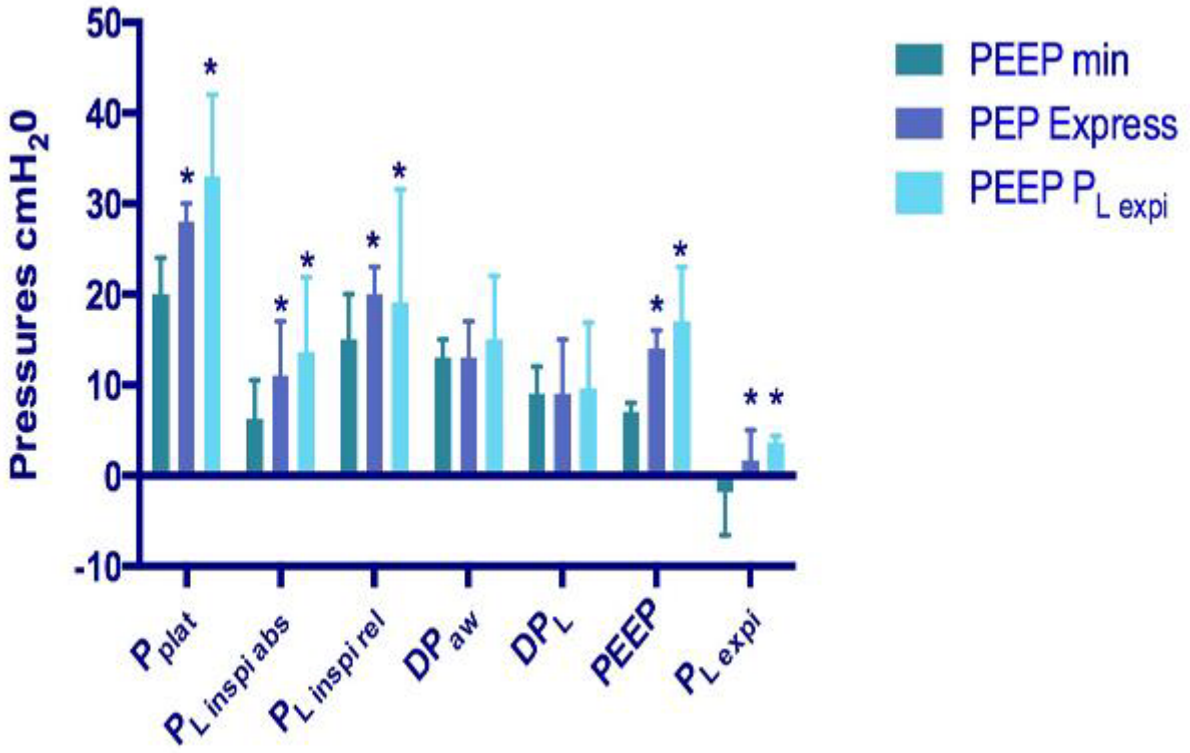
Oral Presentations (6 best abstracts)

001 Positive end expiratory pressure titration using two different targets, plateau pressure or end expiratory transpulmonary pressure in acute respiratory distress syndrome patients

M. Bergez[1], H. Roze[2]
[1]Robert Picque Military Teaching Hospital, Anaesthesia and Critical Care, Villenave d'Ornon, France, [2]Haut Leveque Hospital, Bordeaux University Hospital, South Department of Anesthesia and Critical Care, Pessac, France

PURPOSE. To assess gas exchanges and respiratory mechanics with measurements of transpulmonary pressure (P_L) during individual positive end expiratory pressure (PEEP) titration using two different targets, plateau pressure or moderate positive end expiratory transpulmonary pressure ($P_{L\ expi}$).
METHODS. Prospective study of moderate to severe ARDS patients. Systematic measurement of oesophageal pressure (Pes) was used to estimate P_L. All patients were sedated with myorelaxant. Initial PEEP level was between 5-8 cmH_2O (baseline) and then received in a randomized order PEEP titration based on airway inspiratory plateau pressure (P_{plat}) between 28-30 cmH_2O (Express group) or $P_{L\ expi}$ between 0-5 cmH_2O ($P_{L\ expi}$ group). PEEP induced End expiratory lung volume (EELV) was measured with the nitrogen washin/ washout technique with Engström ventilator (General Electrics, Madison WI, USA).
RESULTS. Results are expressed as median [IQR] (Figure). 19 patients were included. PEEP and oxygenation increased significantly from baseline with both protocols Express (14 [11-16] cmH_2O) and $P_{L\ expi}$, (17 [13-21] cmH_2O), no patient had the same PEEP with both protocols, variation of PEEP between Express and $P_{L\ expi}$, protocols was 4[-3-8] cmH_2O. $P_{L\ expi}$ increased significantly with Express and $P_{L\ expi}$ protocols. 6 patients with the Express protocols had negative $P_{L\ expi}$ -3 [-9--1.6] cmH_2O with PEEP of 14 [8-15] cmH_2O. These patients had a significant lower Crs (25 [16-29] vs 31 [29-39] ml/cmH_2O, p=0.01), and a significant lower EELV (1240 [835-2118] vs 2019 [1700-3045] ml, p=0.04. With P_{Lexpi} protocol in these patients PEEP was increased to 24 [18-26] cmH_2O, Pplat was 40 [33-51] cmH_2O and PaO_2/FiO_2 was higher +31[11-206]%, p=0.06. With $P_{L\ expi}$ protocol alveolar recruitment was higher 222 [9,1-15,5] vs 298,7 [8,7-18,1] ml than with Express but one third of the patients had elastance derived calculation of relative end inspiratory P_L above 25 cmH_2O.
CONCLUSIONS. PEEP titration protocols using plateau pressure or $P_{L\ expi}$ are not interchangeable and a moderate level of P_{Lexpi} might improve recruitment and oxygenation for some patients but does not always prevent $P_{L\ inspi\ rel}$ of being above 25 cmH_2O which might increase the risk of ventilator induced lung injury.
Figure legend: **Comparison to Baseline PEEP 5-8 cmH_20 (Friedman test, p< 0,05)*



