# 276. Non-invasive ventilation: new bricks in the wall

**P2840**
**Efficacy of non-invasive ventilation in cancer patients**
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Prognosis of cancer patients requiring invasive mechanical ventilation (IMV) is poor. Non invasive ventilation (NIV) has been shown associated with better results. The objective of the present study is to compare NIV and IMV in an overall cancer patients population.
47 patients treated by NIV were matched with 47 historical controls treated by IMV. Matching was performed according to 5 variables: type of cancer, leucopenia, allogeneic bone marrow transplantation, SAPS II score and cause of ventilation.
60%, 21% and 19% of the patients had respectively solid tumours, leucopenia and bone marrow transplantation.
72% of the patients were ventilated for hypoxemic respiratory failure, 21% for hypercapnic respiratory failure and 6% for acute pulmonary haemodynamic oedema. NIV was provided by BiPAP Vision ventilator and IMV by Servo or Evita 4 ventilator.
55% and 48% patients treated by NIV versus 27% and 23% treated by IMV were discharged from the ICU and from the hospital respectively. NIV was statistically more effective than IMV in solid tumours, non transplanted and non leucopenic patients. The probability of death in ICU and hospital was statistically higher in the IMV group and in leucopenic patients.
In conclusion, initial NIV is more effective than IMV in cancer patients with acute respiratory failure. If non contra-indicated, NIV should be considered for cancer patients with acute respiratory failure requiring ventilation support, especially for non leucopenic patients.

**P2841**
**Noninvasive ventilation (NIV) in patients with Do-Not-Intubate (DNI) orders: efficacy critically depends on definitions**
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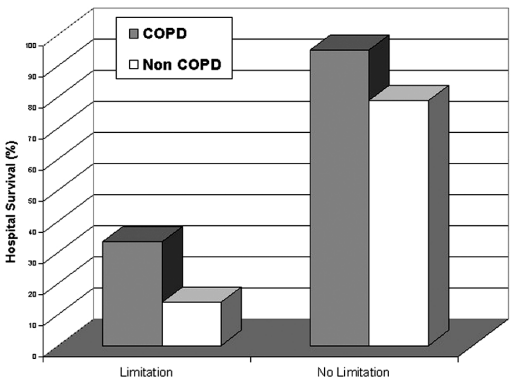
The randomized trials demonstrating benefits of NIV excluded patients with DNI orders, whereas they are frequently treated with NIV in clinical practice. In a recent north-American study, Levy et al. found a 43% hospital survival in DNI patients. Our **hypothesis** was that, due to the very different social and cultural approach, the formal declaration as a DNI patient in a South-European country would select an special population with a very different outcome with NIV. Then, our **objective** was to analyze hospital survival of patients receiving NIV and the impact of DNI orders on survival.
**Material and methods:** Patients admitted from 2002 to 2004 in our medical-surgical ICU. We recorded clinical characteristics, mortality risk, and ICU and hospital outcome. Statistical analysis: Fisher exact test, with odds-ratio and 95% confidence interval calculations.
**Results:** We had 3150 admissions and 251 patients (8%) were treated with NIV with a hospital mortality of 31%, being lower in the 187 patients without DNI orders than in the 64 patients with DNI orders (15% vs. 80%, p<0.001, OR 22,3 (10,2-49,7)), and worse in non-COPD than in COPD patients




**Conclusion:** NIV offers little expectations in DNI patients, being unrealistic in non-COPD patients.
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**P2842**
**CPAP treatment of acute cardiogenic pulmonary edema (ACPE) in very elderly patients**
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We retrospectively analysed 100 patients admitted to our Emergency Dept with ACPE. All patients, treated with standard medical therapy and high-flow CPAP (VitalFlow100, USA), were divided into two groups according to age: Group 1 >80 years (47 patients, mean age: 88.2±4.3) and Group 2 ≤80 years (53 patients, mean age: 70.6±9.06). Mean pH, RR and P/F values in the two groups on admission, after 60 and 180 min were comparable (table). Respiratory acidosis was reversed in both groups within 180 minutes. However, patients over 80 years showed greater intolerance (Gr1=8 vs Gr2=2, p=0.046) and death rate (Gr1=6 vs Gr2=0, p=0.012), as anticipated by SAPS II values (47.4±7.1-Gr1 vs 40.5±8.7-Gr2, p=0.0001). Combined end-point (death, intubation, intolerance and BiLevel ventilation) was significantly higher in Gr1 patients (17-Gr1 vs 7–Gr2, p=0.008, RR = 3.6, 95%CI = 1.35–9.84).

