Korean J Thorac Cardiovasc Surg 2015;48:375-377 □ Case Report □
ISSN: 2233-601X (Print) ISSN: 2093-6516 (Online) http://dx.doi.org/10.5090/kjtcs.2015.48.5.375

Lung Entrapment between the Pectus Bar and Chest Wall after Pectus Surgery: An Incidental Finding during Video-Assisted Thoracoscopic Surgery

Kyung Soo Kim, M.D., Kwanyong Hyun, M.D., Do Yeon Kim, M.D., Kukbin Choi, M.D., Hahng Joon Choi, M.D., Hyung Joo Park, M.D.

We report a case of an entrapped lung after the pectus bar repair of a pectus deformity. The entrapped lung was found incidentally during video-assisted thoracoscopic surgery (VATS) for pneumothorax. Based on VATS exploration, multiple bullae seemed to be the cause of the pneumothorax, but the entrapped lung was suspected to have been a cause of the air leakage.

Key words: 1. Pneumothorax
2. Lung entrapment
3. Pectus excavatum/carinatum
4. Thoracoscopy
5. Video-assisted thoracic surgery

CASE REPORT

An 18-year-old male patient presented with pneumothorax on postoperative day four after the minimally invasive repair of pectus carinatum. The pectus carinatum repair was performed using the sandwich technique, which involves a 33.02-cm press-molded internal bar and a 30.48-cm press-molded external bar (Fig. 1). Instead of a chest tube, a small-bore central venous access catheter was inserted to relieve the pneumothorax in a less invasive manner. A chest computed tomography scan indicated the presence of multiple bullae at the apex of the upper lobe of the right lung. On postoperative day seven after the pectus repair, three days after the development of pneumothorax, we decided to remove the bullae through video-assisted thoracoscopic surgery (VATS) because the lung collapse was persistent.

Under general anesthesia, using double-lumen endotracheal intubation with the patient in the left lateral decubitus position, a 10-mm thoracoscopic port was placed at the eighth intercostal space of the middle axillary line, below the pectus bar insertion level in order to avoid bar interruption. A 2-cm working incision was made at the fourth intercostal space of the anterior axillary line and a 5-mm working port incision was made at the subscapular tip area of the posterior axillary line for a three-port VATS approach. VATS exploration using a 30° thoracoscope (Karl Storz endoscope; Karl Storz, Tuttlingen, Germany) revealed minimal hemothorax and multiple apical multiple bullae as indicated by the preoperative computed

Department of Thoracic and Cardiovascular Surgery, Seoul St. Mary's Hospital, The Catholic University of Korea College of Medicine
†This report was presented as an e-poster at the 46th Annual Meeting of the Korean Society for Thoracic and Cardiovascular Surgery.
Received: November 11, 2014, Revised: December 10, 2014, Accepted: December 10, 2014, Published online: October 5, 2015
Corresponding author: Hyung Joo Park, Department of Thoracic and Cardiovascular Surgery, Seoul St. Mary's Hospital, The Catholic University of Korea College of Medicine, 222 Banpo-daero, Seocho-gu, Seoul 06591, Korea
(Tel) 82-2-2258-6320 (Fax) 82-2-594-8644 (E-mail) hyjpark@catholic.ac.kr

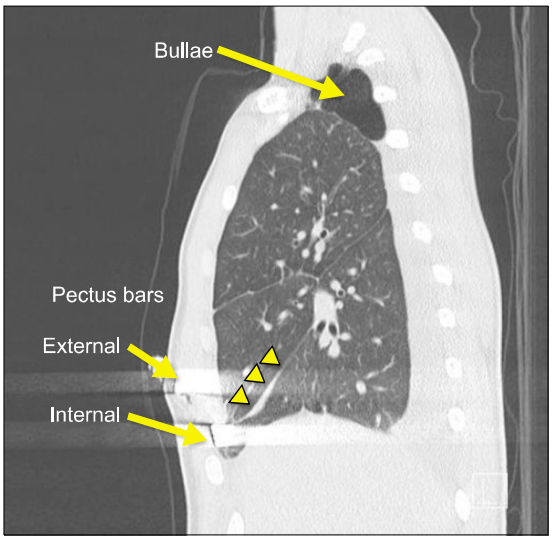

Fig. 1. Computed tomography scan showing the multiple bullae at the apex of the right upper lobe, the sandwich pectus bars (external, internal bars) for repair of pectus carinatum, and curvilinear upward deviation of the minor fissure due to the right middle lobe entrapment into the internal pectus bar (arrow head).

tomography scan. A finding that we did not anticipate was that the middle lobe of the right lung was entrapped between the chest wall and the pectus bar. Adhesion was present around the pectus bar and the entrapped lung, but we did not observe air leakage at that moment (Fig. 2).

