Assessing the variation in respiratory mechanics and lung volumes during percutaneous tracheostomy: focus on Electrical Impedance Tomography monitoring

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Argomento: VENTILAZIONE

Background

Percutaneous tracheostomy (PT) is a frequent maneuver in ICU setting that may lead to a loss of end expiratory volume and gas exchange alteration, role of recruitment maneuver (RM) is uncertain. Electrical impedance tomography (EIT) provides a real-time monitor of volume and ventilation distribution. Our aims are: 1) to monitor respiratory function during PT and 2) to test if a RM at the end of PT may reverse the lung derecruitment.

Material and Methods

Prospective, observational, ongoing study. Patients admitted to the Neuro ICU of Niguarda Hospital who underwent PT were enrolled. EIT monitoring and respiratory mechanics measurements were performed in three steps: a) baseline; b) after PT and c) after a standardized RM (10 sighs of 30cmH_2O*3 seconds each).

Results

18 patients were included in the preliminary analysis, mean respiratory system compliance (Crs) was 62 ± 12 mL/cmH_2O, mean length of the procedure was 16 ± 4 minutes, mean baseline P/F was 289 ± 75 mmHg, median time from onset of mechanical ventilation to PT was 3 [3; 6] days.

PT produced a significant drop in Crs compared to baseline (55 ± 13 vs 62 ± 12 mL/cmH_2O, p<.0001); after RM, compliance increased significantly (70 ± 17 mL/cmH_2O) compared to the previous two steps (p<.0001). The end-expiratory lung impedance (EELI, EIT derived) follows the Crs behavior (DeltaEELI 15.7 ± 25.9 % after RM vs -15.3 ± 25.9 % after PT, p=.037).

Interestingly, in some patients we observed a sudden increase of EELI during fiberoscopy (prior to PT), probably related to dynamic hyperinflation caused by an increase in airway resistance and longer expiration.

Conclusion

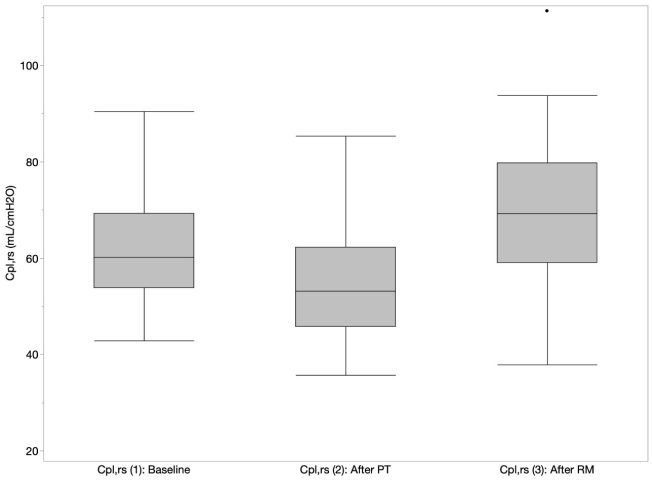
Among patients without lung injury and a short history of mechanical ventilation, a RM can counterbalance the PT-related derecruitment. EIT can be a valuable tool to detect and estimate a fiberoscopy-related dynamic hyperinflation.

Table 1: Characteristics of Study Population

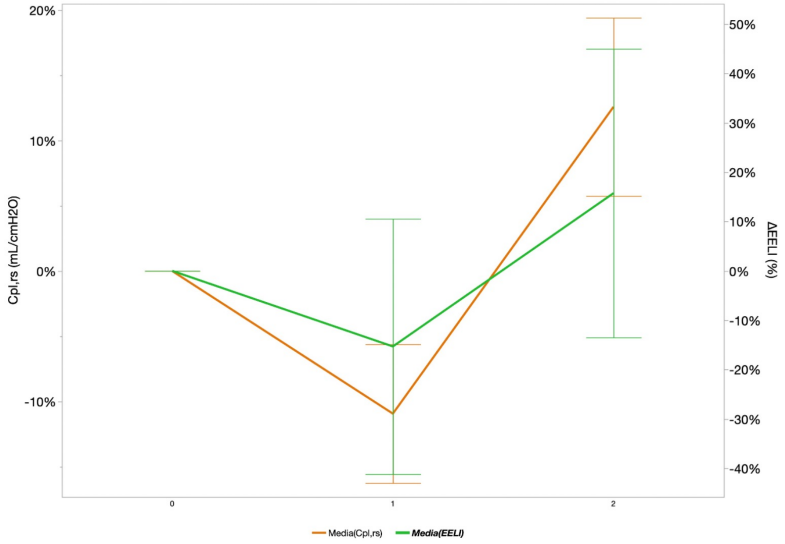
Age (years)	54 ± 18
BMI (Kg/m^2)	25.4 ± 3.4
PEEP (cmH_2O)	6 [5; 8]
Day of tracheostomy*	3 [3; 6]
Cpl,rs (mL/cmH_2O)	62 ± 12
Length of procedure (min)	16 ± 4
P/F (mmHg)	289 ± 75

*Calendar days counted from the day of onset of mechanical ventilation

Box plot showing Cpl,rs in the three steps (Baseline, After PT, After RM)



Variation in mean Cpl,rs and ΔEELI in the three steps (Baseline, After PT, After RM)



Each error bar is constructed using one standard deviation from the mean

Figure showing the variation in EELI during PT maneuver, with a particular focus on the increase in EELI after fiberscope insertion