| | T0 | 60' | 180' | |
|---|---|---|---|---|
| pH | 7.23±0.14 | 7.32±0.11 | 7.35±0.09 | Gr1 |
| | 7.24±0.12 | 7.34±0.07 | 7.39±0.06 | Gr2 |
| P/F | 126.7±53.6 | 232.9±99.1 | 250.3±86.3 | Gr1 |
| | 125.4±50.3 | 203.8±99.8 | 287.7±277.1 | Gr2 |

CPAP effects on clinical and physiological parameters are similar in very eldery patients and adults. However, the greater clinical severity on admission, as predicted by SAPS II values, could explain the higher in-hospital mortality observed in the very elderly patients.

**P2843**
**NIV in near-drowning**
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NIV is a supporting tool in patients with acute respiratory failure(ARF).Little is known however about its efficacy in victims of near-drowning, a state of ARF.
We studied 37 victims of near-drowning, 21 males and 16 females aged 15-85 years old, who were hospitalized in a small district hospital without an ICU, during the last three years.
On admission, 25 of the victims were conscious though 12 of them were in a state of confusion.20 patients had moderate to severe hypoxemia with $PO_2$:53.3±8.2mmHg and had limited infiltrations on the chest film.These patients were treated with oxygen administration and standard therapy (rewarming, fluid replacement etc.) and were discharged after an average of 2days hospitalization.
17 patients fulfilled the criteria of ALI or ARDS with extensive, diffuse infiltrations in chest film and very severe hypoxemia $PO_2$:35.3±6.6mmHg resistant to oxygen administration.In addition 12 of them exhibited respiratory acidocis with pH<7.35(7.22-7.34) due to elevated $PCO_2$:47.4±6.9mmHg.NIV was performed to these patients (CPAP or BiPAP) with a mean duration of application 15.8h±17.9h (8h up to 3 days).All patients restored ABG within the first 24hours (8h-18h) and continued with conventional oxygen therapy.The average time of hospitalization of that group was 5.6 days(3d-14d) depending on the severity of complications which set in.Only one patient developed full ARDS, transferred to ICU and finally died.
ARF due to near-drowning is a strong indication for NIV which should be considered as a first line treatment to such patients particularly in district health units not equipped with ICU.

**P2844**
**The outcome of non-invasive ventilation for the severely acidotic COPD patients**
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Non-invasive ventilation is known to reduce mortality in patients with acidotic respiratory failure due to Chronic Obstructive Pulmonary Disease(COPD). British Thoracic Society (BTS) guidelines recommend NIV for patients whose pH ranges between 7.25 and 7.35. There are not enough guidelines for treating patients who are more acidotic (pH <7.25). We compared the outcome of such severely acidotic (A) patients with the less acidotic (B) ones after treatment with NIV.
54 patients were treated with NIV between 2003-04. 15 patients were excluded from the study as excessive oxygen administration was felt to contribute to their

acidosis. Of the 39 patients analysed, 15 patients (male=7; mean age: 68.13 yrs.) had more severe acidosis (pH<7.25, group A). 24 patients (male=12; mean age: 66.43 yrs.) were less acidotic. (pH 7.25-7.35, group B).
In group A, COPD was the main diagnosis in all 15 patients. 8 patients (53.3%) were considered unsuitable for ICU intervention. The mean pH was 7.17±0.05 pre NIV. 14 patients (93.3%) survived to discharge. One patient received invasive ventilation due to failure of NIV.
In group B, 21 patients had COPD and 3 had obesity/hypoventilation. All 24 patients were deemed unsuitable for ICU. The mean pH was 7.29±0.02 pre NIV. 15 patients (62.5%) survived to discharge.
Surprisingly, the outcome was better in the more acidotic group (A) than the less acidotic group (B). Hence NIV should not be denied to the severely acidotic (pH<7.25) patients with respiratory failure, even if deemed unsuitable for ICU.

