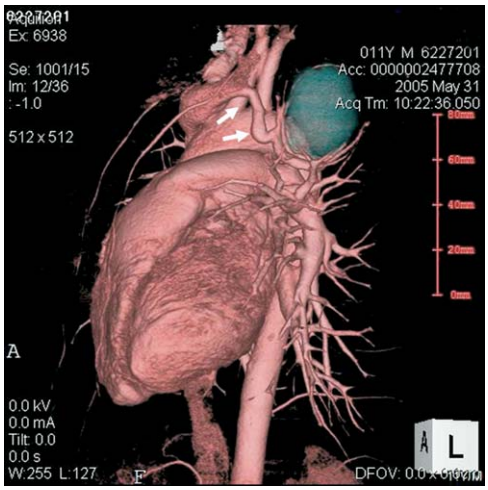

Figure 2. Chest 3-dimensional computed tomography scan showing an afferent vessel from the pulmonary artery in the sequestrated lung segment and reflux of the pulmonary vein into the innominate vein *(arrows).* No aberrant arteries from the aorta were observed.

considered to be a benign disease, and VATS is indicated for its treatment.[3,6] However, attention needs to be paid to abnormal structures such as aberrant arteries and associated malformations. Detailed preoperative identification of aberrant arteries is essential for safe thoracoscopic surgery. Three-dimensional CT is extremely useful for the identification of aberrant arteries, afferent vessels, and reflux vessels, and invasive angiography is not required given current 3-dimensional CT technology. In the present case, 3-dimensional CT without angiography was implemented to precisely characterize the afferent and reflux vessels and to perform VATS safely. VATS is indicated for pulmonary sequestration, and carrying out this operation requires the skills necessary for VATS lobectomy, such as ablation or incision of the pulmonary vessels.

References

1. Felker RE, Tonkin ILD. Imaging of pulmonary sequestration. *AJR Am J Roentgenol.* 1990;155:241-9.
2. Sade RM, Clouse M, Ellis FH Jr. The spectrum of pulmonaru sequestration. *Ann Thorac Surg.* 1974;18:644-58.
3. Gluer S, Scharf A, Ure BM. Thoracoscopic resection of extralobar sequestration in a neonate. *J Pediatr Surg.* 2002;37:1629-31.
4. Pryce DM. Lower accessory pulmonary artery with intralobar sequestration of lung: a report of seven cases. *J Pathol Bacteriol.* 1946;58: 457-67.
5. Clements BS, Warner JO. Pulmonary sequestration and related congenital bronchopulmonary vascular malformations: nomenclature and classification based on anatomical and embryologic consideration. *Thorax.* 1987;42:401-8.
6. Lagausie PD, Bonnard A, Berrebi D, Petit P, Dorgeret S, Guys JM. Video-assisted thoracoscopic surgery for pulmonary sequestration in children. *Ann Thorac Surg.* 2005;80:1266-9.

Postpneumonectomy empyema treated with a combination of antibiotic irrigation followed by videothoracoscopic debridement

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Postpneumonectomy empyema (PPE) is a serious complication in fragile patients. Usual surgical treatment ranges from pleural irrigation[1] to aggressive management with open-window thoracostomy.[2] This study reports a minimally invasive method combining antibiotic irrigation and videothoracoscopic debridement.

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Clinical Summary

Between January 2000 and December 2005, 254 pneumonectomies were performed at our department. PPE confirmed by bacteriologic examination of the pleural fluid developed in 18 patients (7%), 16 men and 2 women with a mean age of 65.2 years. Clinical and bacteriologic characteristics are depicted in Table 1. Seven patients had a neoadjuvant therapy. Pneumonectomy was performed under antibiotic prophylaxis with a second-generation cephalosporin (cefamandole). The mean interval between surgery and PPE was 12 days (2-35 days). After bronchoscopic exclusion of a bronchopleural fistula and bronchial bacteriologic sampling, the protocol consisted of antibiotic irrigation for 10 days (according to culture sensitivity) through two 18F Monaldi chest tubes (Porges, Le Plessis Robinson, France) with simultaneous parenteral antibiotics. Antibiotic lavage was performed through an axillary chest tube twice per day every 12 hours (Figure 1). Aspiration of pleural fluid was performed through an anterior chest tube for 1 hour after lavage. Pleural pression was

