251. New evidence in home mechanical ventilation

P2085

Hemodynamic effects of non-invasive ventilation in patients with obesity-hyperventilation syndrome

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Background: Although it was occasionally reported that pulmonary hypertension (PH) is more frequent in obesity-hyperventilation syndrome (OHS) patients than in “pure” obstructive sleep apnea syndrome (OSAS) patients, little is known about the haemodynamic repercussion of this entity. The aim of this study was to describe the hemodynamic situation—assessed by echocardiography and six-minute walking test (6MWT)—of patients newly diagnosed with the most severe form of OHS and to evaluate the impact of non-invasive ventilation (NIV) on it.

Methods: We conducted a prospective, descriptive, single-center follow-up study. As baseline, patients underwent echocardiography, sphygmometry, static lung volumes measurement, 6MWT, overnight pulse-oximetry and polygraphic recording. We assessed changes in echocardiographic findings and 6MWT after 6 months of NIV implementation. Right ventricular overload (RVO) was defined by the presence of right ventricular (RV) dilatation, RV hypokinesis, paradoxial septal systolic motion or/and PH.

Results: A total of 30 subjects (20 women; mean age: 69±11 years) were included. The percentage of patients with RVO did not change significantly after NIV (from 43.3% to 41.6%; p = 0.24). Pulmonary artery systolic pressure (PASP) for patients with RVO at diagnosis decreased significantly at 6 months (from 58±11 to 44±12 mmHg; p = 0.014) and the mean distance walked on the 6MWT increased from 110 to 426 ± 78 m (p = 0.006) without significant changes in the body mass index.

Conclusions: PH is a frequent finding in patients with the most severe form of OHS. Treatment with NIV leads to a decrease in PASP and an increase in the distance covered during the 6MWT.

P2086

The effects of non-invasive bilevel positive airway pressure ventilation on insulin resistance in patients with obstructive sleep apnea

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Background: The effects of the noninvasive ventilation on insulin resistance in obstructive sleep apnea (OSA) patients has been elusive. Although there are a lot of trials concerning its effectiveness, data is still conflicting. There is a lack of studies dealing with the results of the bilevel positive airway pressure (BiPAP) therapy.

Materials and methods: Thirteen patients with type 2 diabetes and eighteen with insulin resistance and newly diagnosed OSA (AHl>30) received BiPAP therapy. Patients were followed up for a mean period of 3.9 months (+/-1.5) and had a compliance >80%. The average body mass index (BMI) was 32.8 and the mean AHl = 61.4. Baseline tests - blood glucose, GOMA-index, immunoreactive insulin (IRI), HbA1C were performed and repeated at the end of follow up.

Results: Are given as mean (+/-SD). Blood glucose measurements did not change significantly in none of the groups - type 2 diabetes (5.5+/-1.8 vs. 5.4+/-1.1, p>0.05). insulin resistance (6.4+/-1.1 vs. 6.0+/-1.1, p>0.05). There was a more significant decrease of IRI and HOMA – index the insulin resistance group – (IRI-21.06+/-11.9, vs. 14.46+/-10.1, p<0.05). (HOMA-index – 5.23+/-1.18 vs. 3.47+/-1.12, p<0.05). In comparison the group with type 2 diabetes showed a lesser effect of BiPAP therapy (IRI-26+/-11 vs. 22.5+/-10.9, p>0.05). (HOMA-index – 7.7+/-4.6 vs. 6.0+/-2.7, p>0.05).

Conclusion: BiPAP therapy reduced the insulin resistance in obese OSA patients. The effectiveness was better in patients with insulin resistance than with those already overt type 2 diabetes. HOMA-index seems to be the most sensitive marker for the effect of BiPAP therapy.

P2087

Prevalence of patient-ventilator asynchronies and effects on sleep quality in neuromuscular patients using long term non-invasive ventilation

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Background: There are few studies on the association between asynchronies and arousals in patients using long term noninvasive ventilation (NIV) and among them, only one has been performed on neuromuscular patients. Moreover, in the real life of home ventilated neuromuscular patients sleep fragmentation is probably far from being perfectly corrected.

Objective: The aim of this work was to investigate the prevalence of patient-ventilator asynchronies and their association with sleep quality in stable neuro-muscular patients chronically ventilated after optimization of ventilator setting.

Methods: Eighteen patients were included in the study. Sleep was recorded during ventilator application using standard polysomnography. Physiologic tracings were scored for autotriggerings, patient-ventilator desynchronizations, prolonged insufflations (PI) and respiratory arousals.

