placed patients with preoperative Pao₂ as low as 55 mm Hg, simple oxygen addition by a Venturi mask assured an optimal oxygenation throughout the procedure. This is possibly facilitated by the maintained diaphragmatic motion as well as by suprapontine compensatory mechanisms.

Increasing pathophysiologic knowledge and clinical evidence suggest that general anesthesia is not always necessary in thoracic surgery, and in some patient populations awake anesthesia can offer a less morbid, parapsycho-physiologic model of management. We congratulate Noda and coworkers¹ for their interesting series with excellent results and cautious conclusions.

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References

1. Noda M, Okada Y, Maeda S, Sado T, Sakurada A, Hoshikawa Y, et al. Is there a benefit of awake thoracoscopic surgery in patients with secondary spontaneous pneumothorax? *J Thorac Cardiovasc Surg.* 2012;143:613-6.
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. Tacconi F, Pompeo E, Mineo TC. Late-onset occult pneumothorax after lung volume reduction surgery. *Ann Thorac Surg.* 2005;80:2008-12.
4. Pompeo E, Tacconi F, Frasca L, Mineo TC. Awake thoracoscopic bullaplasty. *Eur J Cardiothorac Surg.* 2011;39:1012-7.

doi:10.1016/j.jtcvs.2012.01.083

Reply to the Editor:

We appreciate the useful comments expressed by Dr Pompeo on behalf of the Awake Thoracic Surgery Research Group regarding our recently published original article entitled, "Is There a Benefit of Awake Thoracoscopic Surgery in Patients With Secondary Spontaneous Pneumothorax?"¹ We are grateful for the opportunity to respond to these comments.

We agree that severe air trapping attenuates the effect of atmospheric

intrapleural pressure on ventilation as a result of prolonged exhalation times and the existence of positive end-expiratory pressures in peripheral alveolar regions that may counteract the detrimental effects of pendular ventilation during the awake procedure.

Moreover, we have reported a case of intractable right pneumothorax after left pneumonectomy that was successfully treated with awake video-assisted thoracoscopic surgery under conditions of local and epidural anesthesia.² In this case, the patient maintained spontaneous single-lung breathing throughout the operation with supplied oxygen to maintain functional oxygen saturation greater than 94% because of the prolonged exhalation times and existence of positive end-expiratory pressures in 1 lung.

Although there are a few exceptions, if the lung collapse is extremely progressed under atmospheric pressure conditions and desaturation is recorded during the awake procedure, the lung should be temporarily re-expanded by sucking the air in the pleural cavity through the chest drainage tube.

The vital issue in awake thoracic procedure is the surgical position. Our awake thoracic procedure for intractable pneumothorax is generally conducted in the lateral surgical position, with most of the bubbling alveolar air leakage managed by sucking the air through the chest drainage tube because the air leakage sites can be immediately identified during the awake procedure. If the patients have shoulder or lumbar pain on the contralateral side during awake procedure in the lateral position, the position may be gradually altered to a semilateral or supine position.

Moreover, in patients undergoing awake thoracic procedures for pneumothorax, the surgical technique for controlling air leakage is vital for preventing a recurrence. In all our patients with pneumothorax, the area of ligation or the staple line was reinforced with

nonwoven polyglycolic acid sheets (NEOVEIL; Gunze Co, Ayabe, Japan) or regenerated oxidized cellulose mesh (Surgicel; Ethicon, Inc, Somerville, NJ) and fibrin glue (Bolheal; Chemo-Sero-Therapeutic Research Institute, Kumamoto, Japan).³ This mechanism facilitates thickening of the visceral pleural surface.⁴

We thank Dr Pompeo and his group for their informative and encouraging comments on the awake surgical management of secondary pneumothorax.

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References

1. Noda M, Okada Y, Maeda S, Sado T, Sakurada A, Hoshikawa Y, et al. Is there a benefit of awake thoracoscopic surgery in patients with secondary spontaneous pneumothorax? *J Thorac Cardiovasc Surg.* 2012;143:613-6.
2. Noda M, Okada Y, Maeda S, Sado T, Sakurada A, Hoshikawa Y, et al. A total pleural covering technique in patients with intractable bilateral secondary pneumothorax: report of five cases. *Surg Today.* 2011;41:1414-7.
3. 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.
4. Kurihara M, Kataoka H, Ishikawa A, Endo R. Latest treatments for spontaneous pneumothorax. *Gen Thorac Cardiovasc Surg.* 2010;58:113-9.

doi:10.1016/j.jtcvs.2012.03.042

AN IMPORTANT STEP TOWARD AMBULATORY VENO-VENOUS EXTRACORPOREAL MEMBRANE OXYGENATION To the Editor:

We read with great interest the recently published work entitled, "Ambulatory Veno-Venous Extracorporeal Oxygenation: Innovations and Pitfalls," from the Maryland extracorporeal membrane oxygenation group.¹

First, we congratulate Garcia and colleagues¹ on their clear article,

indicating an important step toward facilitated mobilization on extracorporeal pulmonary support. They described their experience with a new medical device, a double-lumen cannula for single-vessel access in adults that is introduced through the right jugular vein.