TABLE 1. Clinical and bacteriologic characteristics of the study population

Patient	Indication of pneumonectomy	Surgical procedure	Neoadjuvant therapy	Bacterial colonization (cavity)	Identical bacterial colonization (bronchus)	Antibiotic lavage	Hospital stay (d)
1	NSCLC	Pleurolysis + Py	No	*Haemophilus influenzae*	Yes	Am + CA	16
2	NSCLC	Pleurolysis + Py	No	*Staphylococcus aureus*	No	Oxacillin	15
3	NSCLC	Pleurolysis + Py	Yes	*Pseudomonas aeruginosa*	Yes	Ceftazidime	12
4	NSCLC	Py	Yes	*Klebsiella terrigena*	Yes	Cefotaxime	15
5	NSCLC	Py + pericardial prosthesis	No	*Streptococcus pneumoniae*	No	Am + gentamicin	13
6	NSCLC	Completion Py	Yes	*Staphylococcus aureus*	No	Oxacillin	10
7	NSCLC	Completion Py	No	*Streptococcus viridans*	No	Am + gentamicin	10
8	Chronic pulmonary infection	Pleurolysis + Py	No	*Pseudomonas aeruginosa*	Yes	Piperacillin + tobramycin	10 (death)
9	NSCLC	Py + chest wall resection + prosthesis	No	*Streptococcus oralis*	Yes	Am + CA	13
10	Mesothelioma	EPPP + diaphragm and pericardial prosthesis	No	*Staphylococcus aureus*	No	Vancomycin + gentamicin	12
11	Mesothelioma	EPPP + diaphragm and pericardial prosthesis	No	*Staphylococcus aureus*	No	Oxacillin	13
12	NSCLC	Py	Yes	*Streptococcus pneumoniae*	No	Am	13
13	NSCLC	Py	No	*Haemophilus influenzae*	No	Am + gentamicin	27
14	NSCLC	Py + chest wall resection	Yes	*Streptococcus pneumoniae*	No	Am + CA	13
15	NSCLC	Py	No	*Staphylococcus aureus*	No	Oxacillin	24
16	NSCLC	Py + pericardial prosthesis	Yes	*Staphylococcus aureus*	No	Vancomycin + gentamicin	18
17	NSCLC	Py	Yes	*Staphylococcus aureus*	No	Oxacillin	14
18	NSCLC	Completion Py	No	*Pseudomonas aeruginosa*	Yes	Ceftazidime	13

NSCLC, Non–small cell lung cancer; *Py*, pneumonectomy; *EPPP*, extrapleural pleuro-pneumonectomy; *Am*, amoxicillin; *CA*, clavulanic acid.

maintained constant because of the opening of the axillary drain with antibacterial filter during aspiration.

Surgical Procedure

Videothoracoscopy was performed after an instillation of 250,000 UI of streptokinase through a chest tube 2 hours before the surgical procedure. The patient was in a supine position. After removal of the chest tubes, the skin was excised around the drains to prevent chest wall sepsis and to allow the insertion of two 10-mm thoracoports. After pleural debridement and bacteriologic sampling, the bronchial stump was examined and tested with saline serum. A pleural lavage was performed at the end of the procedure.

The success rate of antibiotic lavage was 88.8% (n = 16/18). In 1 patient, videothoracoscopy diagnosed an asymptomatic bronchopleural fistula, which was treated immediately with an open-window thoracostomy. Systematic perioperative bacteriologic examination was also positive in 1 patient, who was treated with antibiotic irrigation for 7 more days.

