



Thoracoscopic transareolar approach for primary spontaneous pneumothorax in young male patients

Hitoshi Igai, Mitsuhiro Kamiyoshihara

Department of General Thoracic Surgery, Japanese Red Cross Maebashi Hospital, Maebashi, Japan

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Correspondence to: Hitoshi Igai, MD, PhD. Department of General Thoracic Surgery, Japanese Red Cross Maebashi Hospital, 389-1 Asakura-cho, Maebashi, Gunma 371-0811, Japan. Email: hitoshiigai@gmail.com.

Abstract: Most patients with primary spontaneous pneumothorax (PSP) are treated via thoracoscopic surgery. However, the number of ports used during thoracoscopic surgery (i.e., uni- or multi-portal) varies among institutions. We evaluated the efficacy of the thoracoscopic transareolar approach for the treatment of PSP. To the best of our knowledge, four studies (two of them were our reports) have evaluated the usefulness of the thoracoscopic transareolar approach for the treatment of PSP. Two of the studies, including ours, had a comparative arm while the other two reports, including ours, had a single arm. We used three ports for the transareolar approach for PSP treatment; by contrast, the other previous studies used one or two ports. However, any studies, including ours, have demonstrated higher cosmetic satisfaction with the transareolar than conventional approach, in which the skin incisions were made on the axillary line. Furthermore, the areolar incision made during the transareolar approach was not visible at the sixth postoperative month. Compared to patients undergoing thoracic surgery for other diseases, those undergoing surgery for PSP are younger and place greater emphasis on the cosmetic outcome. Therefore, higher cosmetic satisfaction with the transareolar approach is a major advantage over the conventional approach. Two previous studies reported equivalent perioperative outcomes between the transareolar and conventional approaches. Both of the single-arm studies also reported acceptable perioperative outcomes. Although a comparative study revealed that postoperative pain was similar between the transareolar and conventional approaches, in the other study postoperative pain was lower with the transareolar than conventional approach. Based on the aforementioned findings of better cosmetic satisfaction and postoperative pain relief, as well as equivalent perioperative outcomes, the transareolar approach may be superior to the standard treatment for young males with PSP.

Keywords: Transareolar approach; uniportal approach; thoracoscopy; primary spontaneous pneumothorax (PSP)

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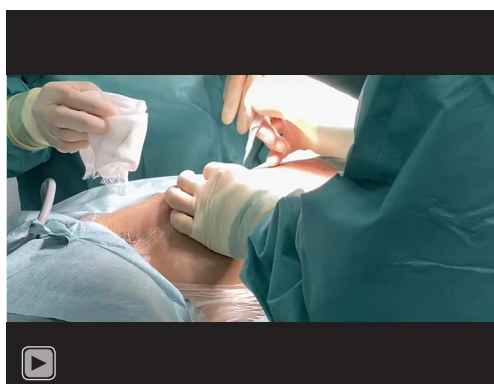
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Introduction

Most patients with primary spontaneous pneumothorax (PSP) are treated via thoracoscopic surgery. However, the number of ports used during thoracoscopic surgery (i.e., uni- or multi-port) varies among each institution. Although the multiportal approach was commonly used previously, uniportal approach has increasingly been used in the last

decade (1-8). The uniportal approach involves making a 2–3-cm-long single skin incision along the lateral axillary line, which leads to less postoperative pain and higher cosmetic satisfaction than the multiportal approach. In our previous study, we compared the efficacy of the uni- and multi-portal approaches for thoracoscopic bullectomy for the treatment of PSP (8).



Video 1 Thoracoscopic bullectomy via transareolar approach. The operation was performed using single-lung ventilation, with patients under general anesthesia in the lateral decubitus position. In the transareolar approach, the areola was adjusted at the level of the fourth intercostal space by moving the patient's arm. We created a 2-cm incision for stapling on the upper edge of the areola, and a 5-mm incision for the forceps on the lower edge. We made both incisions over the fourth intercostal space. The 2-cm incision was covered with an XXS-sized wound retractor (Applied Medical, Rancho Santa Margarita, CA, USA) and a 3-mm rigid port through the 5-mm incision was inserted. The 1-cm skin incision on the fifth intercostal space of the anterior axillary line was used to insert a thoracoscopic port after preoperative chest tube withdrawal. We created a thoracoscopic port in the same position when the patients did not receive drainage. Blebs and bullae were excised using an endostapler (Powered Echelon Flex GST System; Johnson & Johnson, Parsippany, NJ, USA). Polyglycolic acid felt (Neoveil, sheet type; Igaki Medical Planning Co., Ltd., Kyoto, Japan) was applied to the staple lines using fibrin glue (Beriplast P; CSL Behring, King of Prussia, PA, USA); this treatment prevented postoperative air leakage with reduction of the recurrence rate. Intraoperative pleurodesis (talc administration, pleurectomy, or pleural abrasion) was not performed. Furthermore, intraoperative sealing tests were not performed because the bullae or blebs that required resection were visible on the preoperative CT and, in our experience, the incised stapler lines rarely leak. Finally, a chest drain was positioned in the thoracic cavity.

