A Successful Case of an Implanted Polyglycolic-Acid Sheet Inside the Bulla for Preventing the Residual Cavity After Video-Assisted Thoracoscopic Bullectomy

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Case Report

A Successful Case of an Implanted Polyglycolic-Acid Sheet Inside the Bulla for Preventing the Residual Cavity After Video-Assisted Thoracoscopic Bullectomy

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Video-assisted thoracoscopic surgery (VATS) stapler bullectomy can be performed with minimal morbidity. The residual cavities are frequently observed postoperatively, especially in cases with wide large bullae. We describe a technique using an exclusive thoracoscopic approach utilizing a polyglycolic-acid (PGA) sheet for preventing the postoperative residual cavities in a patient with a large bulla. A 40-year-old man was referred to our hospital for progressive shortness of breath. Chest computed tomography (CT) revealed multiple bullae in the upper lobe of left lung. A large bulla had compressed a significant volume of functional lung parenchyma; VATS stapler bullectomy was performed. This procedure excised no normal lung tissue and reduced the volume of the air-containing cavity with airtight repair. A PGA sheet inside the bulla reduced and prevented air leakage from the stapled margin. The patient was discharged and the postoperative course was uneventful. Compared with preoperative expiratory volume in 1 s (FEV_1), postoperative FEV_1 increased by 0.66 L. Postoperative chest CT 16 months after surgery demonstrated no air-containing cavity. At 38 months after surgery, the patient had no symptoms.

Keywords: bulla, bullectomy, polyglycolic-acid, air leakage, video-assisted thoracoscopic surgery

Introduction

The development of surgical staplers has made video-assisted thoracoscopic surgery (VATS) bullectomy much easier, and a modification of the method suggested by Naclerio and Langer is routinely used.[1,2] VATS stapler bullectomy can be performed with minimal morbidity and similar outcomes to those obtained with open bullectomy.[3] However, residual cavities are frequently observed postoperatively, especially in cases with wide large bullae.[1-3]

We describe a technique using an exclusive thoracoscopic approach with a polyglycolic-acid (PGA) sheet for preventing the postoperative residual cavities in a patient with a large bulla.

Case Presentation

A 40-year-old man was referred to our hospital for progressive shortness of breath. He was a non-smoker. His dyspnea was Grade I in a modified Hugh-Jones and Lambert grading system. There were no abnormal findings in

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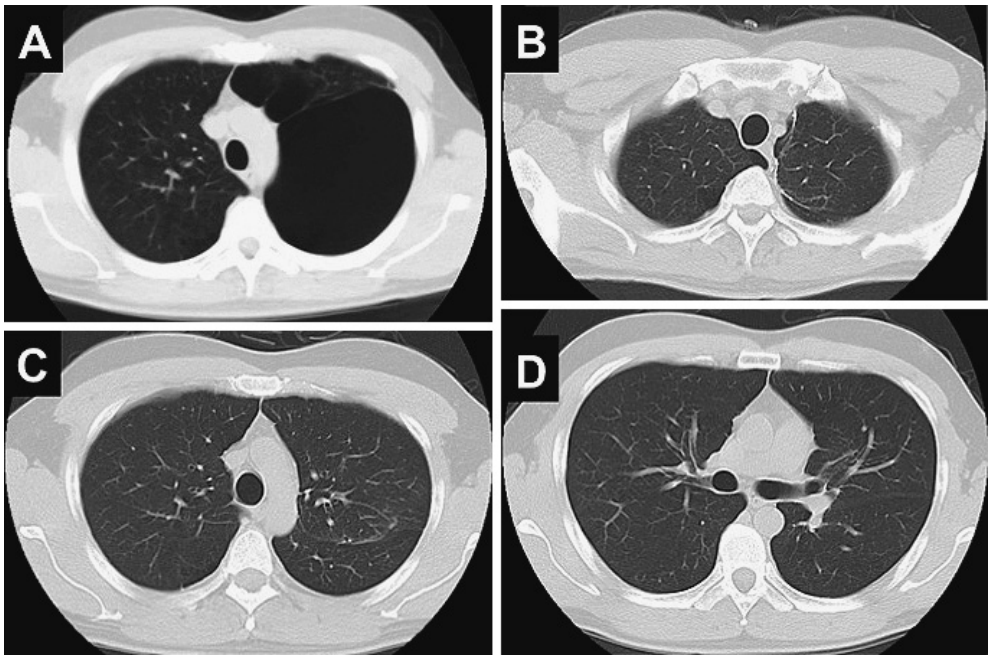

Figure 1. Computed tomography (CT) of the chest of a 40-year-old patient.
(**A**) Multiple bullae in the normal underlying healthy lung had compressed a significant volume of functional lung parenchyma (preoperatively). (**B**-**D**) At 16 months after surgery, no air-filled cavities and no compressed functional lung parenchyma were found in the left lung. The CT images from B to D were taken from the head side to the bottom.

laboratory data. Computed tomography (CT) of the chest revealed multiple bullae in the upper lobe of left lung (**Figure 1A**). A large bulla had compressed a significant volume of functional lung parenchyma. VATS stapler bullectomy was performed to relieve compression of the functional lung parenchyma.