[Figure all pressures]

002 Feasibility and validity of an observational scale as a surrogate of dyspnea in non-communicative intubated patients in the intensive care unit (ICU): The Mechanical Ventilation - Respiratory Distress Observation Scale (MV-RDOS)

M. Decavele[1,2], C. Bureau[1,2], S. Campion[2,3], R. Ainsouya[2], J. Mayaux[1], S. Demiri[1,2], M.-C. Nierat[2], M. Raux[2,3], T. Similowski[1,2], A. Demoule[1,2]
[1]Hôpital Pitié Salpêtrière - Sorbonne Université, Service de Pneumologie et Réanimation médicale, Paris, France, [2]Hôpital Pitié Salpêtrière - Sorbonne Université, UPMC Univ Paris 06, INSERM, UMRS_1158 Neurophysiologie respiratoire expérimentale et clinique, Paris, France, [3]Hôpital Pitié Salpêtrière - Sorbonne Université, Département d'Anesthésie Réanimation, Paris, France

INTRODUCTION. In invasively mechanically ventilated (IMV) patient, dyspnea is frequent and severe. The Gold Standard for the measurement of dyspnea in intubated patients is the Dyspnea-Visual Analogic Scale (D-VAS), which involves a self-assessment. However, intubated patients are often unable to reach the level of communication required for its achievement. Unfortunately, physicians markedly underestimate dyspnea in this context, when relying on their subjective perceptions. Alternatively, our team has developed a dyspnea hetero-evaluation scale named IC-RDOS [1], which is reliable to predict severe dyspnea in ICU patients. However, this score has been only validated in communicative ICU patients.
OBJECTIVES. To validate a new dyspnea hetero-evaluation scale, namely the MV-RDOS, in intubated communicative and non-communicative (NC) patients. MV-RDOS was compared to D-VAS in communicating patients and to electrophysiological activity associated with dyspnea such as surface electromyographic (EMG) activity of extra diaphragmatic inspiratory muscles in all patients.
METHODS. Between February 2016 and February 2017, IMV patients with clinical respiratory discomfort were included. The MV-RDOS and EMG activity of the Parasternal and Alae nasi were measured before and after one or two interventions aiming at reducing dyspnea. These interventions consisted in an optimization of ventilator settings followed, if discomfort remained, by the injection of opioids.

RESULTS. 50 patients were included (age 67 [61-76], SAPS II 52 [35-62]); 25 (50%) were NC. Among all patients, MV-RDOS decreased from 5.4 [4.2-6.5] at baseline (BL) to 4.2 [2.1-4.7] (p< 0.001) following ventilator optimization and 2.5 [2.1-4.7] after morphine injection. Concomitantly, we observed a decrease of the EMG area under the curve activity (EMG_{AUC}) of the Parasternal compared to BL (-26% [p< 0.001] and -52% [p< 0.001] after ventilator optimization and morphine injection respectively). Among the 25 communicative patients we observed a positive correlation between the MV-RDOS and D-VAS (r=0,55 [0.33-0.71], p< 0,001). Among NC patients, we found a significant positive correlation between MV-RDOS and Parasternal EMG_{AUC} (r=0.39 [0.14-0.60], p=0.003) and Alae nasi EMG_{AUC} (r=0.37 [0.12-0.58], p=0.004). Moreover we observed a strong positive correlation between the variations of MV-RDOS and EMG_{AUC} after therapeutic interventions (r=0.61 [0.34-0.79], p< 0.001 with the Parasternal EMG_{AUC} and r=0.63 [0.36-0.80], p< 0.001 with the Alea nasi EMG_{AUC}).
CONCLUSION. MV-RDOS is a reliable tool to monitor dyspnea in intubated ICU patients, even in non-communicative ones.
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GRANT ACKNOWLEDGMENT. “Fond de dotation Recherche en Santé Respiratoire” and the “Fondation du Souffle”.