The mean C-reactive protein level decreased from 236 (107-364) U/L to 53.5 (5-155) U/L after videothoracoscopy. The mean hospitalization stay after empyema diagnosis was 13.9 (13-27) days. One patient (5.5%) died of pulmonary edema during the treatment. There was no reoperation. No early or late recurrence was observed with a mean follow-up of 44.4 (12-71) months. Prosthetic material (polytetrafluoroethylene mesh n = 3, polyglactin mesh n = 3) was conserved in every cases.

Discussion

The 7% rate of PPE that we observed is in agreement with the 2% to 15% rate reported by Deschamps and colleagues.[3] Our protocol is the combination of a standard treatment of PPE and a minimally invasive surgical approach. The videothoracoscopic exploration of the pleural cavity after antibiotic irrigation and fibrinolysis allows direct-control verification of effective tight bronchial stump closure. It also prevents recurrences by removing false membranes and debris, which are a potential source of late infection.

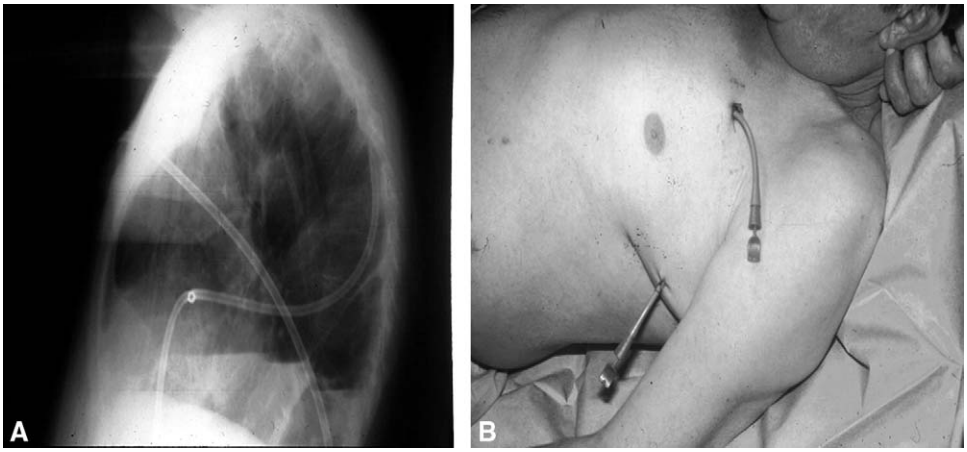

Figure 1. Axillar and anterior chest tube placement for antibiotic irrigation after left-sided PPE. A, Chest x-ray film. B, Position of chest tubes.

Management of PPE based on early thoracoscopic debridement is efficient but has a 27% recurrence rate when open-window thoracostomy is performed with no antibiotic irrigation[4] and has a mean duration of thoracic drainage of 22 ± 9 days when antibiotic irrigation is performed after videothoracoscopy.[5] Compared with these protocols, pleural antibiotic irrigation performed first, rather than videothoracoscopic debridement, provides satisfactory results in terms of hospital stay and number of sepsis recurrences.

Conclusion

The combination of antibiotic irrigation followed by thoracoscopic debridement is a minimally invasive and efficient method to treat PPE and conserve the prosthesis.

References

1. Azorin J, Bah T, Renard JL, De Saint Florent G, Battesti JP. Postpneumonectomy pyothorax with and without broncho-pleural fistula. *Rev Pneumol Clin.* 1988;44:1-5.
2. Schneiter D, Cassina P, Korom S, et al. Accelerated treatment for early and late postpneumonectomy empyema. *Ann Thorac Surg.* 2001;72:1668-72.
3. Deschamps C, Pairolero P, Allen M, Trastek V. Management of postpneumonectomy empyema and bronchopleural fistula. *Chest Surg Clin N Am.* 1996;6:519-27.
4. Gossot D, Stern JB, Galetta D, et al. Thoracoscopic management of postpneumonectomy empyema. *Ann Thorac Surg.* 2004;78:273-6.
5. Hollaus P, Lax F, Wurnig P, Janakiev D, Pridun N. Videothoracoscopic debridement of the postpneumonectomy space in empyema. *Eur J Cardiothoracic Surg.* 1999;16:283-28.