Under general endotracheal double-lumen anesthesia with split-lung ventilation, the patient was kept lying on the healthy side and positioned in lateral decubitus. We first used a 10-mm camera port in the 7th intercostal space (ICS) in the mid-axillary line, serving as an observation port with a rigid 30-degree endoscope. The second (12-mm) port was placed in the anterior axillary line in the 4th ICS, and the third (10-mm) port was placed along the 7th ICS in the posterior axillary line. Three-port complete VATS was performed.

After identification, the largest bulla was punctured opened longitudinally (**Figure 2A and G**). Upon opening the air-filled cavities, the strands of fibrous septa were excised. After the loose strands of fibrous tissue were cut, those cavities were re-made into one space. A folded PGA sheet was inserted through the 12-mm port, opened in the thoracic cavity, and then placed at the basal side of the bulla on the raw surface (**Figure 2B, C, and H**). A part of the grasped wall of the bulla was excised with endostaplers, and the basal side of the bulla was left for preserving the lung tissue. We were able to observe the implanted PGA sheet through the wall of the bulla (**Figure 2D, E, F, and I**). It was important that this procedure excised no normal lung tissue and reduced the volume of the air-containing cavity with airtight repair. The PGA sheet inside the bulla prevented air leakage from the stapled margin.

The operation time was 143 min and the intraoperative blood loss was 3 g. The patient was discharged uneventfully. In his pulmonary function test, preoperative expiratory volume in 1 s (FEV_1) was 3.49 L, but postoperative FEV_1 increased to be 4.09 L at 6 months and 4.15 L at 18 months after surgery. Postoperative chest CT at 16 months demonstrated no air-containing cavity (**Figure 1B-D**). At 38 months after surgery, the patient had no symptoms.