**P2845**
**High frequency jet ventilation via facial mask: an unusual method of noninvasive ventilatory support**
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In patients who suffer from respiratory failure (RF) but are not yet candidates for invasive ventilation, the application of high frequency jet ventilation (HFJV) via facial mask is an unusual mode of noninvasive ventilation (NIV).
For ventilatory support of patients with RF, we apply HFJV via facial mask (using PARAVENT PAT). We compared results of treatment in alived patients with RF due to acute exacerbation of chronic obstructive pulmonary disease (GOLD III and IV) with HFJV in group I (G I) – 20 patients (mean age 69,8±10,3 yr) and with bilevel positive pressure ventilation (BiPaP - RESPIRONICS) in group II (G II) – 20 patients (73,8±7,3 yr). We focused on changes in $paO_2$ , pH, $paO_2$ /$FiO_2$ and $paCO_2$ before NIV, in 2nd hour, 2nd, 4th,6th day, and at discharge.
During treatment we found continual increase in $paO_2$, pH, $paO_2/FiO_2$ (P <0,0005) and initial increase in $paCO_2$ to 2nd day followed by subsequential decrease (P>0,05) in both groups. We found statistical significant differences between G I and G II in days of application NIV: 5,30±2,08 in G I against 9,05±3,82 in G II (0,01<P<0,05). No statistical significance we found in $paO_2$, pH, $paO_2/FiO_2$ and $paCO_2$ comparing both groups.
According to literature and our results we suppose that HFJV applied via facial mask is good alternative method of NIV. This method used in our work demonstrate to be effective and well tolerated. It is accesible and possible to use it in treatment of patients with RF due to AE COPD.

**P2846**
**Preliminary study of a noninvasive bilevel ventilator algorithm for the automatic adjustment of pressure support, respiratory rate and cycling**
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**Purpose:** Feasibility and tolerance assessment in patients with acute respiratory failure, after initial stabilization, of a prototype algorithm implemented in a bilevel home-ventilation device, designed to maintain a clinician-set minute-volume, provide a backup ventilatory rate, and adjust cycling.
**Methods:** The same ventilator was used, in classical bilevel pressure support (PS) mode (inspiratory pressure titrated to 8-10 ml/kg expired tidal volume, PEEP 5 cmH2O) or with the automated algorithm (autoPS), set to maintain the same minute-volume as in PS. Sequence (measurements at end of each period): 1) baseline (Base 1); 2) 45 min. with PS (PS1); 3) 60 min. without NIV (Base 2); 4) 45 min. with autoPS (autoPS); 5) 60 min. without NIV (Base 3); 45 min. with PS (PS 2).
**Results:** 11 pts (7M:4F), age 72±14 yrs, NIV for acute hypercapnic respiratory failure. PS, minute-volume, and respiratory rate were comparable in all 3 modes.

| mean (SD) | Base 1 | PS 1 | Base 2 | autoPS | Base 3 | PS 2 |
|---|---|---|---|---|---|---|
| Dyspnea VAS | 3.4 (2) | 2.0 (0.9)* | 2.7 (1.8) | 2.3 (0.8) | 2.5 (1.6) | 2.0 (0.8) |
| pH | 7.38 (.03) | 7.41 (.03)* | 7.39 (.04) | 7.43 (.04)* | 7.40 (.04) | 7.45 (.01)* |
| PaCO2 kPa | 7.7 (1.3) | 6.9 (1.6)* | 7.3 (1.0)* | 5.6 (0.9)* | 7.4 (1.0) | 6.7 (1.2)* |

* p < 0.05 vs. corresponding base

**Conclusions:** The autoPS algorithm improved dyspnea and hypercapnia as well as PS, and was well tolerated. Further studies should determine the possible clinical benefits associated with automatic adjustment of bilevel devices, both in the acute and chronic settings.