The uniportal approach is not commonly used, despite its less invasive nature; this may be because surgical instrument maneuvering is markedly different between the uni- and multiportal approaches. In the uniportal approach, several instruments, including forceps, a stapler, and a thoracoscope, are simultaneously inserted through a single skin incision, which may be difficult to maneuver for

inexperienced surgeons.

Operation

To defeat the difficulty associated with the insertion of multiple instruments, we developed the thoracoscopic “transareolar” approach for bullectomy in September 2017 as an alternative to the minimally invasive approach (9). The transareolar approach was performed with the patients under general anesthesia using single-lung ventilation in the lateral decubitus position (*Video 1*). The areola was put on the level of the fourth intercostal space by moving the patient's arm. We made a 2-cm arc incision for applying staples on the upper edge of the areola, as well as a 5-mm arc incision for the insertion of forceps on the lower edge of the areola. Both incisions were created at the level of the fourth intercostal space. The 2-cm incision was covered with an XXS-sized wound retractor. In addition, a 3-mm rigid port was inserted through the 5-mm incision. Moreover, we made a 1-cm skin incision to insert the thoracoscope into the fifth intercostal space along the anterior axillary line. Preoperative thoracic drainage was performed using the 1-cm skin incision. If not, we created a new thoracoscopic port in the same position. Our team initially conducted a single-arm study showing the feasibility and safety of the thoracoscopic transareolar approach in 10 consecutive patients. In all patients of the study, the postoperative drainage duration was 1 day, the postoperative hospitalization duration was 2 days, and there were no complications. Moreover, on postoperative day (POD) 7, the mean numerical rating scale score was 3.2; at postoperative month (POM) 12, all patients were pain-free. Subsequently, we prospectively compared the transareolar and uniportal approaches for thoracoscopic lung bullectomy (10). There were no significant differences between the transareolar and uniportal thoracoscopic approaches in terms of the perioperative outcomes, including operative time, intraoperative blood loss (minimal for all patients), duration of postoperative drainage (1 day for all patients), length postoperative hospital stay (2 days for all patients), complication rate (0% for all patients), or 1-year recurrence rate. Between the groups, the numerical rating scale pain scores on POD 7 and POM 12 were statistically similar. Finally, cosmetic satisfaction was evaluated using a 4-point scale (1, poor; 2, not good; 3, good; 4, excellent). Patients undergoing the transareolar approach had higher satisfaction scores than those who underwent the uniportal approach on POD 7 (t , 3.5 ± 0.6 *vs.* u , 2.9 ± 0.9 ; $P=0.02$) and POM 12 (t , 3.8 ± 0.5 *vs.* u , 3.3 ± 0.9 ; $P=0.0065$). Therefore, patients have

Table 1 Summary of studies that described use of the transareolar approach for thoracoscopic surgery

Author	Study period	Study design	Number of patients	Disease/surgical procedure	Results
Xu <i>et al.</i>	January 2012 to December 2014	Retrospective, comparative (vs. conventional two-port)	197 (transareolar: 65, conventional two-port: 132)	Spontaneous pneumothorax or lung nodule/pulmonary wedge resection	Postoperative pain, paresthesia, and cosmetic satisfaction were better after the transareolar approach
Lin <i>et al.</i>	January 2013 to December 2014	Retrospective, single arm	112	Spontaneous pneumothorax/pulmonary wedge resection	Good perioperative outcomes, including postoperative pain and cosmetic satisfaction (no comparison)
Chen <i>et al.</i>	May 2012 to May 2014	Single arm	85	Primary palmer hyperhidrosis/thoracic sympathectomy	Good perioperative outcomes, including postoperative pain and cosmetic satisfaction, and no recurrent symptoms of primary palmer hyperhidrosis (no comparison)
Lin <i>et al.</i>	January 2019 to September 2019	Prospective, randomized, comparative (vs. single-port on axillary line)	118 (transareolar: 58, single-port on axillary line: 60)	Primary palmer hyperhidrosis/thoracic sympathectomy	Postoperative pain and cosmetic satisfaction were better after the transareolar approach Other perioperative outcomes were equivalent between the two groups
Igai <i>et al.</i>	April 2018 to July 2019	Prospective, open-label, comparative (vs. single-port on axillary line)	40 (transareolar: 21, single-port: 19)	Spontaneous pneumothorax/pulmonary wedge resection	Postoperative pain and other perioperative outcomes were equivalent between the two groups Cosmetic satisfaction was better after the transareolar approach

greater cosmetic satisfaction after transareolar pulmonary bullectomy than the uniportal approach with equivalent perioperative outcomes and postoperative pain.