Results: Most frequent asynchronies were autotriggerings and desynchronizations (83.3% and 77.7% of patients, median IQR 1.11 (IQR 0.43-2.84) and 0.23 (IQR 0.12-1.00) respectively). Desynchronization was the asynchrony most frequently associated with arousal (median 63.6% IQR 15.91-96.88) followed by autotriggering (median 66%, IQR 90-90%). PI was not frequent and almost never associated with arousal (median 0 IQR 0-100). Asynchronies were significantly correlated with leaks (r=0.49 p= 0.035).

Conclusion: Patient-ventilator asynchronies may still occur in neuromuscular patients receiving home long term NIV and can contribute to sleep fragmentation. Monitoring of quality of ventilation should be included in long term programme of neuromuscular patients.

P2088

Evaluation of inspiratory rise time versus resistances of four home ventilators

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There is no consensus neither literature nor constructor to define inspiratory rise time (Tam) which is equally called “pressure ramp slope” or “pressurization rate”. The purpose of this study was to evaluate on a test bench the Tam of four home ventilators, versus different resistances.

SMARTAIR ST (Airox), TRILIOGY100 (Respironics), VIV040 (Breas, GE) and VPAP III (Resmed) were tested in a bilevel pressure support mode. All TAM available were tested. Simulations were performed on an ASL 5000 (Ingmar Medical, Pittsburgh, USA) which simulates normal and obstructive lung. Tam has been defined as the delay between return to EPAP (Expiratory Positive Airway Pressure) after begin of inspiratory effort and time where pressure reaches 90% of maximal pressure. For each setting versus resistance, value of Tam, and slope of “pressure flow” curves in their segmental pattern, were calculated.

Only Tam of VPAP III and TRILIOGY100 don’t vary according to resistances. However, values measured are always above than specified, particularly TRILIOGY 100. Tam measured for SMARTAIR ST and VIV040 decrease when resistances increase. Pulmonary dynamics can explain this results. In order to control this Tam four strategies are observed. Resmed uses a fixed pressure slope, whereas Breas set a fixed flow slope. SMARTAIR maintain a fixed pressure slope until a preset time (300ms), after which slope vary versus resistances. Lastly, curve’s TRILIOGY
is an exponential. This ventilator seems to improve symptoms of acute and chronic respiratory insufficiency. The method uses a warmed and humidified high flow of air with 20-50 liter per minute (lpm). By using these devices an increase of mean pressure, pressure amplitude and a decrease in pCO2 is observable. This is a first step in elaboration of standardized test lung protocols to control mechanical problems and higher sampling rate. The integration of hardware control of mechanical problems and higher sampling rate. The integration of hardware

| Method: | Healthy volunteers and patients with COPD were included in this study. For detection of volume changes, frequency variations and VE-ratios we used two classical volume measure belts (thoracal/abdominal). The signal was relayed to a polytomograph device. Flows from 20 lpm up to 50 lpm with small, medium and large nasal prongs were tested. To compare the results with a closed ventilation support system, the measurements were also performed with CPAP (6 and 10 mbar) and BiPAP (14/6mbar). We compared the results with values measured during spontaneous breathing. Results: nHF led to a significant decrease in minute volume, tidal volume and breathing rate in healthy volunteers in comparison with spontaneous breathing. The VE-ratio results in no significant changes. In patients with COPD the breathing rates were also decreased, but the tidal volumes were increased with partial reduction during NIV in spontaneous ventilation. The VE-ratio was not changed in COPD. In comparison with spontaneous breathing, CPAP and BiPAP showed significant changes in patients with COPD.

Discussion: nHF resulted in significant effects on respiratory parameters of healthy volunteers and in patients with COPD. The changes deliver a possible explanation of the active manner of the breath support and the decrease in pCO2.

Advantageous ventilation modes like pressure support PS require the accurate setting of parameters based on individual characteristics of the patient’s respiratory system. As these change, a method for their continuous measurement is necessary. We tested a value setting concept for the “delta” method (Delta = the measured Pdi and its reconstruction were compared using the inspiratory Pressure Time Product (PTP)). The correlation from simulated data was high (R2 = 0.90, 0.05) permitting to validate the relevant analysis systems, but the correlation from real data was low (R2 = 0.68) which was associated to difficulties at measuring Pdi without artifacts and compliances unwantedly attached to the system. We present now a test setup and methodology to investigate real data more accurately. This includes measurement of flow, airway- and transdiaphragmatic pressure from volunteers with minimized susceptibility to artifacts, improved control of mechanical problems and higher sampling rate. The integration of hardware required for occlusion to the ventilator and experienced measurement of Pdi intend to increase the reliability of the parameters determining pressure using software for improved recognition of outliers including online analysis.