**P2847**
**Noninvasive ventilation using a mouthpiece and COPD patients with acute respiratory failure. A matched case-control study**
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In patients with chronic obstructive pulmonary disease (COPD), noninvasive ventilation delivered via a facemask or nasal mask (nIPPV) is used in acute respiratory failure (ARF) to avoid endotracheal mechanical ventilation. Noninvasive ventilation delivered via a mouthpiece (mIPPV) has been successfully used in stable chronic restrictive respiratory insufficiency, but not in acutely ill patients. The purpose of this study was to compare the usefulness of mIPPV to nIPPV or a standard medical treatment (SMT) in COPD patients with ARF.
Twenty-nine patients receiving mIPPV were paired with 29 patients receiving either nIPPV or SMT according to age, SAPSII, admission $PaCO_2$ and pH.
At admission, the mean $PaCO_2$ and pH were 78.6±12 mmHg and 7.30±0.04, respectively, in the mIPPV group indicating that encephalopathy was moderate. mIPPV and nIPPV avoided the need for endotracheal intubation in 27 and 25 patients, respectively whereas SMT resulted in a significantly higher mechanical ventilation rate (13 patients). At the end of the protocol, $PaCO_2$ was lower in mIPPV group (62.2±9.6 mmHg) than in SMT group (72.4±20.4 mmHg, p<0.018) leading to a higher pH in mIPPV group (7.41±0.06) than in SMT group (7.34±0.1, p<0.004). No significant differences in $PaCO_2$ and pH were observed between mIPPV and nIPPV groups.
In the case of moderate respiratory acidosis, mIPPV significantly reduces the endotracheal intubation rate and should be recommended as a useful alternative to nIPPV.

**P2848**
**Multicentric survey on the performance of mechanical ventilators at home**
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**Aim:** To assess the performance of home ventilators in an extended sample of patients with chronic respiratory failure.
**Methods:** The study was conducted at the home of 300 patients on ventilation prescribed by 4 university hospitals in Barcelona. The prescribed ventilation settings were compared with the corresponding actual values provided by the ventilator measured by a special purpose portable system (Ventest, Soderel).
**Results:** In volume targeted ventilators (48% of total) the absolute value of the difference (error) between actual and prescribed minute volume (Vmin) was 9.6±13.2% (m ± SD), ranging up to 133%. In pressure targeted ventilators, the error in inspiratory pressure (Pins) was 10.5±11.7%, ranging up to 54%. In 30% of patients the error (in Vmin or Pins) was >10%; in 12% of patients the error was >20%.
**Conclusions:** The results obtained in a sample covering about 50% of patients on home ventilation in the Barcelona area show considerable differences between actual and prescribed ventilation settings and enhance the need for adequate quality control of home ventilation.
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**P2849**
**Physiologic evaluation of high frequency intrapulmonary percussive ventilation (IPV)® in COPD patients with chronic respiratory failure**
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IPV, designed also for mobilisation of secretions, in normal subjects has been shown to guarantee a satisfactory ventilatory support, while increasing diaphragm efficacy (ERJ2004;24:P2009). 10 patients with chronic respiratory failure (PaO2/FiO2=234+43 and PaCO2=49.3+7.7) and excessive secretions underwent to 5 randomised trials of IPV (1.2 bars/250cycles/min=T1; 1.8/250=T2; 1.2/350=T3; 1.8/350=T4), spared by return to baseline, using the IMP2 (Breas,Sweden). Minute ventilation did not vary among the trials, but tidal volumes (VT) were significantly greater during T1,T3 and T4 compared to spontaneous breathing (SB), so that breathing frequency was lower. Diaphragm oxygen expenditure, estimated as Pressure Time Product of the diaphragm (PTPdi) per minute, was also significantly reduced during T1 and T2 (222 cmH20xmin/s for SB vs 138 and 129 for T1 and T2, respectively, p<0.05). Diaphragm efficiency, measured as ratio between the tidal energy expenditure (PTPdi/b) and the corresponding mechanical output (VT), was improved in all the trials and significantly during T2. Tolerance to ventilation and gas-exchange were satisfactory and did not change during the different trials. Only 2/10 patients showed a significant (>1cmH20) expiratory muscle recruitment during the IPV trial. In conclusion, IPV was able to guarantee an adequate ventilation, while improving the efficiency of the diaphragm and decreasing its energy expenditure during the "low frequency" trials, this despite few patients (2/10) showed an increase in expiratory muscle recruitment.

