FIGURE 3. Surgical incisions after skin approximation (A) and 6 months after surgery (B).

previously²; however, the addition of balloon occlusion of the outflow graft allowed controlled exchange of the device without the need to surgically control and clamp the graft,³ reducing surgical dissection and potential morbidity. Placement of a Foley catheter into the outflow graft⁴ offers another option of controlling back bleeding from the aorta; however, connecting the outflow graft to the new device can be made difficult by uncontrolled bleeding because the Foley catheter must be removed. Furthermore, deairing of the outflow graft is more difficult with this approach, whereas endovascular control facilitates this process. We advocate a combined

hybrid approach to device exchange in patients for whom minimal surgical trauma is paramount.

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Surgical treatment for secondary pneumothorax in patients aged more than 80 years

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Secondary pneumothorax in elderly patients is usually a refractory condition and sometimes leads to a fatal outcome because of underlying diffuse lung disease, such as emphysema and interstitial pneumonia. Surgical approaches should be considered for these patients after failure of chest drainage or pleurodesis; however, surgeons hesitate to apply surgical

treatment because of concerns related to operative mortality and morbidity. We describe 11 patients aged more than 80 years with secondary pneumothorax who were successfully treated with surgical approaches.

CLINICAL SUMMARY

A total of 171 patients with primary or secondary spontaneous pneumothorax underwent surgical treatment at the NHO Okayama Medical Center between January 2005 and March 2012. Eleven patients (6%) were aged more than 80 years with secondary pneumothorax. **Table 1** summarizes the clinical features of these patients. All patients were male, and the median age at the time of surgery was 81 years (range, 80-95 years). Ten patients had severe emphysema, 2 of whom were also diagnosed with interstitial pneumonia. Two patients were receiving home oxygen

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TABLE 1. Summary of preoperative and postoperative status in patients aged more than 80 years with secondary pneumothorax

Case	Sex	Age (y)	Side	Underlying lung disease	Comorbid disease	Drainage		Operation	Anesthesia	time (min)	Procedure	Drainage (d) after surgery
						PS	score					
1	M	88	R	Emphysema	Bleeding peptic ulcer	1	2	18	G	200	Bullectomy + PGA sheet + fibrin glue	2
2	M	82	R	Emphysema		0	1	4	G	78	Bullectomy + PGA sheet + fibrin glue	3
3	M	80	L	Emphysema	HOT post-RLL	1	1	10	E + L	68	PGA sheet + fibrin glue	3
4	M	80	L	Emphysema		2	3	22	E + L	80	PGA sheet + fibrin glue	6
5	M	81	R	Emphysema, lung cancer		1	3	17	G	70	PGA sheet + fibrin glue	7
6	M	88	R	Emphysema		1	1	8	G	61	Bullectomy + PGA sheet + fibrin glue	1
7	M	80	R	Pneumoconiosis		0	1	28	G	130	Bullectomy + PGA sheet + fibrin glue	2
8	M	81	R	Emphysema, IP		1	1	17	G	81	PGA sheet + fibrin glue	1
9	M	95	R	Emphysema	Heart failure, dementia	3	5	26	G	65	Bullectomy + PGA sheet + fibrin glue	1
10	M	81	L	Emphysema	Brain infarction	1	4	8	G	71	Bullectomy + PGA sheet + fibrin glue	2
11	M	84	L	Emphysema, IP	HOT	2	1	27	G	100	Bullectomy + PGA sheet + fibrin glue	2

M, Male; R, right; L, left; IP, interstitial pneumonia; HOT, home oxygen therapy; RLL, right lower lobectomy; PS, performance status; G, general; E, epidural; L, local; PGA, polyglycolic acid.

therapy. One patient had advanced lung adenocarcinoma. Three patients had poor performance status of 2/3 on the criteria of the Eastern Cooperative Oncology Group scale, and 4 patients scored 3 or more on the Charlson score. All patients were managed with chest drainage before surgery because of persistent air leakage. Chemical pleurodesis was performed before surgery in 7 of 11 patients, but all procedures failed. The median duration of chest drainage until surgery was 17 days (range, 4-28 days). All patients underwent video-assisted thoracoscopic surgery (VATS) with 3 ports, and no cases were converted to thoracotomy. All patients under general anesthesia were extubated immediately in the operating room. Pain was well controlled, and there was no hemodynamic or respiratory instability in 2 patients under local and epidural anesthesia. The median operative time was 78 minutes (range, 61-200 minutes). We performed a minimal repair technique that targeted the active leakage point only. The leakage site was simply covered with absorbable polyglycolic acid (PGA) sheet and aerosolized fibrin glue in 4 patients. In 7 patients, an endostapler was applied at the leakage site, which was reinforced with PGA sheet and fibrin glue (Figure 1). The median duration of postoperative drainage was 2 days (range, 1-7 days). The postoperative courses were uneventful in all but 1 patient (case 8) who had pneumothorax on postoperative day 4. The chest tube was reinserted, and pneumothorax was cured by chemical pleurodesis on postoperative day 20. One patient (case 5) died of lung cancer 8 months after surgery without recurrence of pneumothorax. The other patients had no recurrence during the follow-up period.

DISCUSSION

As life expectancy has increased, the number of elderly patients with diffuse lung disease, especially those aged more than 80 years, who require major surgery has increased. Because of the surgical risk in this population, clinicians tend to avoid surgery or apply less-invasive surgical procedures on the basis of age and comorbidity. However, advances in perioperative care and in surgical and anesthetic techniques have offered surgical therapy for elderly patients with comorbidities and contributed to the favorable results. Several reports on lung cancer surgery in octogenarians have been published that show its feasibility and acceptable outcomes.¹ With careful perioperative management, age alone should not disqualify a patient for surgery.

Reports of the surgical results for pneumothorax in elderly patients have been limited,² and there is no report focusing on octogenarians or the older population. Careful attention is needed when considering the treatment strategy for secondary pneumothorax in elderly patients compared with primary spontaneous pneumothorax in younger patients, who are relatively manageable because of the absence of underlying lung disease.³ Refractory pneumothorax requiring a longer period of chest drainage may result in deterioration of quality of life and induces other medical maladies, especially in elderly patients. After failure of chemical pleurodesis, minimally invasive surgery such as VATS should be applied to these patients to resolve persistent air leakage. "A puncture repair" that applies a patch over the hole using PGA sheets and fibrin glue is a simple and effective procedure to seal pulmonary air leakage. Furthermore, we and others^{4,5} have reported the

FIGURE 1. Representative repair technique (case 9). A, Specific site of air leakage was identified by lung inflation followed by underwater submersion. B and C, Bulla was resected with an endoscopic linear stapler. D, Lung surface around the suture line was covered with a PGA sheet and fibrin glue.

efficacy of VATS under local and epidural anesthesia to avoid adverse effects with single lung ventilation for intractable pneumothorax in high-risk patients. Despite including patients with a poor clinical condition, these surgical procedures were well tolerated in our series and allowed early resolution of pneumothorax without complications.

CONCLUSIONS

The minimally invasive surgical approach is an effective option even in elderly patients with intractable secondary pneumothorax.

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A simple technique of commissural reconstruction in aortic valve-sparing surgery

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Techniques of aortic valve repair have proven efficacy; however, these techniques cannot be used to treat all types of valves. In several instances, valve morphology requires commissural reconstruction (CR) with variable cusp extension. Generally, cusp extension techniques are performed with 2 or 3 distinct pericardial patches, which are joined on the aortic root wall to create the neocommissures.^{1,2} We have developed a method of CR with a single pericardial patch, as adapted from a technique described by Tolan and colleagues³ in 1997.