The entrapped lung was separated from the adhesion and carefully pulled out of the pectus bar. However, a portion was injured, and it had to be resected with endostaplers (TriStapler; Covidien, Norwalk, CT, USA). The apical bullae lesion of the upper lobe was also wedge resected. An air leak test confirmed that both resected areas of the apex and the entrapped middle lobe were airtight. Bio-absorbable felt (Neoveil; Gunze, Osaka, Japan) was used to cover the lesions, followed by glue injection on the resected lesions. The patient recovered uneventfully and was discharged four days after VATS. He underwent nine months of follow-up with no recurrence of the pneumothorax.

DISCUSSION

Pectus deformity repair using pectus bars is a standard operation to correct pectus excavatum that has been widely performed since its development in 1998 by Donald Nuss [1].

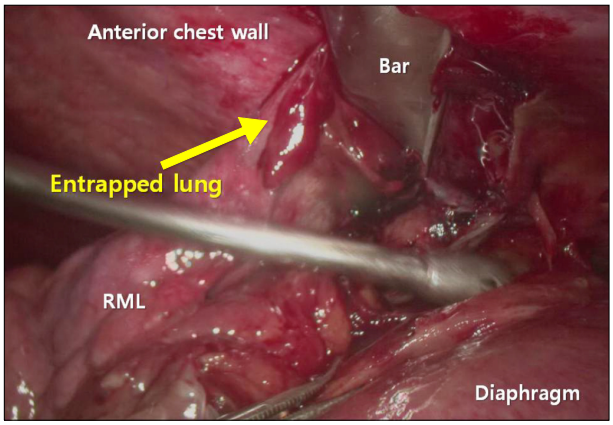

Fig. 2. Thoracoscopic view of the entrapped lung of the RML between the pectus bar and anterior chest wall. RML, right middle lobe.

Pneumothorax is one of the early postoperative complications of this procedure, and is caused by an incidental lung injury or air that was retained during the surgical procedure [2]. In order to prevent this early complication, we routinely insert hemovac catheters into the bilateral pleural cavities in cases of the parallel insertion of two bars, intrapleural procedures, such as suturing for the placement of hinge plates, or in adult cases [3]. However, primary spontaneous pneumothorax, caused by the rupture of subpleural blebs or bullae, may occasionally occur in combination with pectus repair. In such instances, it is difficult to determine the etiology of the pneumothorax and the subsequent treatment strategy. Initially, pneumothorax can be conservatively managed by chest tube or catheter insertion, but prolonged air leakage or recurrent pneumothorax must be treated by thoracoscopic wedge resection [4].

Lung entrapment by surgical hardware is sharply distinct from usual cases of trapped lung, in which a part of the lung is unexpandable due to pleural inflammation, the development of adhesion after a surgical procedure, such as coronary artery bypass surgery, or pleural diseases including empyema, hemothorax, tuberculosis, and pleuritic [5,6].

The entrapment of part of the lung can occur in pectus repair using pectus bars, and it may be difficult to recognize without surgical exploration. Few reports have addressed lung entrapment by pectus bars. Our VATS finding, although it was incidentally discovered during a surgical procedure for

pneumothorax, clearly demonstrated that the lung was caught between the pectus bar and the chest wall in our patient.

In our case, a sizable portion of the parenchyma of the right middle lobe was caught between the pectus bar and the anterior chest wall, with adhesions formed around it. The cause of pneumothorax was uncertain in this case because no definitively identifiable ruptured bullae were leaking air at the time of surgery. Although the air leak points in the entrapped lung were also uncertain, we thought that the damaged lung may have been leaking air, which may have been the cause of the pneumothorax. Our surgical approach, therefore, combined resecting all bullae that we encountered and relieving the lung entrapment, which was ultimately accompanied by the removal of some damaged lung tissue.

We report a case of spontaneous pneumothorax involving lung entrapment in a pectus bar and multiple bullae in the lung. This case demonstrates that pectus repair may be complicated by lung entrapment in the pectus bar.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Kelly RE, Goretsky MJ, Obermeyer R, et al. *Twenty-one years of experience with minimally invasive repair of pectus excavatum by the Nuss procedure in 1215 patients.* Ann Surg 2010;252:1072-81.
2. Park HJ, Song CM, Her K, et al. *Minimally invasive repair of pectus excavatum based on the Nuss principle: an evolution of techniques and early results on 322 patients.* Korean J Thorac Cardiovasc Surg 2003;36:164-74.
3. Park HJ, Lee SY, Lee CS. *Complications associated with the Nuss procedure: analysis of risk factors and suggested measures for prevention of complications.* J Pediatr Surg 2004;39:391-5.
4. Bostanci K, Evman S, Yuksel M. *Simultaneous minimally invasive surgery for pectus excavatum and recurrent pneumothorax.* Interact Cardiovasc Thorac Surg 2012;15:781-2.
5. Pereyra MF, Ferreiro L, Valdes L. *Unexpandable lung*. Arch Bronconeumol 2013;49:63-9.
6. Doelken P. *Clinical implications of unexpandable lung due to pleural disease*. Am J Med Sci 2008;335:21-5.