003 Comparisons of esophageal pressure and direct pleural pressures measurments in mechanically ventilated lung transplant recipients

C. Guervilly[1,2], A. Tilmont[1], S. Hraiech[1,2], M. Adda[1,2], R. Rambaud[1], B. Coiffard[1], F. Daviet[1], J.-M. Forel[1,2], X.-B. D'journo[3], L. Papazian[1,2]
[1]Intensive Care Unit, North Hospital, Marseille, France, [2]Center for Studies and Research on Health Services and Quality of Life EA3279, Aix-Marseille University, Marseille, France, [3]Thoracic Surgery and Lung Transplantation Unit, Marseille, France

INTRODUCTION. Esophageal pressure (P_{es}) is a surrogate of pleural pressure ($P_{pleural}$) and may be useful to set ventilator parameters as positive end expiratory pressure (PEEP) and to assess the transpulmonary pressure (P_L). However, esophageal pressure may be rather the estimation of pleural pressures in mid thoracic region and could either underestimate or overestimate the variations of regional P_L.
OBJECTIVES. Main objective of the study was to compare measures of P_{es} by esophageal manometry and direct measures of $P_{pleural}$ in 4 predefined pleural spaces of dependent, nondependent, right and left regions in a cohort of mechanically ventilated transplanted lung patients.
METHODS. After written informed consent, lung transplant recipients were investigated during the post-operative period by esophageal manometry (Nutri Vent, Sidam®) and $P_{pleural}$ by measures through pleural catheters (Pleurocath, Prodimed®) positioned on direct view by the surgeon at the end of the surgery according to predefined pleural spaces. Short time simultaneous continuous recordings of flow, volume, airway pressure (P_{aw}), P_{es} and $P_{pleural}$ were performed using the Fluxmed monitor, MBMed®).
RESULTS. We report here the results of the first nine lung transplant recipients included. We obtained 615 paired measurements of P_{aw}, P_{es} and $P_{pleural}$ in one of the four regions. We found significant correlations between P_{es} and $P_{pleural}$ measured in the four predefined pleural spaces with the highest correlation between P_{es} and $P_{pleural\ anterior\ left}$ (r=0.77, p< 0.01, n=114) (Fig 1) and the lowest correlation between P_{es} and $P_{pleural\ anterior\ right}$ (r=0.53, p< 0.01, n=208). P_L calculated as P_{aw} - P_{es} were lower than those calculated as P_{aw} - $P_{pleural}$ particularly with the sensor localized in the nondependent pleural spaces and can lead to underestimation of local P_L especially during pressure support ventilation (Fig 2).
CONCLUSIONS. Esophageal pressure is a global surrogate of different regional pleural pressures[1]. However, determination of transpulmonary pressure using esophageal manometry during mechanical ventilation with inspiratory efforts can lead to underestimation of regional transpulmonary pressures.
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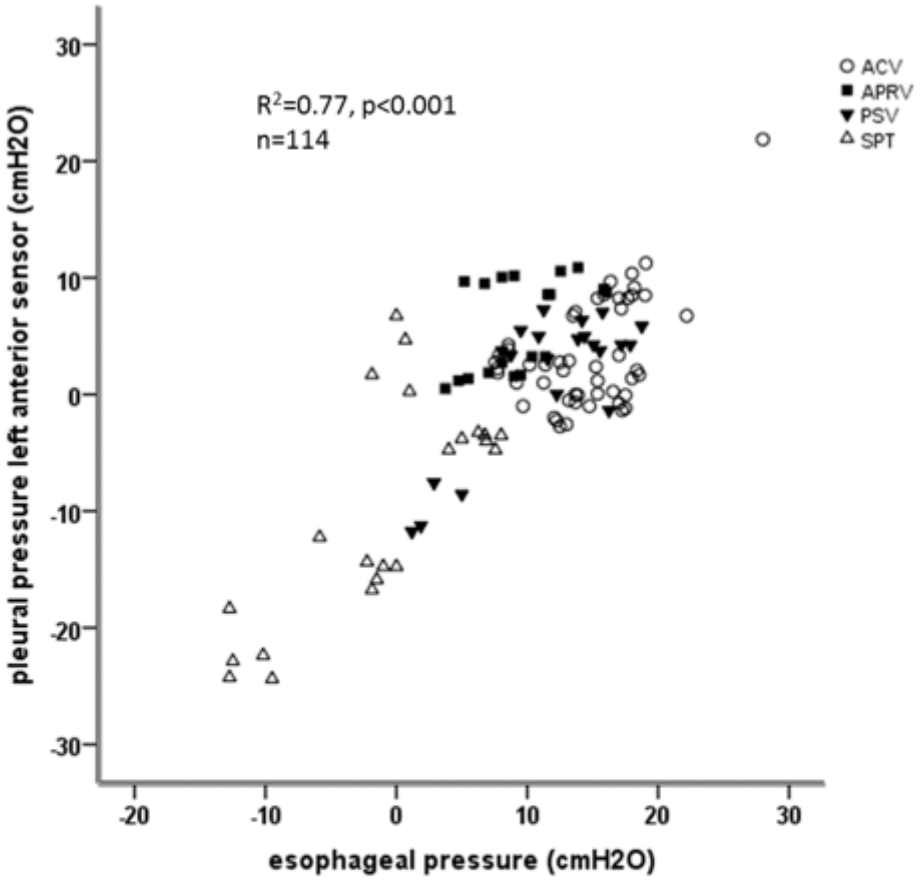
GRANT ACKNOWLEDGMENT. AORC from APHM 2016



