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A physiological systematic review and meta-analysis on positive end expiratory pressure-induced lung recruitment in patients with acute respiratory distress syndrome

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INTRODUCTION. Recruited lung volume (Vrec) elicited by positive end expiratory pressure (PEEP) can be measured by using either CT scan or pressure-volume (P-V) curve method.
OBJECTIVES. The purpose of this study was to perform a systematic review and meta-analysis of Vrec measured by the P-V curve in patients suffered from Acute Respiratory Distress Syndrome (ARDS). Primary aim was prevalence of recruiters (R). The secondary aims were to compare physiologic data and ICU outcome in R and non-recruiters (NR).
METHODS. We conducted a search on PubMed, including all papers published from inception to 30/11/2018 containing the key words: lung recruitment, alveolar recruitment, volume pressure curve, ARDS, PEEP, humans and adult. Two reviewers independently screened all articles. Articles concerning animals, children, case reports and reviews were excluded. We also excluded studies that didn't measure Vrec by PV curve or in which Vrec was not elicited by PEEP. Disagreements were resolved by discussion. Subsequently, same both reviewers extracted data into a predefined case record form. The data of Vrec was obtained directly from the studies or from reported graphs using the GetData Gaph Digitizer software to retrieve values or by contacting directly the authors. Extracted data also included the baseline value of anthropometric variable, ARDS cause, physiologic characteristic of patients, ventilator settings, respiratory mechanics. Patient outcome at ICU discharge was also recorded. We used the threshold of Vrec > 150 ml to define R patients. Data are expressed as mean±SD. The meta-analysis was performed using R (meta package). For the continuous variables we used the mean difference and for the binary variable the relative risk (RR) with their confidence intervals (C.I.) between R and NR. A random effects model was applied for pooling the data.
RESULTS. From a total of 650 studies, 26 were potentially eligible. After full-text evaluation, 16 articles were kept for the present study and included 316 patients. Vrec was measured between PEEP 5 and 15 cmH2O in 6 papers, from 0 to 15 in 4, from 0 to 10 in 3 and from other range in 3. Vrec averaged 373±146 ml in R and 81±33 ml in NR (P<0.001). The prevalence of R was 71% (0.57; 0.82). The pooled data analysis showed no significant difference between R and NR groups for baseline anthropometric variables, PEEP, tidal volume, PaO2/FIO2, FIO2, Simplified Acute Physiology score 2, ARDS cause, and for days in ARDS before the start of the investigation. However, we found a significantly higher compliance (mean difference 9.40 (C.I. 2.26; 16.53) ml/cmH2O) and significantly lower plateau pressure (mean difference 2.41 (4.11; 0.72) cmH2O) in R than in NR. Finally, mortality at ICU discharge was similar in R and NR: 40.7 (40.0; 41.0) vs: 47.8% (41.0; 55.0) (P=0.40, Fisher exact test), RR 1.11 (0.85-1.45).
CONCLUSION. Most of ARDS patients exhibited lung recruitment after increase in PEEP. However, this recruitement did not correlate with any difference in mortality.

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Feasibility and safety of prolonged continuous monitoring with electrical impedance tomography in neonates and infants with respiratory failure

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INTRODUCTION. Multiple studies have shown the potential of electrical impedance tomography (EIT) as a tool for monitoring of regional lung function in neonates and infants with respiratory failure. In this high-risk population, EIT can detect one-sided intubation [1], pneumothorax [2, 3] and identify recruitable atelectasis and overdistension [4]. As all previous studies have used EIT for analyzing short and specific episodes, the feasibility and safety of long-term monitoring with EIT has not yet been established.
OBJECTIVES. To assess the feasibility and safety of continuous EIT monitoring for up to 72 hours in neonates and preterm infants at risk for respiratory failure.
METHODS. In the ´**C**ontinuous **R**egional **A**nalysis **D**evice for neonate **L**ungs´ (CRADL) study (clinicaltrials.gov NCT02962505), we determined the feasibility and safety of continuous EIT monitoring for up to 72 hours in critically ill neonates and infants. We included patients needing supplemental oxygen, non-invasive or invasive respiratory support who were treated in neonatal or pediatric intensive care units. After obtaining written informed consent from the parents or legal representatives, a 32-electrode EIT belt was placed around the patient's chest and connected to an EIT image acquisition system (Sentec BB2, Landquart, Switzerland). At the bedside, investigators were blinded to the EIT findings but were prompted by the device to reattach the EIT belt if a loss in electrode contact occurred. The maximum duration of EIT examinations was 72 hours, but examinations could be terminated earlier, e.g. if the patients were discharged or transferred to another unit.
The study was conducted between November 2016 and March 2019 at four European university hospitals. As a primary outcome parameter, we assessed the overall percentage of EIT examination time with at least 26 out of 32 electrodes exhibiting sufficient skin contact impedance, the minimum required for reliable EIT image reconstruction with the Sentec BB2 system. Numerical results are presented as mean±SD unless otherwise specified.
RESULTS. 200 patients were included in the study. For our preliminary analysis, we included the first 194 data sets of 117 male and 77 female patients with a gestational age of 31±5 (range: 24-42) weeks and postnatal age of 5±15 (range: 0-122) weeks. The most frequent diagnoses explaining the need for respiratory support included

prematurity, respiratory distress syndrome, meconium aspiration and bronchopulmonary dysplasia.
The average duration of EIT measurements was 54±21 hours. The percentage of EIT examination time suitable for analyzing as defined in the primary outcome parameter was 84.7±17.6%. No moderate or severe study-related adverse events were recorded. Minor study-related adverse events included reversible redness of skin or imprint of EIT belt on the patient´s skin.
CONCLUSION. In the CRADL observational study, continuous EIT measurement for up to 72 hours was feasible and safe in a mixed population of neonatal and pediatric critically ill patients with respiratory failure.

