Esophageal and transpulmonary pressure in the clinical setting: meaning, usefulness and perspectives

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ONLINE DATA SUPPLEMENT

PLeUral pressure working Group – PLUG: aims and members

The PLeUral pressure working Group or "PLUG" is part of the Acute Respiratory Failure Section of the European Society of Intensive Care Medicine (ESICM) and it's active since 2012. The PLUG working group is chaired by Prof. Laurent Brochard from Toronto, Canada with the help of Prof. Jordi Mancebo from Barcelona, Spain, and of Dr. Tommaso Mauri from Milan, Italy. The aims of the working group include:

- Dissemination of knowledge regarding the utility and methodologies for esophageal pressure monitoring;
- Organization of dedicated scientific meetings during the ISICEM (Brussels, Belgium), SMART (Milan, Italy) and ESICM congresses every year to promote discussion of original data and clinical cases including esophageal pressure monitoring among members of the group;
- Promotion of original research on the role of applied physiology approaches to lung ventilator management, including esophageal pressure monitoring;
- Proposal of thematic sessions on esophageal pressure and respiratory monitoring at major international conferences.

PLUG Working Group members include (as of February 24th, 2016):

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ONLINE FIGURE LEGENDS

Figure 1 online. ΔTranspulmonary pressure to guide mechanical ventilation. Percent change of total lung capacity as a function of the changes of transpulmonary pressure. The curve is derived from Mead and Agostoni [ref. 1-2 online]. The status of the collagen (strings), and elastin (spring) in the extracellular matrix when transpulmonary pressure increases is derived from Weibel [ref. 3 online]. The specific elastance values were derived from Chiumello [ref. 4 online]. As shown, V_0 (the functional residual capacity) in the Handbook of Physiology is 35% of the Total lung capacity when the collagen is completely unfolded. The specific lung elastance is around 12 cmH_2O indicating that, at this level of transpulmonary pressure the lung volume doubles. Note that in the Mead cartoon the transpulmonary pressure is expressed as absolute values, while we used the Δvalues. Furthermore, in this cartoon, the total lung capacity is made equal to $3\times V_0$, while experimentally we found, during anesthesia and paralysis, that it equals $2.5\times V_0$. The overall picture is made to present the concept. In the reality, each of the given numbers presents a wide variability.

Figure 2 online. Respiratory effort indices derived from the esophageal pressure analysis during weaning. Esophageal pressure (Pes)–volume loops in a patient at the start (*left panel*) and end of a failed weaning trial (*right panel*). Blue dashed line represent dynamic lung compliance (CL,dyn); green dashed lie represents the chest wall compliance (Ccw). The resistive work is represented as the area (*light blue shading*) to the left of dynamic lung compliance (CL,dyn) line; the elastic work is represented as the area (*blue shading*) between the dynamic lung compliance line and the chest wall compliance line. Total inspiratory work of breathing is the sum of elastic and resistive work. The area (*light brown shading*) to the right of the chest wall compliance line represents expiratory work. Over the course of the trial, patient developed an increase in total inspiratory work of breathing. When partitioned, the increase in inspiratory work was mostly due to an increase in the elastic component. The

increase in elastic work made the clinician suspicious for subclinical pulmonary edema. Accordingly, the patient had a coronary angiography that showed critical obstructions involving the left anterior descending and circumflex coronary arteries. Next, he underwent a balloon angioplasty and stent placement. Two days later, the patient was successfully weaned from the ventilator.

ONLINE REFERENCES

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2 online. Agostoni E, Hyatt R (1986) Static behavior of the respiratory system. In: Handb. Physiol., 2nd ed. American Physiological Society, Bethesda, MD, pp 113–30.

3 online. Weibel ER (1984) The pathway for oxygen: structure and function in the mammalian respiratory system. Harvard University Press, Cambridge, MA.

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ONLINE FIGURES

Figure 1 online.