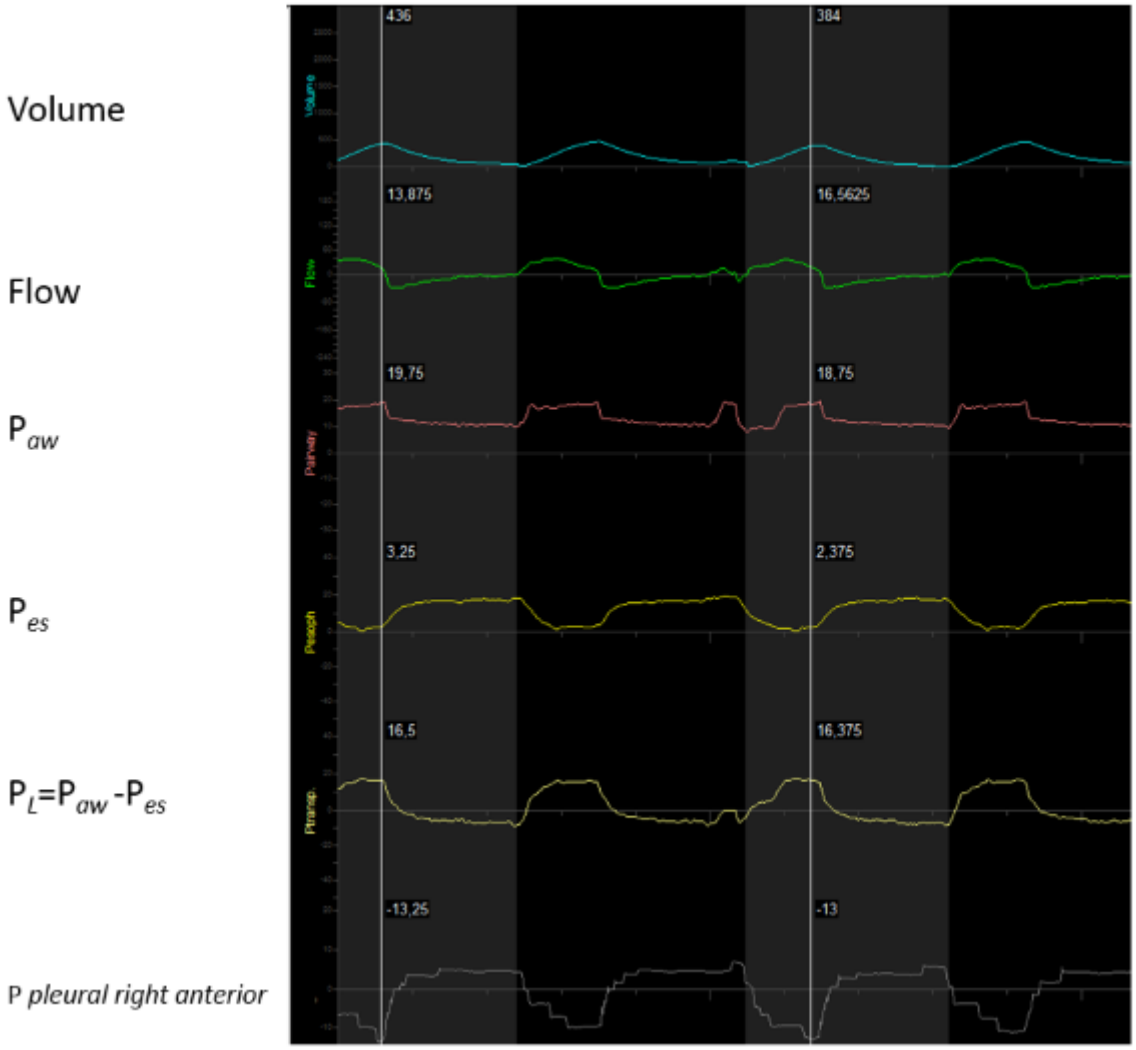
ACV: Assisted controlled volume ventilation

APRV: Airway pressure release ventilation

PSV: Pressure support ventilation

SPT: Spontaneous breathing ventilation

[Correlation between esophageal pressure and pleural pressure (left anterior sensor) according to ven]