Our group in Regensburg, Germany, has gained an extensive experience in extracorporeal life support during the last decade, with currently more than 500 extracorporeal membrane oxygenation cases for respiratory and cardiac support. The Avalon double-lumen cannula (Avalon Laboratories, LLC, Rancho Dominguez, Calif) for respiratory support was introduced in our institution in 2009. As of this writing, 40 patients in our institution have been equipped with this double-lumen catheter. We therefore appreciate the opportunity for some remarks regarding the work of Garcia and colleagues.¹

Similar to the Maryland group, we strongly recommend visual guidance during the implantation of the double-lumen cannula. Cannula placement has the potential to be harmful, damaging crucial structures, including the great veins and the heart. Garcia and colleagues¹ described advancing the tip of the guidewire 2 cm into the inferior vena cava. Our group prefers advancing the guidewire down to the iliac veins if possible, to minimize the risk of guidewire dislocation during implantation of the actual cannula.

We were surprised and at the same time encouraged by the fact that veno-venous support was used successfully in patients with right ventricular failure, because veno-arterial support is generally the preferred mode for the failing right ventricle. Garcia and colleagues¹ did not comment on this new approach in detail. Apparently, in some patients an atrial septal defect was present, acting as a pop-off shunt for the right ventricle.

Garcia and colleagues¹ noted that they did not use the double-lumen

cannula in patients with a body surface area greater than 2.0 m². Our group has seen a special advantage in the use of the double-lumen catheters, especially in morbidly obese patients with a body surface area greater than 2.0 m² and a body mass index greater than 40 kg/m², because cannulation of the internal jugular vein in this patient population is often still possible.

We also remark on the displayed gas transfer. In screening our database, we found the recorded gas transfer rates to have a mean between 200 and 300 mL/min. We have never calculated values above 500 mL/min, however, and according to the manufacturer a gas transfer of 529 mL/min with the Quadrox oxygenator (Maquet Medical Systems USA, Wayne, NJ) is virtually impossible.²

We congratulate Garcia and colleagues¹ for their approach to tunneling the cannula in the neck to prevent infection and dislocation. On the other hand, we are concerned as to whether the correct placement of the cannula might be hindered by tunneling the cannula.

Last but not least, Garcia and colleagues¹ have described an important and significant step toward ambulatory lung support that might be applicable in the future on an outpatient level. For now, however, ambulation on extracorporeal membrane oxygenation is only possible in intensive care settings.

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References

1. Garcia JP, Kon ZN, Evans C, Wu Z, Iacono AT, McCormick B, et al. Ambulatory veno-venous extracorporeal membrane oxygenation: innovation and pitfalls. *J Thorac Cardiovasc Surg.* 2011;142:755-61.

2. Maquet GmbH & Co KG. Maquet Web site. Available at: <http://www.maquet.com>. Accessed December 12, 2011.

doi:10.1016/j.jtcvs.2011.12.068

Reply to the Editor:

We greatly appreciate the comments by Camboni and colleagues in response to our early experience with ambulatory extracorporeal membrane oxygenation. Although the avoidance of groin cannulation with the use of a dual-lumen, single-cannula system for extracorporeal membrane oxygenation is a critical component, we prefer to view ambulatory extracorporeal membrane oxygenation as an overall treatment strategy, rather than simply the use of a new device. We believe that reducing mechanical ventilatory support and encouraging ambulation to minimize ventilator-induced lung injury and deconditioning are vital to better outcomes in this patient population.

In response to the comments concerning cannula placement, we agree that for safe cannula placement, the final stiff guidewire should be placed into the iliac veins; however, our practice is to place an initial soft guidewire into the inferior vena cava. A catheter is then placed over the soft guidewire at least 2 cm into the inferior vena cava. The soft guidewire is then exchanged for a stiff guidewire, which is then advanced to the iliac veins for placement of the cannula. This extra step allows easier and safer advancement of a stiff guidewire across the right atrial-inferior vena caval junction. Moreover, in light of anecdotal reports of atrial perforation with cannula displacement during patient movement in other centers, we favor tunneling the catheter whenever possible. In our experience, which has been guided by the use of fluoroscopy and transesophageal echocardiography, tunneling the catheter has not resulted in any difficulty with catheter positioning.

The Regensburg group also makes a prudent observation with regard to