TABLE 1. Ten years of awake thoracic surgery with local or epidural anesthesia

Indications	Year	N	Morbidity (no.)	Mean hospital stay (d)	Mean global operating room time (min)	Shift to general anesthesia (no.)
Pulmonary nodules (median and IQR)	2004	30	1 (3.3%)	2.0 (2–3)	65 (56–72)	2 (6.6%)
Bilateral sympathectomy (mean $\pm$ SD)	2005	15	—	1.0	86.5 $\pm$ 5.7	—
Nonresectional lung volume reduction (mean $\pm$ SD)	2006	12	3 (25%)	7.8 $\pm$ 5	88 $\pm$ 12	1 (8.3%)
Pneumothorax (mean $\pm$ SD)	2007	21	3 (14.2%)	2.0 $\pm$ 1.0	78 $\pm$ 20	—
Lung metastases (median and IQR)	2007	14	1 (7.1%)	2.5 (2–3)	62.5 (55–70)	—
Decortication (median and IQR)	2010	19	6 (31.6%)	6 (5–7)	50 (40–70)*	4 (21%)

IQR, Interquartile range. *Intraoperative time.

general conditions.² In response to the surgeon's suggestions, the patient can spontaneously regulate the breath, ventilating more slowly in case of the onset of hypercapnia or more deeply when the re-expansion of the lung is required. Although these actions may lengthen the operative time, they favor lung manipulation and ultimately avoid endotracheal intubation.

Since 2001, we have successfully established a structured program of awake thoracic surgery conducted with local or epidural anesthesia.³ Apart from pneumothorax, we have obtained excellent results for such other conditions as pleural decortication in empyema thoracis⁴ and nonresectional surgery for advanced emphysema⁵ (Table 1). We have thus become familiar with procedures performed in hypoxic patients, who represent the optimal candidates for awake surgery as well as the most tolerant of intraoperative hypercapnia.

It is our understanding that operating with a breathing lung can represent a conceptual obstacle for many thoracic surgeons. However, they should consider more often the possibility of working with a lung in movement and gain practice with this new situation. We have found that the learning curve for surgeons well trained in video-assisted thoracoscopic surgery is not longer than that required for any other new endoscopic procedure. Similarly, with the increases in the surgical proficiency, we found increasingly higher postoperative satisfaction levels of both patients and their referring physicians.

In addition, the avoidance of general anesthesia may have significant positive implications for immune response after surgery. We have hypothesized that the lower incidence of postsurgical infections and the attendant lesser rate of morbidity, faster recovery, and shorter hospital stay may be attributable to this condition.⁶ Indeed, a more competent postoperative immunologic response might be considered a useful effect even in surgical oncology, as it would possibly reduce the probability of future relapses. The awake surgical resection of the thoracic neoplasm represents a new and challenging frontier that we have recently undertaken to explore.

To date, we think that surgery performed in awake, spontaneously breathing patients with local and epidural or solely epidural anesthesia may meet all the requirements for a safe and effective use in many procedures of thoracic surgery. We are confident that in the near future it can become part of the routine practice of the thoracic surgeons.

Tommaso Claudio Mineo, MD
Vincenzo Ambrogi, MD
University Tor Vergata of Rome
Department of Thoracic Surgery
Policlinico Tor Vergata
Rome, Italy

References

1. Noda M, Okada Y, Maeda S, Kondo T. Successful thoracoscopic surgery for intractable pneumothorax after pneumonectomy under local and epidural anesthesia. *J Thorac Cardiovasc Surg.* 2011;141:1545-7.
2. Pompeo E, Tacconi F, Mineo D, Mineo TC. The role of awake video-assisted thoracoscopic surgery

in spontaneous pneumothorax. *J Thorac Cardiovasc Surg.* 2007;133:786-90.

3. Mineo TC. Epidural anesthesia in awake thoracic surgery. *Eur J Cardiothorac Surg.* 2007;32:13-9.
4. Mineo TC, Pompeo E, Mineo D, Tacconi F, Marino M, Sabato AF. Awake nonresectional lung volume reduction surgery. *Ann Surg.* 2006;243:131-6.
5. Tacconi F, Pompeo E, Fabbri E, Mineo TC. Awake video-assisted pleural decortication for empyema thoracis. *Eur J Cardiothorac Surg.* 2010;37:594-601.
6. Vanni G, Tacconi F, Sellitri F, Ambrogi V, Mineo TC, Pompeo E. Impact of awake video-thoracoscopic surgery on postoperative lymphocyte responses. *Ann Thorac Surg.* 2010;90:973-8.

doi:10.1016/j.jtcvs.2011.08.046

Reply to the Editor:

We read with interest the letter of Mineo and Ambrogi concerning our novel technique for the surgical management with local and epidural anesthesia of intractable pneumothorax after pneumonectomy. We appreciate all the useful comments that we have received in response to the submission of our article.¹