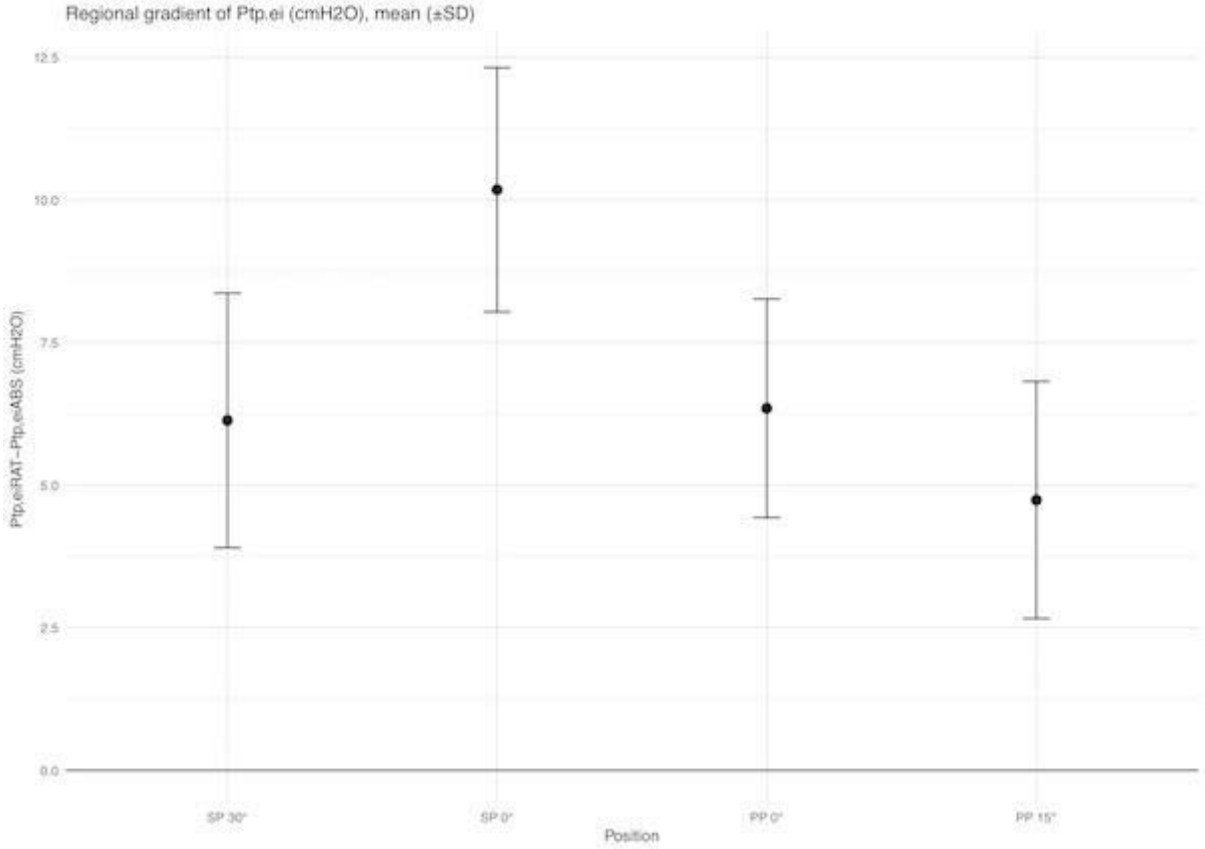
[Wave tracings of volume, flow, airway pressure, esophageal pressure, transpulmonary pressure and ple]

004 Impact of position on the regional gradient of end-inspiratory transpulmonary pressure in ARDS patients

M. Mezidi[1], L. Baboi[1], N. Chebib[1], H. Yonis[1], F. Lissonde[1], L. Kreitmann[1], E. Joffredo[1], J.-C. Richard[1], C. Guérin[1,2]
[1]Hôpital de la Croix-Rousse, Réanimation Médicale, Lyon, France, [2]INSERM 955, Créteil, France

INTRODUCTION. Yoshida et al. [1] recently showed that absolute end-inspiratory transpulmonary pressure (Ptp,eiABS), computed as the difference between airway pressure (Paw,ei) and end-inspiratory Pes (Pes,ei) at the end of inspiration, reflected the Ptp,ei of the dependent lung. On the contrary, the elastance method Ptp,ei (Ptp,eiRAT), computed as Paw,ei multiplied by the ratio of lung to respiratory system elastance, reflected the Ptp,ei of the non dependent lung.
The difference between Ptp,eiRAT and Ptp,eiABS (regional gradient) might therefore reflect lung heterogeneity.
OBJECTIVES. To analyze the variation of the regional gradient in different inclinations and positions in patients suffering from moderate-to-severe ARDS.
METHODS. This is a retrospective analysis of physiologic data of patients included prospectively. With constant ventilator settings, patients were positioned successively in supine position (SP) at 30° and

0° head-of-bed inclination (SP30° and SP0°, respectively) then in prone position (PP) with bed inclination of 0° and 15° procubitus (PP 0° and PP15°, resepctively). Respiratory system mechanics were measured after 10 minutes in each position.
Ptp,eiABS, Ptp,eiRAT and regional gradient were computed as detailed above.
The impact of position was assessed through repeated measures Anova and post-hoc comparisons with the Holm correction. Quantitative data are expressed as mean ±SD. A linear mixed model to predict Ptp,ei was performed using the inclination/position and the method to assess Ptp,ei (absolute and ratio) as fixed effects and the patient as the factor with Random effects.
RESULTS. Data were available for 24 patients. Regional gradient averaged 6±2, 10±2, 6±2 and 5±2 cmH2O in SP30°, SP0°, PP0° and PP15°, respectively (Fig. 1).



