as effective as thoracotomy but less invasive and with lower morbidity, it has been performed widely in the diagnosis and treatment of intrathoracic disease. Efforts to reduce the number of ports and minimize the length of incisions are being made to reduce postoperative pain, chest wall paresthesia, and length of hospitalization.

As reduced-port surgery, SITS offers clear advantages over traditional techniques, particularly with regard to postoperative pain and length of hospitalization.[5] Recently,

chest wall paresthesia has been described as a significant postoperative complication of the conventional VATS approach.[6] However, this complication can be reduced by limiting the number of port incisions. In addition, the use of a rigid thoracic port might increase postoperative pain and paresthesia. Although several studies have been published describing a SILS port used for uniportal VATS in order to reduce postoperative pain,[7,8] Japanese health insurance does not pay for the use of a SILS port in thoracic cases.

Recently, the development of technology in the videoscopic field has produced 2- to 3-mm-thick needlescopic equipment and instruments that can accelerate the advancement of minimally invasive surgery. Chen, et al. have reported that needle VATS is technically feasible and can be a satisfactory alternative to conventional VATS in treating primary spontaneous pneumothorax.[9] Furthermore, Ikeda, et al. reported that MLR II is useful for needlescopic surgery for spontaneous pneumothorax[10] and other partial lung resections.[11] Although Ikeda, et al. have used an excellent technique, they performed needle VATS exclusively for primary spontaneous pneumothorax[10] or used a number of puncture devices, including a 2-mm needle thoracoscope, in a single operation.[11] We used SITS for a variety of procedures, such as metastasectomy, with a single puncture of MLR II. Smaller instruments, such as MLR II with a shaft diameter of 2.2 mm, would permit smaller incisions, which, in addition to improving cosmetic results, might reduce postoperative pain and incision-related morbidity.

We present 16 cases of SITS using MLR II for spontaneous pneumothorax, biopsy of interstitial lung disease, and tumor resection of the lung. Because MLR II is a thin puncture instrument and can be used several times for punctures at other sites, interference of endoscopic instruments was avoided by its use. Of course, it is very important to decide the accurate resection line to secure the safest resected margin. We exempt tumors that are closer than 1 cm from visceral pleura and smaller than 2-cm in diameter from its application as was described earlier. Rocco reviewed that uniportal VATS could be considered as a means to resect nodules located in the outer third of the lung and less than 2 cm in diameter.[12]

Because uniportal VATS or most SITS techniques are based on a completely different geometric concept compared with conventional three-port VATS, the use of articulating instruments inserted parallel to the videoscope is necessary for the surgeon to carry out wedge resection of the lung.[12,13] In contrast, a similar geometric condition compared with three-port VATS could be made by use of MLR II, which is punctured at the adequate site to lift the objective lesion. With our SITS technique, it is not necessary to use particular kinds of instruments, such as articulating instruments. Furthermore, adequate lifting of the pulmonary nodule by MLR II makes it possible to resect within the safety margin.

This is the first report of SITS with a "single-puncture" MLR II for not only spontaneous pneumothorax but also lung biopsy of interstitial lung disease and tumor resection. The length of the single incision (1.8 cm) is one of the smallest in the field of VATS tumor resection in the literature on Medline.

We believe there are several advantages of our method over conventional three-port thoracoscopic surgery. First, the cosmetic advantage is significant because puncture(s) of MLR II leave little or no scaring of the skin as shown by **Fig. 2**. Second, since MLR II is reusable, our method is adaptable for the resection of a number of lesions through the same route in a single operation. Third, postoperative pain is reduced because of the use of a soft wound retractor rather than a rigid plastic port as an access window, and having only one incision is significant in reducing postoperative pain. Finally, because an expensive SILS port for laparoscopic surgery is unnecessary with the SITS technique, the financial advantage of reduced-port thoracic surgery is clear.

Conclusion

Our report demonstrates that SITS using MLR II is a safe and beneficial approach for thoracoscopic partial resection of the lung. We believe that SITS using MLR II is a feasible and promising procedure for a variety of thoracoscopic partial resections of the lung.

Disclosure Statement

The authors have no conflicts of interest or financial ties to disclose.

References

1) Curcillo PG, Podolsky ER, King SA. The road to reduced port surgery: From single big incisions to single small incisions, and beyond. World J Surg 2011; **35**: 1526-31.
2) Castellucci SA, Curcillo PG, Ginsberg PC, et al. Single port access adrenalectomy. J Endourol 2008;

22: 1573-6.
3) Liliana M, Alessandro P, Giada C, et al. Single-port access laparoscopic hysterectomy: A new dimension of minimally invasive surgery. J Gynecol Endosc Surg 2011; **2**: 11-7.
4) Asao T, Yanagita Y, Nakamura J, et al. Usefulness of a visceral mini-retractor accessible without trocar port during laparoscopic surgery. Surg Endosc 1999; **13**: 91.
5) Rocco G, Martin-Ucar A, Passera E. Uniportal VATS wedge pulmonary resections. Ann Thorac Surg 2004; **77**: 726-8.
6) Sihoe AD, Au SS, Cheung ML, et al. Incidence of chest wall paresthesia after video-assisted thoracic surgery for primary spontaneous pneumothorax. Eur J Cardiothorac Surg 2004; **25**: 1054-8.
7) Berlanga LA, Gigirey O. Uniportal video-assisted thoracic surgery for primary spontaneous pneumothorax using a single-incision laparoscopic surgery port: A feasible and safe procedure. Surg Endosc 2011; **25**: 2044-7.
8) Assouad J, Vignes S, Nakad J, et al. Single incision video-assisted thoracic surgery using a laparoscopic port. Ann Thorac Surg 2011; **91**: 2020-1; author reply 2021.
9) Chen JS, Hsu HH, Kuo SW, et al. Needlescopic versus conventional video-assisted thoracic surgery for primary spontaneous pneumothorax: A comparative study. Ann Thorac Surg 2003; **75**: 1080-5.
10) Ikeda Y, Tamura M, Umezu H, et al. [Usefulness of mini loop retractor in video-assisted thoracic surgery]. Kyobu Geka 2003; **56**: 199-202.
11) Ikeda Y, Miyoshi S, Seki N, et al. Needlescopic operation for partial lung resection. Ann Thorac Surg 2003; **75**: 599-601.
12) Rocco G. One-port (uniportal) video-assisted thoracic surgical resections—a clear advance. J Thorac Cardiovasc Surg 2012; **144**: S27-31.
13) Chen PR, Chen CK, Lin YS, et al. Single-incision thoracoscopic surgery for primary spontaneous pneumothorax. J Cardiothorac Surg 2011; **6**: 58.