| Method: | The current NIV prevalence per 100,000 for each condition was 1.8 for bronchiectasis, 4.5% for COPD, 80% for thoracic cage, 35% for neuromuscular, 85% for OHS and 75% for overlap syndrome. The current NIV prevalence per 100,000 for each condition was 1.8 for bronchiectasis, 4.5% for COPD, 80% for thoracic cage, 35% for neuromuscular, 85% for OHS and 75% for overlap syndrome. The current NIV prevalence per 100,000 for each condition was 1.8 for bronchiectasis, 4.5% for COPD, 80% for thoracic cage, 35% for neuromuscular, 85% for OHS and 75% for overlap syndrome.

### P2089

**Effects of a nasal high-flow system (nHF) on tidal volume, breathing rate, minute volume and VE-ratio in healthy volunteers and patients with COPD**

**Introduction:** Treatment with nHF-system is able to improve symptoms of acute and chronic respiratory insufficiency. The method uses a warmed and humidified high flow of air with 20-50 liter per minute (lpm). By using these devices an increase of mean pressure, pressure amplitude and a decrease in pCO2 is observable.

**Method:** Healthy volunteers and patients with COPD were included in this study. For detection of volume changes, frequency variations and VE-ratios we used two classical volume measure belts (thoracal/abdominal). The signal was relayed to a polytomograph device. Flows from 20 lpm up to 50 lpm with small, medium and large nasal prongs were tested. To compare the results with a closed ventilation support system, the measurements were also performed with CPAP (6 and 10 mbar) and BiPAP (14/6mbar). We compared the results with values measured during spontaneous breathing. Results: nHF led to a significant decrease in minute volume, tidal volume and breathing rate in healthy volunteers in comparison with spontaneous breathing. The VE-ratio results in no significant changes. In patients with COPD the breathing rates were also decreased, but the tidal volumes were increased with partial reduction during NIV in spontaneous ventilation. The VE-ratio was not changed in COPD. In comparison with spontaneous breathing, CPAP and BiPAP showed significant changes in patients with COPD.

Discussion: nHF resulted in significant effects on respiratory parameters of healthy volunteers and in patients with COPD. The changes deliver a possible explanation of the active manner of the breath support and the decrease in pCO2.
P2094
Comparing a nasal high-flow therapy with single and double sided application (TNloXy) on breathing and gas exchange at stable hypercapnic respiratory failure COPD
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Introduction: Nasal high-flow therapy is another option of respiratory support in sleep and ventilation medicine. But the precise pathophysiological effects (reduction of dead space ventilation, development of a PEEP) remain unknown, and the patient group, that may profit of such therapy, is not defined.
Question: Compared are respiratory frequency (RF) and gas exchange under nasal high flow therapy of 20l/min (applied through one and both meatus of the nose) with the effect oxygen therapy (LOT) of 2 l/min at 21 patients with stable hypercapnia in a prospective randomised order for always 45 minutes while awake. A capillary blood gas analysis (BGA) was made after each phase, as well as a 15 minutes break.
Results: The mean RF/min was under LOT 19.4±4.0 and was reduced to 17.8±4.7 under double sided TNI application and 17.7±4.3 under single sided TNI application (difference between LOT and single sided: p=0.043).
BGA: After LOT the PO2 was 68.5±16.8 mmHg, TNI double: PO2: 61.6±22.9 mmHg, TNI single: PO2: 59.0±14.5 mmHg (difference between TOT and single sided: p=0.046).
Conclusion: In the course of 45 minutes at daytime the application of TNloXy can reduce the RF and PO2 in COPD GOLD IV patients with stable hypercapnia significantly compared to LOT. The different effects of single sided and double sided application let us presume a reduction of dead space ventilation.

P2095
Home mechanical ventilation in chronic respiratory diseases: An experience from a pediatric semi-intensive respiratory care unit
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Mechanical, invasive and non invasive ventilation represents an important therapeutic tool for many acute and chronic respiratory diseases in childhood. We retrospectively analyzed clinical history of children receiving home mechanical ventilation (HMV) in our Pediatric Semi-Intensive Respiratory Care Unit from 2003 to 2010.

From 2003 to 2010 we treated with HMV 153 children (M/F 80/73 girls, mean age 10.5years). Most of the patients (138) were treated with non-invasive ventilation (CPAP or BiPAP). In this group, the most frequent diagnoses were Spinal Muscular Atrophy, followed by Prader Willi syndrome, obstructive sleep apnoea, Encephalopathies and invasive HMV through trachestomy. In this group the most frequent diagnoses were brain tumors and otolarinohiatric diseases. Fifteen patients were treated with home invasive ventilation.