**P2850**

**$CO^2$ rebreathing from a one limb circuit with a fixed leak and without expiratory valve during BiPAP ventilation**

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Single limb circuit with intentionnal leak was introduced for mechanical ventilation in the 90's with the BiPAP device (Respironics®). $CO^2$ rehinalations (rebreathing) may occur from the circuit (Lofaso F et al. Chest 1995; 108:772) with the risk of $PaCO^2$ increasing. This study aims to study the effect of PEEP, VT, f, $CO^2$ET on mean $FICO^2$ (%) with BiPAP ventilation (Synchrony, Respironics® in pressure support in 18 subjects either intubated (n=11) or during non-invasive naso-facial ventilation. Mean FICO2 of each breath is calculated from the records (Biopac MP100, sampling=200Hz) of inspiratoty $CO^2$ concentration and flow (Fleish). Changes of PEEP (4 and 8 cmH2O) and VT (7 and 10 ml/kg) were randomly made in 4 runs lasting 15 min each. For all the measurements (n=22876) $FICO^2$=0.239±0.583, when intubated $FICO^2$=0.280±0.636 (n=6515) and with NIV $FICO^2$=0.163±0.411 (S $p<10^{-5}$). The variation coefficients respectively of 2.4, 2.3 and 2,5 reflect that for some patients the FICO2 may reach values higher than 2%. Regression analysis shows that f/VT, PEEP, $CO^2$ET explain respectively 76%, -17% and 14% of the variation. These results confirm that a) variable CO2 rebreathing exists with BiPAP and single limb intentionally leaking circuit b) all the factor able to induce or increase non intentional leaks decrease the rebreathing c) rapid shallow breathing is the major factor which increases the rebreathing.

**P2851**

**Quantification of inspiratory asynchronisms during non invasive ventilation**

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**Objectives:** To evaluate the occurrence of non-triggered cycles (NTC) during bi-level noninvasive ventilation (NIV) and their relation to the breathing pattern.
**Subjects and methods:** 12 subjects in stable state (4 COPD patients, 4 patients with obesity-hypoventilation syndrome and 4 healthy subjects) were ventilated via a facial mask during six successive 10-min sequences with inspiratory positive airway pressure (IPAP) varying from 10 to 20 cmH20. All other ventilatory settings were kept constant during the sequences. NTC were defined by the presence of an inspiratory flow associated with positive airway pressure inferior to the pre-set IPAP value and were quantified by a Fortran program written by us.
**Results:** Incidence of NTC was 15%, varying from one patient to the other (range 1.7 – 47.8%) but without any correlation with the subject's subgroup or the IPAP values. NTC were associated with lower respiratory frequency, lower minute ventilation and with a lesser extent with an increased inspiratory time.
**Conclusion:** NTC during NIV seem to be related to a lower frequency rate but their clinical significance is limited to patients with an incidence > 10%.

**P2852**

**Long-term home nocturnal (LTHN) noninvasive positive pressure ventilation(NPPV) reduces chronic hypercapnia by acting on $CO_2$ body stores**

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**Background:** LTHN NPPV is considered an useful tool to manage chronic hypercapnic respiratory failure.
**Objective:** to evaluate the effects of LTHN-NPPV on pulmonary gas exchange($P_{A\text{-}a}O_2$ index of V/Q mismatch),PaCO2,CO2 sensitivity and $CO_2$ stores in chronic stable hypercapnic respiratory failure.
**Methods:** in 6 COPD and/or chest wall patients,we measured at baseline and after 8 weeks of treatment: ABG in room air spontaneous breathing; response to $CO_2$ rebreathing ($DV_I/DP_{et}CO_2$) and rate of increase in $P_{et}CO_2$ during rebreathing ($DP_{et}CO_2$/sec) which depends both on metabolic rate and dimensions of fast and intermediate $CO_2$ store compartments:for a constant metabolic rate, greater the size of these compartments, slower the increase in $P_{et}CO_2$ during rebreathing.
**Results:** Baseline ABG data were: $P_aCO_2$ 72.2±8.4mmHg; pH7 .36±0.03; $HCO_3^-$ 39.8±4.3mmol/l; $P_{A\text{-}a}O_2$ 25.4±13.1mmHg. After treatment $P_aCO_2$ and $HCO_3^-$ resulted respectively 59.3±13.3mmHg (p=0.05 vs baseline) and 36.2±3.8mmol/l (p=0.048). pH increased to 7.41±0.03 (p=0.035). $P_{A\text{-}a}O_2$ increased, although not significantly,to 29.2±8.3mmHg. $CO_2$ stores significantly decreased ($DP_{et}CO_2$/sec: 0.12±0.04 vs 0.20±0.03mmHg/sec at baseline; p=0.035). $DV_I/DP_{et}CO_2$ did not change(from 0.23±0.12 to 0.28±0.07ml/mmHg).
**Conclusion:** LTHN NPPV is able to decrease chronic hypercapnia without improving gas exchange nor modifying the control of breathing and alveolar ventilation. This effect seems to depend on a reduction of CO2 stores. It may be interesting to explore if this phenomenon is stable, progressive and really useful.