Several previous studies have described the use of the thoracoscopic transareolar approach for general thoracic surgery (11-14), including wedge resections for bullae and lung nodules, and sympathectomy for primary palmer hyperhidrosis. *Table 1* summarizes the results of previous and current studies. In previous studies, the transareolar approach used one or two skin incisions, whereas we used three incisions. Two studies described the usefulness of the thoracoscopic transareolar approach for pneumothorax (11,12). Xu *et al.* retrospectively compared the perioperative results, postoperative pain,

and cosmetic satisfaction after thoracoscopic pulmonary wedge resection using the transareolar and conventional biportal approaches (11). The patients receiving the transareolar approach had the reduction of postoperative pain and higher cosmetic satisfaction than the biportal approach with the statistically similar other perioperative outcomes. In a single-arm retrospective study, Lin *et al.* performed thoracoscopic transareolar bullectomy in 112 male patients, and demonstrated that this minimally invasive approach was feasible and safe (12). Additionally, the postoperative outcomes, including pain and cosmetic satisfaction, were excellent at the 6- and 12-month follow-ups. Two other studies described the use of thoracoscopic transareolar sympathectomy for the treatment of primary

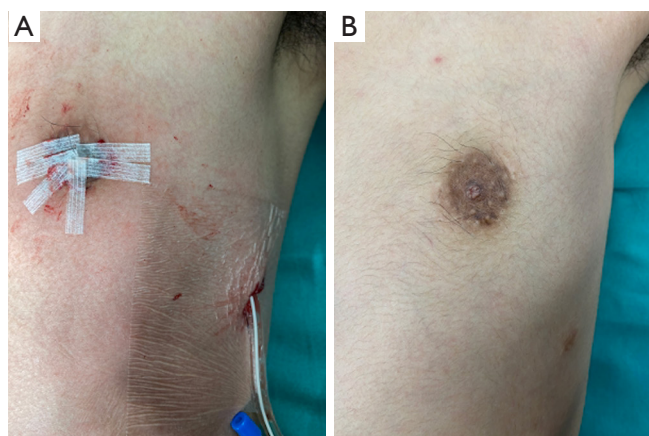


Figure 1 Postoperative changes in the surgical wounds of a patient receiving the transareolar approach. (A) Right after the operation, surgical tape fixed and covered the wounds. (B) At postoperative month 12, the surgical wounds were nearly invisible.

palmer hyperhidrosis and reported excellent perioperative outcomes, reduced postoperative pain, and satisfactory cosmetic results (13,14).

Most previous studies reported higher cosmetic satisfaction after the transareolar than comparative approach, which involved an incision on the lateral axillary line (10,11,13). Moreover, the areolar incision was not visible at POM 6. Compared to patients undergoing thoracic surgery for other diseases, those undergoing surgery for PSP are younger and place greater emphasis on cosmetic satisfaction. The cosmetic satisfaction of patients is a major advantage of the transareolar approach. *Figure 1* demonstrates the postoperative courses of surgical wounds of a patient receiving the transareolar approach.

In female PSP patients, the transareolar approach is contraindicated, which makes it less applicable to the general population, whereas the conventional uniportal approach involving a single incision on the lateral axillary line can be used for both males and females. Therefore, the transareolar approach might not be useful for other diseases, such as primary and metastatic lung cancer, because of the lack of significant sex differences, although it may be a better option for standard treatment of young males with PSP.

In the transareolar approach, we penetrate mammary fat tissue, which may lead to mastitis. However, any local wound complications, such as mastitis, were not reported in previous studies (9-14). Therefore, we consider that mastitis is not a major concern when we perform the transareolar approach. Moreover, there are no reports describing

other specific complications related with the transareolar approach.

Conclusions

In conclusion, the thoracoscopic transareolar approach is associated with higher cosmetic satisfaction, good postoperative pain relief, and equivalent perioperative outcomes compared to the conventional approach. Therefore, the transareolar approach might be preferred for the treatment of young males with PSP.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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