A capillary blood gas analysis (BGA) was made after each phase, as well as a 15 minutes break.

Results: The mean RF/min was under LOT 19.4±4.0 and was reduced to 17.8±4.7 under double sided TNI application and 17.7±4.3 under single sided TNI application (difference between LOT and single sided: p=0.043).

BGA: After LOT the PO2 was 68.5±16.8 mmHg, TNI double: PO2: 61.6±22.9 mmHg, TNI single: PO2: 59.0±14.5 mmHg (difference between TOT and single sided: p=0.046).

Conclusion: In the course of 45 minutes at daytime the application of TNloXy can reduce the RF and PO2 in COPD GOLD IV patients with stable hypercapnia significantly compared to LOT. The different effects of single sided and double sided application let us presume a reduction of dead space ventilation.

P2096
Lung function values as predictors for outcome during non-invasive ventilation in COPD patients
Dora Bartusek, Judit Varga, Andras Bikov, Tamas Komaromi, Gyorgy Losonczy.

Introduction: Noninvasive ventilation (NIV) increases the survival of amyotrophic lateral sclerosis (ALS) patients. NIV tolerance factors vary according to different studies.

Aim: To assess the predictive factors which have an impact on NIV tolerance in ALS patients.

Material and methods: Prospective study which included ALS for whom NIV was indicated between January 2004 to January 2010. Demographic, neurological function, respiratory function and night-time monitoring data (before and after the adjustment of NIV with a ventilator) were collected. Tolerance of NIV was defined as use > 4 hours a day.

Results: 71 patients who accepted NIV were included, of whom 34 (47.9%) men, 62.34±8.79 years old, MRC 26.08±3.81 kg/m², 35.2% with bulbar onset, time from onset of disease to NIV 40.78±41.78 months, ALSFRS-R 30.25±15.1. Norris bulbar 28.08±9.70, L FVC 150.6±9.96, L FVC% 52.5±24.57, PEF 3.75±1.98 L/s, MMIC 2.11±1.05 L, Pmax -48.04±23.34 cmH2O, Pmax 73.38±43.9 cmH2O, Tv90 34.27±30.92%, PaO2 74.86±12.94 mmHg, PaCO2 50.3±4.10 mmHg, 74.6% of patients with symptoms of hypventilation, Tc90 with NIV 19.8±4.05%, PaO2 with NIV 83.54±10.19 mmHg, PaCO2 with NIV 42.16±4.65 mmHg, 18% with symptoms of hypventilation with NIV, hours of use 9.28±4.89 h. In 7 patients (9.9%) NIV tolerance was poor (<3h). NIV tolerance factors were: Tc90 with NIV (OR 0.87, p 0.02, IC95% 0.73-0.97) and persistent symptoms of hypventilation with NIV (OR 8.14, p 0.013, IC95% 1.55-42.62).

Conclusions: NIV tolerance in ALS patients is high. The persistence of PaO2 <90% episodes and hypventilation despite NIV are determinant factors in poor NIV tolerance.
NIV for MND in the West of Scotland assisted ventilation service (WoSA VS)

Grant from Motor Neurone Disease Association (UK).

IPA suggests that the adherence to NIV is influenced by individuals’ change when illness progresses.

Results: Out of the six patients, four patients used NIV consistently (mean=9h22m), while two patients used it less than 4 hours (mean=3h10m) per day. IPA suggests that good compliance (≥2h) reflects the individuals’ attitude towards NIV use. Further analysis identified two influential factors: perceived essentiality and the perceived impact of NIV. The sense of need for NIV was reflected in recent guidelines (NICE CG105, 2010). We aimed to evaluate our current practice using NIV in MND.

Methods: Six patients (male=5, mean age=59) who had used NIV for more than 6 months (median 9.5, range 6-11 months) with ventilator interaction data were studied. Repeated interviews were transcribed and qualitatively analysed, using interpretative phenomenological analysis (IPA); IPA provides rich data to explore investigative phenomenon from a small sample.

Conclusions: IPA suggests that the adherence to NIV is influenced by individuals’ attitude towards the use of NIV in terms of its essentiality and impact. Grant from Motor Neurone Disease Association (UK).

Thematic Poster Session

MONDAY, SEPTEMBER 26TH 2011

P2100

Exploring reasons for the pattern of non-invasive ventilation (NIV) use among motor neuron disease (MND) patients: An interpretive phenomenological analysis

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Background: We have previously reported on psychological reasons for declining NIV. This study examines the psychological reasons for adherence to NIV among MND patients.