[Fig. 1]

Overall P value across the four groups was < 0.001. Pairwise comparisons revealed that SP0° regional gradient was significantly higher than the three other positions (p< 0. 001). The regional gradient was significantly lower in PP15° than in PP0° (p< 0.001).
The results of the linear mixed model is shown in Table 1.

Table 1. Linear mixed model to predict end-inspiratory transpulmonary pressure

Fixed effects	Estimate	P-value
Reference (SP30°, absolute method) (cmH2O)	9±2	<0.001
Position		
SP0° (cmH2O)	-2±1	<0.001
PP0° (cmH2O)	-2±1	0.004
PP15° (cmH2O)	0±1	0.82
Method (ratio) (cmH2O)	7±0	<0.001
Random effect		
Patient standard deviation	3	

SP, supine position ; PP, prone position

[Table 1]

CONCLUSIONS. Regional gradient of Ptp,ei was maximal in SP0° and minimal in PP15° potentially reflecting more inhomogeneity and more homogeneity in the distribution of lung stress in the corresponding positions.

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005 Diaphragm thickening fraction correlates with diaphragm electrical activity in patients under mechanical ventilation

S. Demiri[1], B.-P. Dubé[2], J. Mayaux[1], E. Morawiec[1], T. Similowski[1], M. Dres[1], A. Demoule[1]
[1]Groupe Hospitalo Universitaire Pitié Salpêtrière, Paris Sorbonne, Paris, France, [2]Centre Hospitalier de l'Université de Montréal (CHUM) Montréal, Montreal, Canada

INTRODUCTION. The evaluation of patient's inspiratory effort is helpful to optimally tailor ventilator settings. While diaphragm electrical activity has been proposed as a valuable tool to assess inspiratory effort, it requires a dedicated tool, namely the NAVA (Neurally Adjusted Ventilatory Assist) catheter that is not widely available. By contrast, the use of ultrasound to evaluated diaphragm contractile activity has been growing in the ICU. However, the relationship between diaphragm contractility activity, i.e. diaphragm thickening fraction (TFdi) and diaphragm electrical activity (EAdi) has not been explored so far. Our hypothesis was that TFdi correlates with EAdi.

OBJECTIVES. In the present study, we sought to investigate the correlation between TFdi and EAdi through several conditions of ventilatory assistance.

METHODS. Patients intubated and ventilated for at least 24 h were eligible for inclusion in the study if they had been previously mechanically ventilated with NAVA mode and the NAVA catheter had been left in place. Ultrasound measurements of diaphragm contractile activity were made synchronously with the measurement of maximal EAdi ($EAdi_{max}$) during 6 consecutive, randomly assigned ventilatory conditions (NAVA 1µV/ml, pressure support levels of 5, 10, 15 and 20 cmH_2O (with Positive end exipartory pressure PEEP of 5 cm H_2O), and zero PEEP with 7 cm H_2O pressure support. Overall correlation between $EAdi_{max}$ and TFdi was assessed using Spearman's correlation coefficient. We also sought to determine the correlation between $EAdi_{max}$ and TFdi for each condition.

RESULTS. Nineteen patients [61 (53-73) years old] were enrolled in the study after a median (25-75) IQR) period of mechanical ventilation of 5 days (2-6). Overall, the correlation between TFdi and $EAdi_{max}$ was r=0.34, p< 0.001, as shown in Figure 1. The Spearman's correlation coefficient decreased when the level of ventilatory assistance increased. It was 0.54 (p=0.03) for zero PEEP with 7 cm H_2O pressure support and 0.53 (p= 0.03), 0.53 (p=0.3), 0.34 (p=0.2) and 0.15 (p=0.57) for a level of pressure support of 5, 10, 15 and 20 cmH_2O with PEEP of 5 cmH_2O and 0.38 (p=0.14) in NAVA.

CONCLUSIONS. There was a moderate correlation between diaphragm thickening fraction and diaphragm electrical activity that increased when the level of ventilatory assistance decreased. Our findings suggest that diaphragm thickening fraction behaves as a relevant surrogate of patient's inspiratory effort but the determinants of this correlation deserve further studies.

REFERENCE(S).

