Combined use of Flusso and Timpel During Ventilatory Circuit Disconnect of a Mechanically Ventilated Patient in ICU:

A Case Report

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Introduction

Disconnection of the ventilation circuit in mechanically ventilated patients is part of the ICU routine, and can occur several times a day, during suctions, transport, or even by accidents. Much has been learned about optimizing mechanical ventilation parameters, but there is little emphasis on disconnecting the ventilation circuit, which can cause lung injury as pulmonary edema, impaired oxygenation, and increased pulmonary vascular resistance[1,2].

The Flusso™ Bypass (MMSI Inc., Rockton, ON) adapter (Figure 1) was designed and developed to safely facilitate planned disconnection of mechanically ventilated patients, allowing the maintenance of positive end-expiratory pressure (PEEP) during the ventilation circuit disconnection[3].

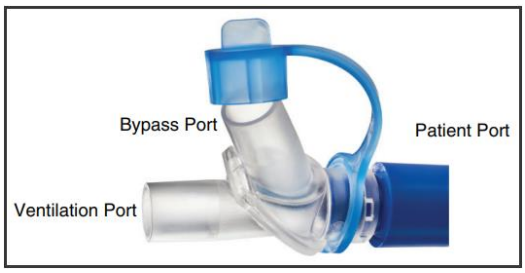

Figure 1. Flusso™ Bypass Adapter.

Timpel is an electrical impedance tomography (EIT) device, which is a noninvasive, radiation-free and real-time imaging method that timely measures ventilation distribution and regional changes in lung volumes. The EIT plethysmogram represents the amount of air that moves in and out of the lungs, and is a waveform derived from the sum of all pixels globally or within a given region of interest (ROI) of a relative image (frame) plotted over time. Thus, EIT is able to identify changes in pulmonary aeration (ΔEELZ) caused, for instance, by PEEP changes (Figure 2)[4,5].

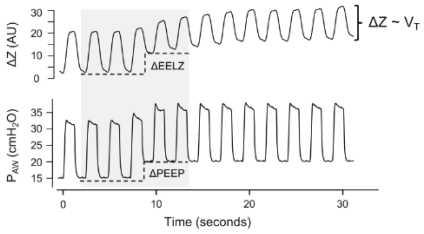

Figure 2. Global plethysmogram and airway pressure (PAW) waveforms. Increment in positive end-expiratory pressure (PEEP) increased end-expiratory lung volume (ΔEELZ).

Case Report

This is the case of a 57-year-old female patient with a previous history of pulmonary hypertension, obesity, asthma, sleep apnea, who had pulmonary thromboembolism after COVID-19 and chronic thromboembolic pulmonary hypertension.

The patient was admitted using an oxygen mask, with low oxygen saturation (86%) and tachypnea (28 breaths per minute). After support with a high-flow nasal cannula without improvement the patient required orotracheal intubation and invasive mechanical ventilation. Following CT exams (Figure 3) the diagnostic hypothesis was chronic thromboembolic pulmonary hypertension decompensated due to pulmonary infection.

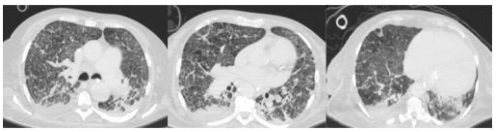

Figure 3. CT at hospital admission.

With a PEEP of 15 cmH_2O, Timpel was installed for lung monitoring. When an open disconnection was necessary for the patient to be taken for exam, through the EIT plethysmogram baseline it was possible to see the EELZ loss globally, and even after

the circuit reconnection, the EELZ did not returned to the level prior to disconnection (Figure 4).

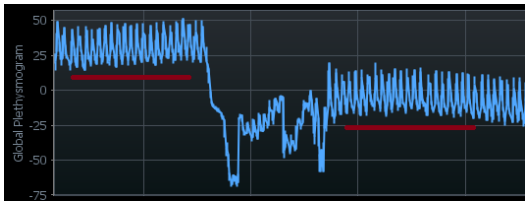

Figure 4. Plethysmogram during open disconnection. The red lines indicate before and after the circuit opening.

Flusso was then installed to keep the PEEP and maintain EELZ and ventilation during disconnection moments.

When a new disconnection was performed, now using Flusso, it was noticed on Timpel's screen how the plethysmogram baseline remained at the same level, which represents the aeration maintenance (Figure 5).

Figure 5. Plethysmogram during disconnection using Flusso. The red lines indicate before and after, whre the aeration/EELZ was maintained, with no aeration loss.

The Figure 6 represents the comparison between the moments before and after the open circuit disconnection and the Figure 7 are the comparison between the moments before and after the circuit disconnections using Flusso.

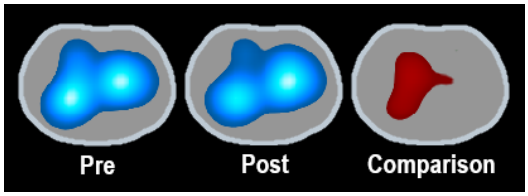

Figure 6. Ventilation maps before and after open disconnection. The red region on the third map represents the area that lost impedance/ventilation between the two moments.

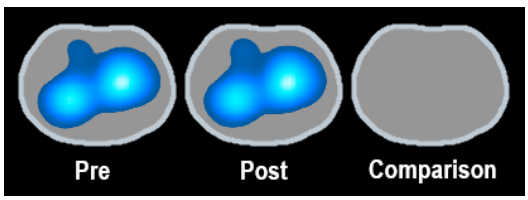

Figure 7. Ventilation maps before and after disconnection with Flusso. As there was no difference between the two moments, the third comparison map does not show losses or gains areas.

Timpel is a lung monitor that displays the ventilation and aeration changes in real time and radiation free, being an important tool for continuous monitoring of lung function, without adding risks to critical patients. Timpel showed how effective the Flusso use is in maintaining ventilation and end-expiratory lung volume, or functional residual capacity, during planned disconnections of the ventilatory circuit, avoiding ventilation and aeration losses and possible lung injury resulting from open disconnections of patients under mechanical ventilation.

References

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