**P2853**

**Effects of assisted ventilation on brain natriuretic peptide levels in elderly heart failure patients with Cheyne-Stokes respiration**

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Cheyne-Stokes respiration with central sleep apnea(CSR-CSA) is common in patients with chronic heart failure (CHF).There are few data on treating CSR-CSA in patients with CHF.The plasma concentration of BNP has been shown to be independent markers of left ventricular ejection fraction(LVEF) and mortality in patients with heart failure.Our study was to compare the effects of assisted ventilation(Autoset CS,ResMed) on clinical outcomes and BNP levels in elderly patients with heart failure and CSR-CSA.25 consecutive patients with stable heart failure were underwent overnight polysomnographic study,echocardiographic evaluation and 6 minute walk test before and after treatment.In addition to standard therapy,patients with CSR-CSA(n=16) were treated by Autoset CS for 4 weeks.Plasma BNP concentrations were measured by radioimmunoassay.BNP levels were significantly greater in patients with CSR-CSA than in patients without CSR-CSA($p<0.01$).There was positive correlation between BNP and central apnea-hypopnea index(AHI,$r=0.64$,$p<0.05$) in patients with CSR-CSA.Autoset CS treatment was associated with decrease of BNP levels($p<0.05$) and improvement of central AHI($p<0.001$),LVEF and exercise capacity($p<0.01$).Autoset CS is effective in treating CSR-CSA in heart failure patients according to clinical and neurohormonal changes.CSR-CSA should be a target for current heart failure treatment strategies.BNP plasma levels could reflect the level of therapeutic success in patients with heart failure.

**P2854**

**The use of protocols and the role of the multidisiplinary team in weaning patients from mechanical ventilation**

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The aims of this study was to systematically review the literature to investigate whether the use of weaning protocols improves outcome for mechanically ventilated patients, and whether there is a role for the non-physician health care professional in this process. The review also aimed to determine whether the evidence from research undertaken in the USA is transferable to the UK setting. Computerised literature searches were performed in Medline, Cinahl and Embase, as well as hand searching. Randomised controlled trials (RCT's), and (CS's) comparing a prospective group with a historical control group were selected using inclusion and exclusion criteria. Both adult and paediatric studies were considered. 4 outcome groups were analysed – duration of mechanical ventilation, length of stay, weaning success and rate of complications. Comparisons were made between physician-weaned and protocol weaned patients. 6 RCT's and 13 CS's were included in the review. Heterogeneity among studies with regard to population and protocol design precluded pooling of results, but descriptive analysis demonstrated results in favour of the intervention. The evidence supports the use of protocol led weaning in adults, but paediatric studies are limited. The role of the non-physician health professional is also supported, but several changes would need to occur to NHS critical care services if this intervention is to be successfully implemented in the UK.

**P2855**

**Continuous external negative pressure ventilation (CENPV) with the chamber-ventilator - first clinical experiences in 6 intubated patients with ARDS**

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The practicability of tankrespirators is very limited in severely ill intensive care patients. We constructed the chamber-respirator and studied the device in a pilot study. ENPV was compared with continuous positive pressure ventilation (CPPV) in each patient using equivalent time intervals. In 6 ARDS-patients the respirator was used 51 times for a total time of 356 h. The respirator was applied in 1 to 18 intervals for a total time of 7 to 133 h in each patient. During CENPV the median chamber-pressures varied between -28 to -35 cmH2O at inspiration and -14 to -19 cmH2O at expiration. Median positive airway pressures that were applied in addition to CENPV varied from 10 to 21 cmH2O at inspiration and from 0 to 14 cmH2O at expiration. These values were considerably lower compared to the plateau pressures (30 to 41 cmH2O, $p<0.05$) and PEEP-values (16 to 23 cmH2O, $p<0.05$) during CPPV. In 5 patients the mean interval paO2/FiO2-values improved in all 43 applications of the chamber-respirator compared to the prior CPPV-interval. The median paO2/FiO2-values increased 39 to 95 mmHg ($p<0.05$ in 4 patients). After changing from CENPV to CPPV the paO2/FiO2-values decreased in 42 of 51 applications. The chamber-respirator enabled to apply efficiently CENPV in intubated ARDS-patients during routine intensive care. These first clinical experiences provide the basis for controlled studies on CENPV in intubated and not-intubated ARDS-patients.