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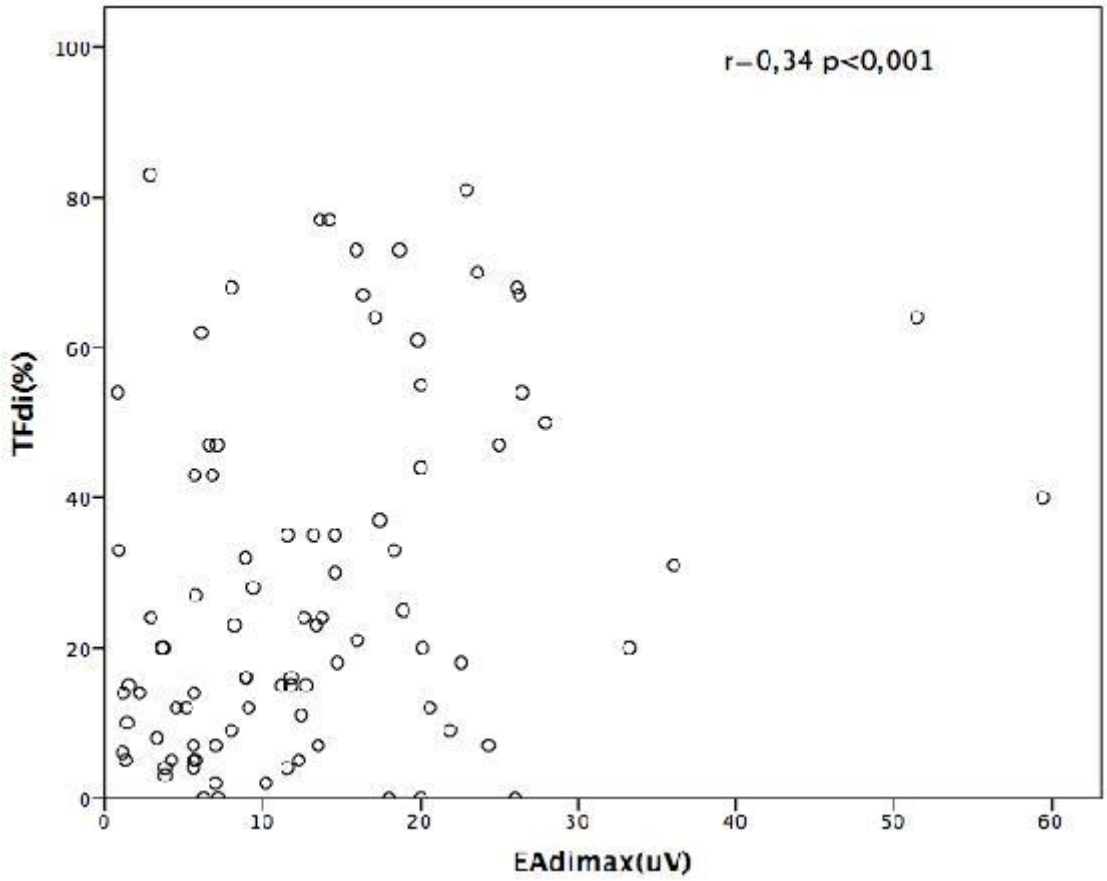


[Correlation between the thickening fraction and the EAdi max.]

006 Propsective validation of ROX index for predicting HFNC success in patients with pneumonia

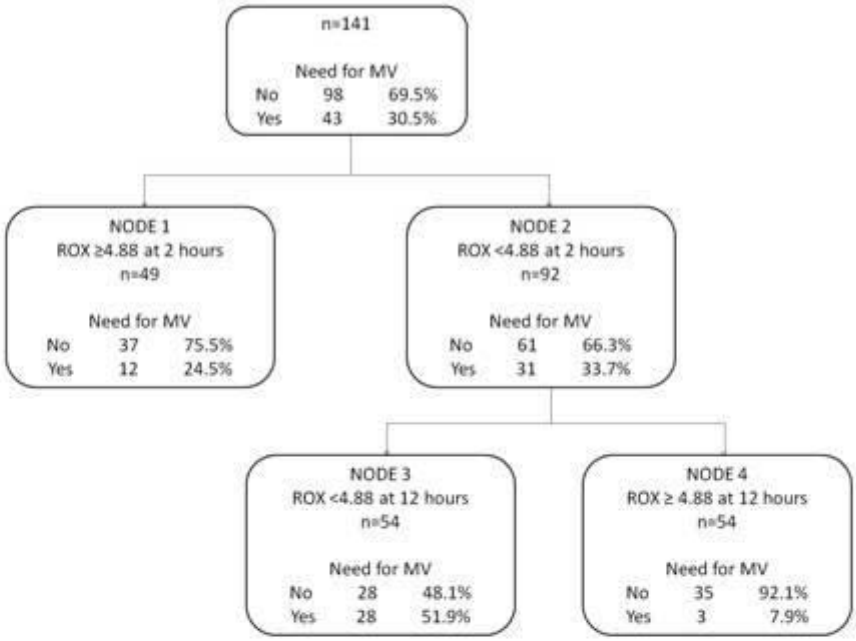
O. Roca[1,2], B. Caralt[1,3], J. Messika[4,5], J.R. Masclans[2,3,6], B. Sztrymf[7], G. Hernández[8], M. Samper[6], M. García-de-Acilu[1], J.-D. Ricard[4,5]