Discussion

The method of Naclerio and Langer has been reported to

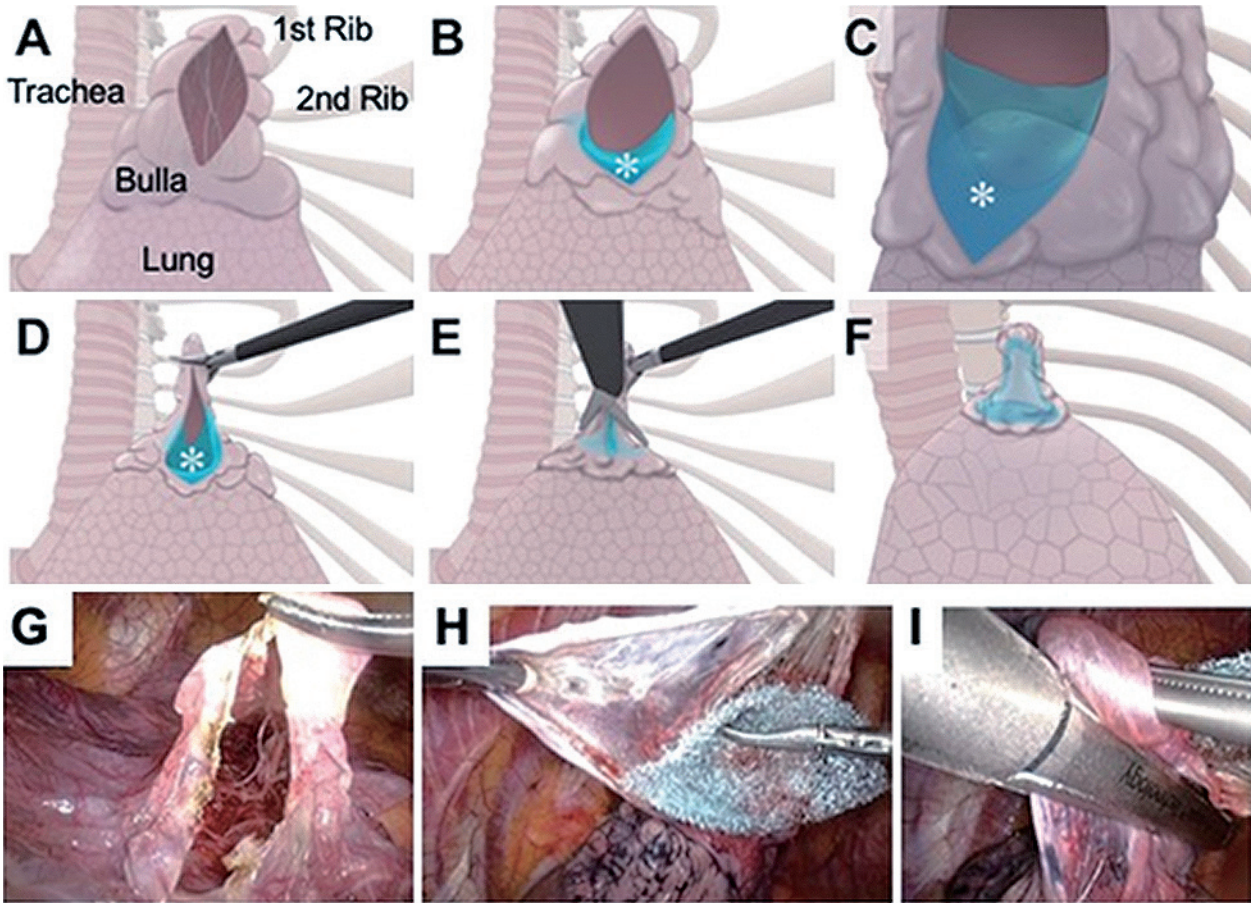

Figure 2. Schematic illustrations of the surgical procedure and photographs during surgery.
(**A**) After multiple bullae were identified, the largest bulla was opened longitudinally with a thoracoscope. (**B**) After the strands of fibrous septa in the bulla were excised, a folded polyglycolic-acid (PGA) sheet marked with an asterisk (*) was opened in the thoracic cavity. (**C**) The PGA sheet was placed at the basal side of the bulla on the raw surface of the lung. (**D**) A part of the wall of the bulla was grasped with endoscopic grasping forceps. (**E**) A part of the grasped wall of the bulla was excised with endostaplers. (**F**) The basal side of the bulla was left in order to preserve the lung tissue. The implanted PGA sheet was observable through the wall of the bulla. (**G**-**I**) All photographs were extracted from digital video data. (**G**) The largest bulla was opened longitudinally. (**H**) The folded PGA sheet was opened in the thoracic cavity and then placed at the basal side of the bulla on the raw surface of the lung. (**I**) A part of the grasped wall of the bulla was excised with endostaplers, and the basal side of the bulla was left intact in order to preserve the lung tissue.

treat giant bullae and diffuse diseases.[1,2] In the operative procedure, bronchial orifices are closed by mattress sutures after opening the air-containing cavities. Subsequently, through-and-through mattress sutures are placed at the basal side of the bulla through the healthy lung tissue to obtain an airtight repair. Finally, the wall of bulla is excised down to the previous suture line, and the lung surface is imbricated with the visceral pleura by suturing the edges of the removed wall of the bulla. Although the development of surgical staplers has made this procedure easier, residual cavities are frequently observed postoperatively, especially in cases with large bullae.[2-5]

Recently, PGA sheets, covered with synthetic-absorbable material combined with fibrin glue, have been used for preventing air leakage after the lung resection of lung cancer or pneumothorax. PGA has been used as absorbable sutures and orthopedic pins in various surgeries. However, PGA is known to induce a strong inflammatory response.[4] As a result, PGA causes pleural adhesion.[5] Previously, we had observed a surgical case of postoperative recurrence of pneumothorax, where the ruptured sites of visceral pleura were widely covered with PGA sheets after thoracoscopic bullectomy for preventing recurrent pneumothorax. Strong pleural adhesion was

found between a part of PGA implantation and the parietal pleura. The adhesion was induced by a local inflammatory response caused by the glycolic acid produced by hydrolysis following the operation. In our case, we utilized this inflammatory response to prevent the development of postoperative residual cavities.

This technique simplified bullectomy, reduced lung air leakage, preserved the healthy lung tissue by avoiding resection, and prevented pleural adhesion.[6] This report describes the preliminarily results of a procedure for closing air pockets (blebs) and preserving the air-filled cavities and the pleuro-pulmonary space, which remained in bulla, by implanting PGA.

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Conflicts of Interest: The authors declare no conflicts of interest.

Author Contributions: Takako Matsumoto and Masato Kanzaki conceptualized this study. All authors performed the procedure and collated this paper as a group. Takako Matsumoto wrote the first draft of the manuscript. Masato Kanzaki reviewed the manuscript. All authors read and approved the final manuscript.

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