We initially believed that it might be difficult to approach lesions located near the hilum; however, we are now encouraged by the comments of Mineo and Ambrogi stating that hilar lesions can be approached and treated in awake patients after adequate surgical training. In addition, we have highlighted the importance of identifying any potential air leakage sites before performing thoracic surgery on awake patients. In our own recent study, preoperative thoracography with iopamidol (Iopamiron 300; Schering AG, Berlin, Germany) was therefore performed through a double-lumen chest tube. The appropriate treatment

for each patient should be selected only after precise determination of any air leakage sites.²

Moreover, we agree that avoiding the use of general anesthesia during surgery may have considerable positive implications for the postoperative immunologic response.³ In our own study,⁴ after propensity score matching, the incidence of postoperative respiratory complications including pneumonia and acute respiratory distress syndrome was lower in the epidural and local anesthesia groups than in the general anesthesia group. We therefore suspect that perioperative barotraumas caused by mechanical ventilation and aspiration pneumonia caused by suppression of cough reflex in general anesthesia can be prevented. With regard to the respiratory condition of awake patients during thoracic operations, in the series of Pompeo and colleagues,³ lung collapse was most of the times equivalent to that achieved with single-lung ventilation. Although video-assisted thoracoscopic management of pneumothorax in awake patients is feasible and was tolerated in almost all our cases, we could not use this technique in 1 case in which the awake patient had wound pain and respiratory deficiency. From the standpoint of safety, it is very important to control pain in patients while performing surgery without the use of general anesthesia.

We thank Mineo and Ambrogi once again for their informative and encouraging comments on video-assisted thoracoscopic surgery with local and epidural anesthesia. Moreover, we hope that in the future this procedure will play a prominent role in routine thoracic surgical practice.

Masafumi Noda, MD

Yoshinori Okada, MD

Sumiko Maeda, MD

Takashi Kondo, MD

Department of Thoracic Surgery
Institute of Development, Aging and
Cancer
Sendai, Japan

References

1. Noda M, Okada Y, Maeda S, Kondo T. Successful thoracoscopic surgery for intractable pneumothorax after pneumonectomy under local and epidural anesthesia. *J Thorac Cardiovasc Surg.* 2011;141:1545-7.
2. Kurihara M, Kataoka H, Ishikawa A, Endo R. Latest treatments for spontaneous pneumothorax. *Gen Thorac Cardiovasc Surg.* 2010;58:113-9.
3. Vanni G, Tacconi F, Sellitri F, Ambrogi V, Mineo TC, Pompeo E. Impact of awake videothoracoscopic surgery on postoperative lymphocyte responses. *Ann Thorac Surg.* 2010;90:973-8.
4. Noda M, Okada Y, Sado T, Sakurada A, Hoshikawa Y, Endo C, Kondo T. Is there a benefit of awake thoracoscopic surgery in patients with secondary spontaneous pneumothorax? *J Thorac Cardiovasc Surg.* 21 Nov 2011 [Epub ahead of print].

doi:10.1016/j.jtcvs.2011.09.010

ANAORTIC OFF-PUMP CORONARY ARTERY BYPASS GRAFTING: THE CRITERION STANDARD FOR MINIMIZATION OF NEUROLOGIC INJURY

To the Editor:

We congratulate Emmert and colleagues¹ on their study, which shows that avoiding manipulation of the ascending aorta is the most effective method of minimizing neurologic injury during coronary artery bypass grafting (CABG).

The reputation of off-pump CABG (OPCAB) has been damaged by the ROOBY trial,² which failed to show a neurologic benefit when cardiopulmonary bypass was avoided. That trial, however, failed to use the anaortic technique and was performed by surgeons inexperienced in the

demanding OPCAB technique. It is likely that the true benefits of OPCAB were underestimated in this and other studies that did not use the anaortic technique and are better represented by the results presented by Emmert and colleagues.¹

We have recently published a meta-analysis of trials comparing neurologic injury after various degrees of aortic manipulation during CABG: anaortic OPCAB, OPCAB with a side clamp, and conventional CABG.³ The results demonstrated a significant decrease in neurologic injury when manipulation of the ascending aorta was avoided. We have updated the results of the meta-analysis to include those of Emmert and colleagues.¹

When anaortic OPCAB (n = 3158) was compared with conventional CABG (with cardiopulmonary bypass and aortic crossclamping with or without a side clamp for proximal anastomosis of grafts to aorta; n = 10,628), the rate of stroke was 0.41% versus 1.98% (risk ratio, 0.28; 95% confidence interval, 0.16–0.48; $P < .00001$). When anaortic OPCAB (n = 4813) was compared with OPCAB with a side clamp (n = 5581), the rates of stroke were 0.29% and 1.34%, respectively (relative risk, 0.35; 95% confidence interval, 0.19–0.64; $P = .0006$; Figure 1).

The results from the meta-analysis confirm a significant decrease in stroke when aortic manipulation is avoided. In our meta-analysis, we excluded studies that used a device for

FIGURE 1. Revised meta-analysis of stroke risk for anaortic off-pump coronary artery bypass grafting versus off-pump coronary artery bypass grafting with a side clamp. Details of studies used appear in reference 3. *M-H*, Mantel-Haenszel test; *CI*, confidence interval.