Estimation of Alveolar Pressure Variations during Panting

To the Editor:

Plethysmographic assessment of thoracic gas volume (TGV), using Boyle's law during panting against an occluded airway, necessitates an estimation of alveolar pressure variations (ΔPp). In the widely used method introduced by DuBois et al in 1956,1 mouth pressure variations (ΔPm) are taken as an estimate of ΔPp. However, these authors noted that in the presence of cheek movements "the change in mouth pressure is less than the change in alveolar pressure and lags in time because of a pressure fall across the trachea owing to airflow.

In a recent issue of Chest, Knudson and Knudson2 studied the error introduced by upper airways using a mechanical model and relating ΔPm to pleural pressure variations (ΔPpl). They concluded that "changes in mouth pressure during panting may underestimate changes in pleural, and hence, alveolar pressures." Although the overall conclusion is true, the point we want to make is that, unless lung compliance is infinite as was the case in that particular model, ΔPpl is not equivalent to ΔPp.

ΔPpl was proposed as an alternative to ΔPm for TGV assessment in obstructive patients.3 The theoretical basis of this method has been fully discussed using electrical analogs and the error introduced was found to be smaller than that resulting from DuBois' method in severe airway obstruction.4,5 However, ΔPpl always overestimates ΔPp and the error is magnified by increasing lung volume, lung elastance and extrathoracic airways compliance.4 Therefore, the best method to assess TGV may vary according to mechanical properties of the respiratory system.

To further illustrate this point, we determined ΔPpl/ΔPm in six normal subjects panting at 0.8 Hz both at functional residual capacity and near total lung capacity. ΔPpl/ΔPm was close to unity at functional residual capacity (mean 1.01±0.01 SD 0.01) but largely increased near total lung capacity (1.15±0.08). At both lung volumes ΔPpl was likely to represent ΔPp owing to normal airway resistance, low frequency of panting and cheek support. However, near total lung capacity ΔPpl should largely overestimate ΔPp due to the increase in lung volume and lung elastance.

In conclusion, ΔPm closely reflects ΔPp except in severe airway obstruction. In this case, TGV assessment may be improved by asking patients to support their cheeks and use panting frequencies below 1 Hz.6 If a detectable phase difference between mouth pressure and the volume signal still exists, an error may be present and an alternative method using ΔPpl may then be useful. Another possibility is to decrease airway resistance by using a low density gas mixture.6

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REFERENCES


2 Knudson BJ, Knudson DE. Frequency-dependent phase and amplitude differences between simulated mouth and pleural pressures during panting. Chest 1984; 86:589-91

3 Stanescu DC, Rodenstein D, Cauberg M, Van de Woestijne KP. Failure of body plethysmography in bronchial asthma. J Appl Physiol 1982, 52:939-48


Lights Out!

A Preventable Complication of Endotracheal Intubation

To the Editor:

Endotracheal intubation, a commonly performed procedure, has a low complication rate and is usually well tolerated by the patient.1,2 This case demonstrates a rare complication of nasotracheal intubation and its treatment.

CASE REPORT

A 20-year-old black man sustained multiple injuries during a motorcycle accident. After transport to the emergency room, he was intubated to control the airway. Because a possible cervical spine injury had not yet been evaluated by radiographs, the nasotracheal route was used for intubation and was assisted by use of a laryngoscope for tube positioning. During intubation, the laryngoscope light bulb became disconnected and was aspirated by the patient, without immediate compromise of respiratory function. Radiographs confirmed the bulb position at the opening to the right upper lobe (Fig 1).

That same day the patient was transferred to our hospital for evaluation by neurosurgery for his T12 subluxation. The pulmonary

FIGURE 1. Roentgenogram obtained postintubation shows the position of the aspirated laryngoscope light bulb obstructing the opening to the right upper lobe. The subluxation of T12 is also seen.