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000977

Implications and description of steroid use in ARDS patients - a 1 year retrospective study

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INTRODUCTION. ARDS remains a major cause of morbidity and mortality and standard of care involves the treatment of the underlying cause and supportive care [1]. The Phase III clinical study of a new potential treatment - Interferon beta-1a [2] - yielded disappointing mortality outcomes, in part thought to be related to the concomitant corticosteroid use. Steroids are commonly used for septic shock (SS) and for several indications associated with ARDS. They have been used in ARDS to improve oxygenation and airway pressures, however the effectiveness on ARDS mortality is debatable [3].
OBJECTIVES. We aimed to identify the current ICU practice around steroid use at UCLH in relation to the severity of ARDS as per the international definition and SS.
METHODS. Demographic data, physiologic scores and outcomes, from January 2017 to January 2018 of our 45 bed ICUs, were accessed via the Unit's electronic record system Philips Intellivue. ARDS patients were defined as: mechanical ventilation requirement >48h, ARDS diagnosis stated in medical notes and ARDS severity according to the Berlin definition. SS patients were defined as a noradrenaline requirement.
RESULTS. 56 patients were documented as having ARDS, with 44 (79%) receiving steroids (28-day mortality - 64% on steroids and 25% no steroids). 28 (50%) of all patients had concomitant SS diagnosis (Table 1).
Of those without SS, only 3 (16%) received steroids for ARDS and 1 (5%) for PCP; 15 (79%) did not have a clear indication but the majority were haematological malignancy patients (HMP). Of those with SS, 10 (40%) received steroids per SS protocol, 2 (8%) per ARDS protocol, 1 (4%) for PCP and 13 (52%) did not have a clear indication but again were commonly HMP.
CONCLUSION. Septic shock-related ARDS patients had a higher overall disease severity, mortality and ventilatory support requirement. 79% of patients with ARDS were treated with steroids, mainly not for ARDS indications and appeared to have a higher mortality rate. This high level of steroid use may have implications for trials in ARDS.

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Table 1 (abstract 000977). ARDS severity: in non-SS and SS

	Non-SS N=28	SS N=28
Mild ARDS (N)	3 (11%)	2 (7%)
Moderate ARDS (N)	9 (32%)	9 (32%)
Severe ARDS (N)	16 (57%)	17 (61%)
ICU Length of stay (Mean ± SD, days)	20.2 ± 18.9	16.4 ± 14.7
28-day mortality (N)	10 (36%)	18 (64%) p = 0.056
28-day ventilator-free days (VFD) (Mean ± SD)	4.8 ± 6.4	2.2 ± 4.5

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Left ventricular diastolic dysfunction during the early phase of ARDS: a pilot study

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INTRODUCTION. Left ventricular diastolic dysfunction (LVDD) is quite common in critically ill patients. Echocardiography plays a vital role in identifying diastolic dysfunction at the bedside. It has been demonstrated to have a strong association with weaning failure, abrupt pulmonary edema and sepsis outcome.
OBJECTIVES. Aim of this study is to investigate the prevalence of LVDD during the early phase of acute respiratory distress syndrome (ARDS) and its relationship with lung mechanical properties.
METHODS. We enrolled mechanically ventilated patients within 48 hours after ARDS diagnosis. Demographic characteristics and partitioned respiratory mechanics variables were recorded; CT scan quantitative analysis was performed at two levels of airways pressure for the evaluation of recruitability; functional residual capacity (FRC) was measured by helium technique. Transthoracic echocardiography, including Pulse wave doppler and Tissue doppler imaging, was performed to measure during early left ventricular diastolic phase the velocity of intracardiac blood flow at the tip of mitral valve (E') and the longitudinal excursion of the septal mitral annulus (e'). LVDD diagnosis was made when septal e' < 8 cm/sec.
RESULTS. 10 of 16 patients presented a normal LV function [ND], 6 patients (37.5%) had a LVDD diagnosed [DD], 4 patients had a grade II dysfunction. No significantly differences were reported in terms of demographic, hemodynamics, respiratory variables and CT parameters between groups. DD group presented a significantly higher FRC (756 [450 – 878] mL vs. 403 [116 – 490] mL, P = 0.038) but a higher dead space compared to ND. DD patients demonstrated significantly higher 28 days mortality compared with ND (5/6 = 83% vs. 2/10 = 20%, p = 0.035).