

## Réanimation respiratoire : translationnel

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### Inter-Lungs insufflation delay and asymmetrical airway closure assessed by Electrical Impedance Tomography in Acute Lung Injury.

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#### Position du problème et objectif(s) de l'étude:

In acute lung injury losses of aeration can differ between the 2 lungs and EIT can be used to detect and quantify asymmetrical lung injuries [1, 2]. EIT-derived PV curve method can assess the airway opening pressure (AOP) of each lung. Asymmetrical AOPs can be responsible for inter-lungs insufflation delay. The goal of this study was to assess the relation between asymmetrical AOPs and inter-lungs insufflation delay at different PEEP levels.

#### Matériel et méthodes:

This prospective study was approved by the appropriate French Ethical Committee (20/42, CPP Est IV) and was registered (NCT04386720). Patients with acute lung injury and airway closure were included. A Pulmovista 500 was connected to an Evita Infinity V500 or V800, Dräger, Germany. Airway closure was considered asymmetrical if the difference of AOP between the 2 lungs was at least 2 cmH<sub>2</sub>O. A low-flow PV curve (without PEEP) with EIT monitoring was drawn for all patients, as previously described [1].

Impedance-Time curves of each lung were recorded during tidal ventilation under passive volume-controlled ventilation at 60 L/min with a PEEP chosen by the attending physician and during the low flow insufflation (6 L/min) for AOP assessment without PEEP.

#### Résultats & Discussion:

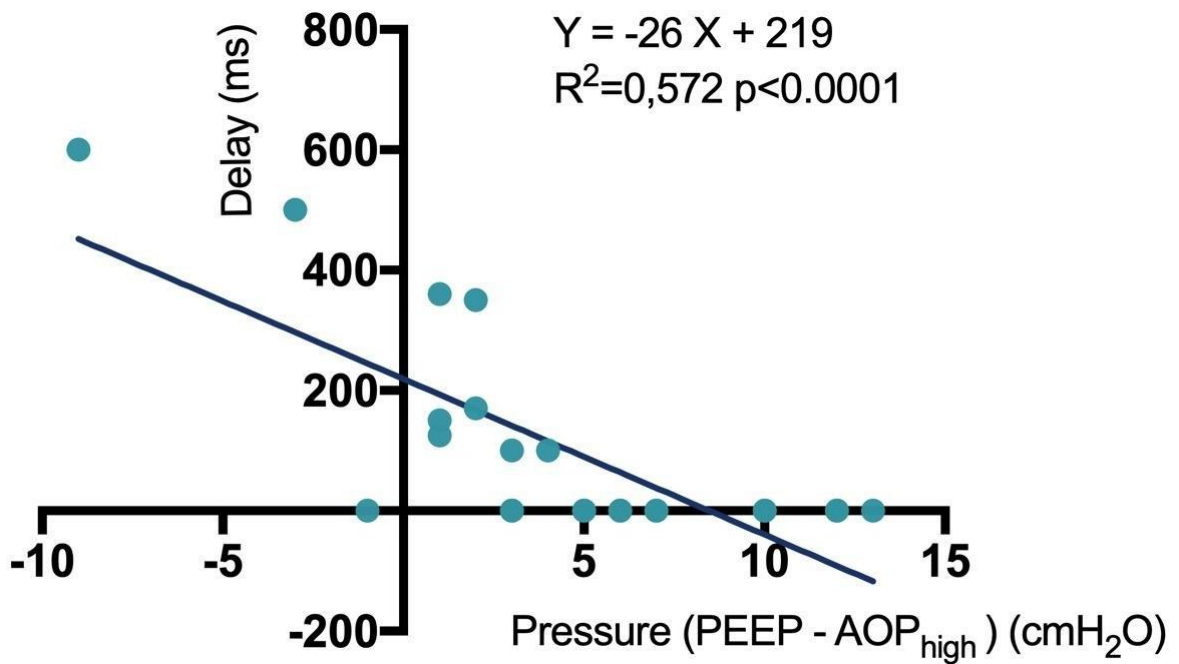
14 patients had symmetrical airway closure with an AOP of 6[2-8] cmH<sub>2</sub>O. 9 patients had asymmetrical lung injury with only 30[25-34] % of tidal ventilation in the sickest lung, AOPs was 10[6-13] cmH<sub>2</sub>O in the sickest lung vs 5[3-9] cmH<sub>2</sub>O in the less injured. The inter-lungs inflation delay during low flow PV curve without PEEP was 0 [0-112] ms in patient with symmetrical AOPs and was 1450 [375-2400] ms and inpatient with asymmetrical AOPs,  $p < 0,0001$ . This delay in the overall population was significantly correlated to the difference of AOP between the 2 lungs,  $R^2 = 0.800$ ,  $p < 0.0001$ . In patients with asymmetrical AOPs, the median inter-lungs insufflation delay with a PEEP of 12 [8-15] cmH<sub>2</sub>O was 150 [50-355] ms and was significantly higher than in patients without asymmetrical lung injury who had 0 [0-62] ms. ( $p = 0.019$ ). The difference between PEEP level and AOP of the sickest lung was significantly correlated with this inter-lungs insufflation delay,  $R^2 = 0.572$ ,  $p < 0.0001$  and figure 1.

#### Conclusion:

With EIT it is possible to assess unilateral or bilateral asymmetrical lung injury, with respiratory mechanics, AOPs, and insufflation delays. The bedside monitoring of the EIT impedance-time curve can help to titrate PEEP in asymmetrical airway closure. The greater the difference of AOPs, the greater the inter-lungs insufflation delay. The overall aim of this approach under controlled ventilation is to set the PEEP in order to reduce the delay and limit the adverse effects of mechanical ventilation with poor lung aeration, and ventilator induced lung injury (repeated opening and collapse).

#### Références bibliographiques:

1. Rozé H, Boisselier C, Bonnardel E, et al (2021) Electrical Impedance Tomography to Detect Airway Closure Heterogeneity in Asymmetrical Acute Respiratory Distress Syndrome. Am J Respir Crit Care Med 203:511–515. 2. Bastia L, Rozé H, Brochard L (2022) Asymmetrical Lung Injury: Management and Outcome. Semin Respir Crit Care Med 43:369-378.



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