Methods: Six patients (male=5, mean age=59) who had used NIV for more than 6 months (median 9.5, range 6-11 months) with ventilator interaction data were studied. Repeated interviews were transcribed and qualitatively analysed, using interpretative phenomenological analysis (IPA); IPA provides rich data to explore investigative phenomenon from a small sample.

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Conclusions: IPA suggests that the adherence to NIV is influenced by individuals’ attitude towards the use of NIV in terms of its essentiality and impact. Grant from Motor Neurone Disease Association (UK).

P2101

NIV for MND in the West of Scotland assisted ventilation service (WoSA VS)

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Introduction: Motor neuron disease (MND) results in respiratory muscle weakness and respiratory failure (RF), with reduced quality of life (QOL) and survival. Non-invasive ventilation (NIV) effectively palliates symptoms related to RF, improves QOL and survival (Boude, Lancet Neurol 2006), and increasing use is responsive to different patterns of electrical stimulation. Ramp HF-SCS compared to spontaneous breathing (SB). Methods: In 3 anesthetized dogs, single motor unit (SMU) activity of the diaphragm (D) and para-sternal muscles (P) were assessed during SB and HF-SCS at the t2 level with ramp and non-ramp stimulation by measuring a) time of onset (To) and b) time to peak firing frequency (TTP) of SMUs. To and TTP were determined relative to the onset of inspiratory flow and expressed as a percentage of inspiratory time (Ti).

Results: During SB, mean onset of D and P were 0.1±1.1 and 14.2±2.0% Ti, respectively. During non-ramp HF-SCS, To was 1.7±0.7 and 2.4±0.3% Ti for D and P, respectively (p<0.05 for each compared to SB). During ramp HF-SCS, To was 13.2±2.4 and 6.4±0.8% Ti for D and P, respectively (p<0.05 for each compared to SB). Mean peak firing frequencies of D and P during both HF-SCS and SB were not different. During SB, TTP was 74.0±4.8 and 71.5±4.6% Ti for D and P, respectively. During non-ramp HF-SCS, TTP was 10.6±3.1 and 15.8±3.5% Ti, for D and P (p<0.05 for each). During ramp HF-SCS, TTP was 63.0±4.5 and 53.0±3.8% Ti for D and P (NS for D and P).

Conclusion: Activation of the inspiratory motoneuron pools via HF-SCS is responsive to different patterns of electrical stimulation. Ramp HF-SCS compared to non-ramp HF-SCS results in a more physiologic method of inspiratory muscle activation.

Support: NIH-NINDS (R01NS064157). Disclosure: Dr.DeMarco has a significant financial interest in Synapse BioMedical, Inc, a manufacturer of diaphragm pacing systems.

Background: Mechanically assisted cough with an insufflator-exsufflator (MAC) increases peak cough flow and improves management of secretions in patients with Amyotrophic Lateral Sclerosis (ALS). Study objective: To evaluate the effect of MAC on VC decline in a group of patients before the onset of NIV. Methods: A total of 38 patients referred (12.7 per yr; 4 per yr 1999-2002). 21 were in RF at 1st AS assessment, RF developed in 17/21 during followup (3 patients died). Patients with RF were referred and assessed sooner after diagnosis, and died earlier. NIV was commenced within 2 weeks of assessment, although half were commenced within 48 hours (data not shown). Those accepting NIV had a similar degree of RF to those that did not, but lived longer (210 vs 33 days) with good NIV compliance (data not shown).

Conclusions: MND referrals have tripled in a decade of NIV use, and will increase further with recent guideline publication, so services must develop to meet this need. Early referral and assessment avoids crisis driven decision making, but the majority of our patients were in RF requiring prompt intervention. Early specialist referral must be encouraged.
(20.5 months in MAC not compliant vs 26.5 in compliant) and in VC at the first respiratory evaluation (85.59 vs 93.42), although the VC decrease was similar before the offering of MAC. VC at MAC starting time was similar in compliant and non compliant groups (70.8% of predicted value vs 71.7%). In the compliant group the VC decreased to 69.4% and 60.4% of predicted value at 4.7 and at 12.2 months after the start of MAC therapy. In the not compliant group VC decreased to 54.3% and 43.5% of predicted value after 4.0 and 8.1 months from offering MAC. The differences were significant: 69.38 vs 54.27; p=0.03 and 60.35 vs 43.5; p=0.008.

Conclusion: MAC compliant patients, in similar condition, meet the prescription criteria for MAC treatment later than the not compliant patients. Their VC decline is reduced and they need to start treatment with NIV later than the not tolerating patients.