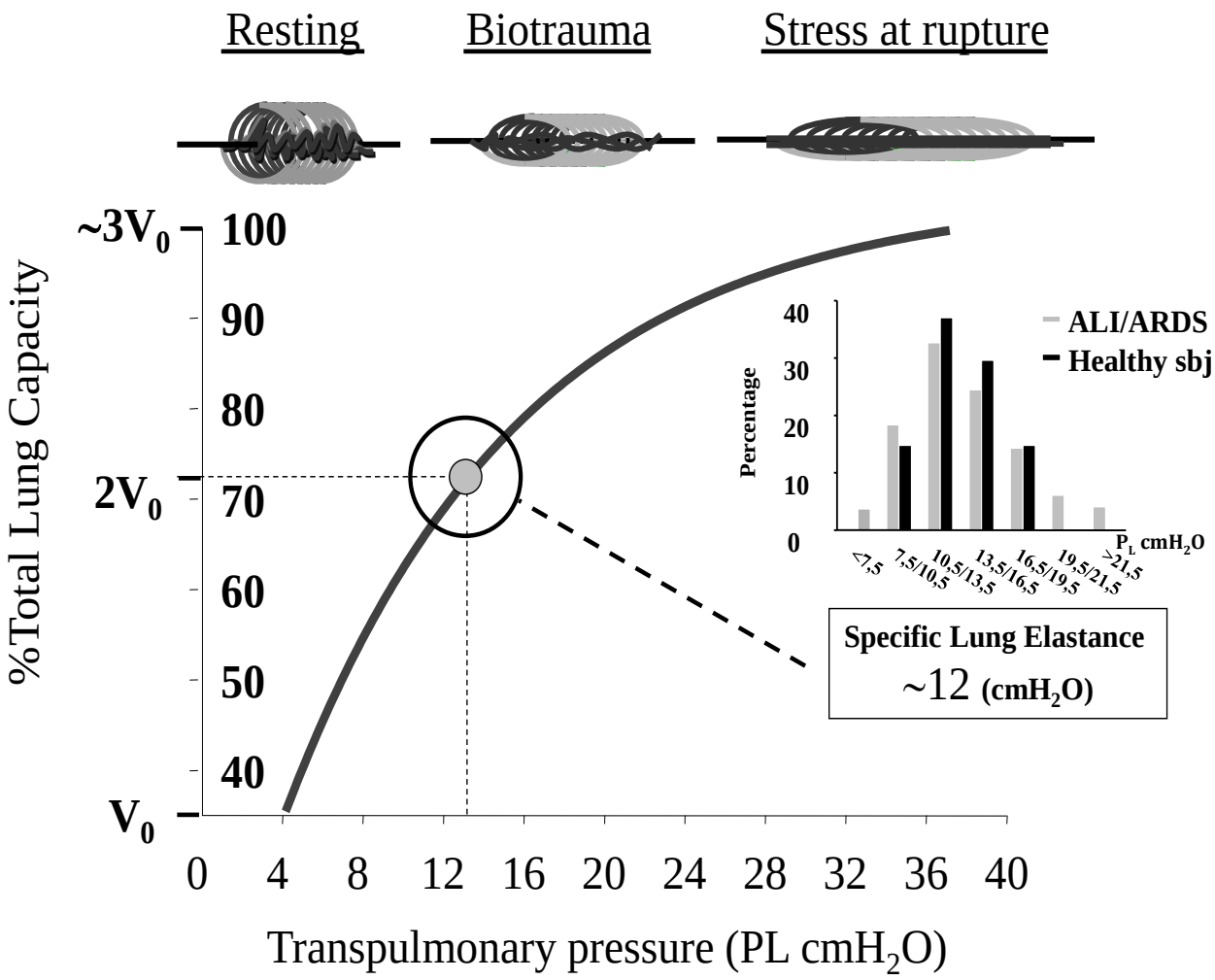

Figure 2 online.