[1]Vall d'Hebron University Hospital and Research Institute, Critical Care Department, Barcelona, Spain, [2]Instituto de Salud Carlos III, Ciber Enfermedades Respiratorias, Madrid, Spain, [3]Universitat Autònoma de Barcelona, Departament de Medicina, Barcelona, Spain, [4]Hopital Louis Mourier, Service de Réanimation Médico-Chirurgicale, Colombes, France, [5]Universite Paris Diderot, Paris, France, [6]Hospital del Mar and Mar Research Insitute (IMIM), Critical Care Department, Barcelona, Spain, [7]Hopital Antonie Bécère, Service de Réanimation polyvalente et surveillance continue, Clamart, France, [8]Virgen de la Salud University Hospital, Critical Care Department, Toledo, Spain

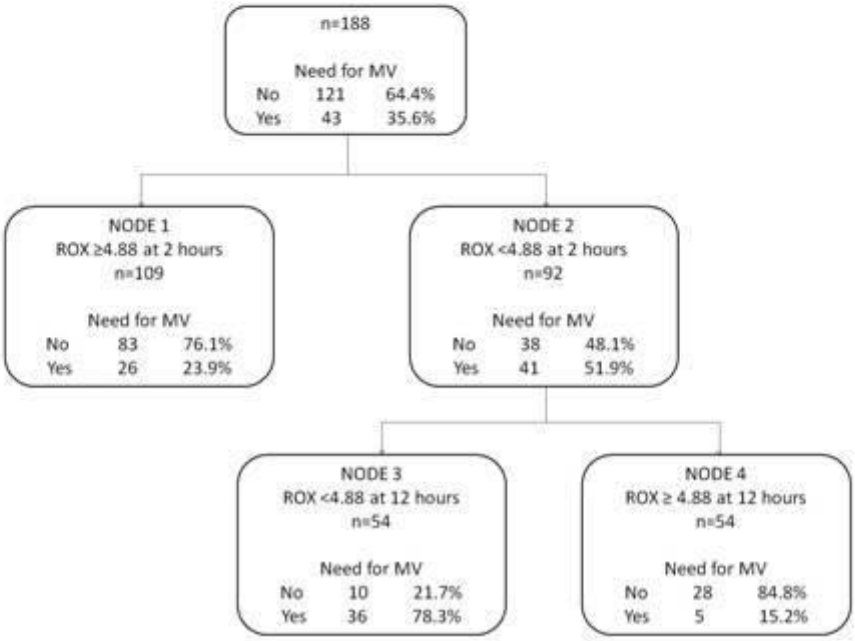
INTRODUCTION. We have recently described the utility of the ROX index, defined as the ratio of SpO_2/F_IO_2 to respiratory rate (RR) that outperformed the diagnostic accuracy of the two variables separately(1) to predict high flow nasal cannula (HFNC) failure.

OBJECTIVES. To prospectively validate the diagnostic accuracy of the ROX index for determining which patients treated with HFNC will need to be intubated in an independent cohort of patients with pneumonia. We also used the ROX index measured at different time points to perform a classification and regression tree analysis (CART). The tree obtained in the training cohort(1) was subsequently validated in the validation cohort.
METHODS. A two-year multicenter prospective observational cohort study including patients with pneumonia admitted in five different ICUs who were treated with HFNC. HFNC failure was defined as the subsequent need for invasive mechanical ventilation (MV). The ROX index was prospectively measured in all the patients. The decision to intubate was left at the physician's discretion. We used the same cut-off of 4.88 for the ROX index we had previously defined(1). To identify if the ROX index was associated with higher need for MV, Cox´s proportional hazards modelling was chosen, while simultaneously adjusting for other covariates. CART analysis was performed on the training set including in a one-step fashion the variable ROX index 4.88 at 2, 6 and 12 hours of HFNC onset. The optimal tree was selected according to its relative misclassification costs, predictive accuracy and clinical relevance. Patients with data missing of both variables included in the tree were excluded from this analysis.
RESULTS. One hundred ninety one were treated with HFNC in the validation cohort, of whom 68 (35.6%) required mechanical ventilation. ROX index ≥4.88 measured at 2, 6 or 12 hours after HFNC initiation was consistently associated with a lower risk of MV, even after adjusting for potential confounding. CART analysis provided a simple algorithm to discriminate three different groups (Figure 1): 1) a high-risk group (ROX index < 4.88 after 2 hours of HFNC and a ROX index < 4.88 after 12 hours of HFNC onset) were intubated from 52% to 78%; 2) intermediate-risk group (ROX index ≥4.88 after 2 hours of HFNC) that have a risk for MV of 24%; and 3) low-risk group (ROX index < 4.88 after 2 hours of HFNC and a ROX index ≥4.88 after 12 hours of HFNC) whose risk for intubation ranged from 8 to 15%. Significant differences in the cumulative risk for intubation between the different terminal nodes of both trees were also observed.
CONCLUSIONS. In pneumonia patients with ARF treated with HFNC, the ROX index can accurately classify the patients according to their risk for intubation. An easy-to-use CART algorithm can help physicians identify those patients with a high risk of intubation and not delay the procedure.
REFERENCE(S).
1. Roca O, et al. J Crit Care. 2016;35:200-5.

a) Training cohort



a) Validation cohort



[Figure 1. CART algorithms of the training and validation cohorts.]