100. Physiology, heart failure and respiration in relation to OSA

P879. The effects of swimming training on alterations in structure and function of sternohyoid muscle of model rats of metabolic syndrome
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We investigated the effects of swimming training on alterations in structure and function of sternohyoid muscle of model rats of metabolic syndrome. Male Sprague-Dawley rats were randomly divided into 3 groups: control group (group A), MS group (group B), swimming training MS group (group C). The level of malondialdehyde of sternohyoid muscles in group B was significantly higher than those of group A and group C. The Superoxide dismutase level of sternohyoid muscles in group B was significantly lower than those of group A and group C. The capillary density, capillary-to-fiber ratio (C/F), cross-sectional area of type I and II fiber, percentage of type I fibers of the isolated sternohyoid muscles in group B were significantly lower than those of group A and group C. In group B, mitochondrions were swelling, vacuolization and reduced, myofibril was dissolved focally. In group C, sternohyoid myofibril was arranged normally, ultrastructure of mitochondrion was normal roughly, occasionally vacuolization. The tensions of sternohyoid muscle of group B were significantly lower than those of group A and group C. In fatigue test, the tension percentages of sternohyoid muscle of group B were significantly lower than those of group A and group C. We concluded that the abnormalities in histological structure and ultrastructure of upper airway muscle induced by MS, via oxidative stress, led to reduction in contractile function in upper airway muscles, contributing to sleep apnea, and swimming training improved contractile dysfunction of upper airway muscles by inhibiting oxidative stress in MS.

P880. Mechanical ineffectiveness of augmented genioglossus activity in OSA during sleep is associated with diminished co-activation of the styloglossus
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The pathophysiological cause of OSA is sleep-induced decline in dilator muscle activation. However, dilator muscles activity often increases during obstructive apneas and hypopneas (OAHs), but fails to improve airflow. It has been postulated that neuromuscular activity does not increase sufficiently to overcome the negative pressures that develop during obstructed breathing. The present study evaluate this hypothesis.

Methods: Intramuscular GG-EMG, esophageal pressure (Pes) and airflow were recorded in 7 OSA patients. In 6 of the patients, we recorded also EMG of the tongue retractor styloglossus (SG-EMG). While awake, EMG/Pes was assessed while patients breathed through a variable resistor, to estimate the EMG required to prevent pharyngeal collapse. During sleep, EMG/Pes was evaluated during flow limitation. Pre-arousal peak inspiratory EMG (sleepEMG) was compared to peak EMG at the same Pes during wakefulness (awakeEMG). SleepEMG/awakeEMG (at equal Pes) > 1 indicated a level of EMG sufficient to prevent pharyngeal collapse.

Results: Patients had AHI of 51.7 ± 10.5/hr. OAHs triggered increasing negativePes and increasing GG-EMG. SleepEMG/awakeEMG > 1 was observed in all but one patient, with highest (mean of 5 events) ratios of 3.27 ± 1.81. In contrast, SG-EMG maintained tonic activity in 4/6 of the patients during OAHs, and the ratio exceeded 1 in one patient only (0.68 ± 0.58).

Conclusions: In OSA patients, large augmentation of GG-EMG can be observed without improvement in airflow. This mechanical inefficiency is not explained by high inspiratory suction pressures. Co-activation of tongue retractors appears to be reduced during sleep.

P881. Treatment with auto-servo ventilation of patients with sleep-disordered breathing, stable systolic heart failure and concomitant diastolic dysfunction – A randomized controlled pilot study
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Background: Systolic heart failure (HF) is frequently accompanied by diastolic dysfunction and sleep-disordered breathing (SDB). We evaluated, whether

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auto-servo ventilation (ASV, BiPAP ASV, Philips Respironics) improves echocardiographic measures of diastolic function in patients with systolic HF and SDB.

**Methods**: 32 patients with stable systolic HF and concomitant diastolic dysfunction (age 66±9y, LVEF 30.7±4%, NYHA class II 72%) and SDB (AHI 48±9/h, 53% OSA) were randomized to either ASV (n=19) or optimal medical treatment alone (control, n=13). Polysomnography and echocardiography was performed at baseline and after 12 weeks.

**Results**: AH1 improved significantly more in the ASV group compared to the control group (AHI: 1.2±1.32/h, P<0.001) in patients who had impaired left ventricular relaxation, and 8 (25%) had a pseudonormalized filling pattern. At the 12-weeks control visit, diastolic function as assessed by the isovolumetric relaxation time (IVRT, 10.3±3.26 vs. 9.3±4.91, P<0.05) and deceleration time (DT, -43.9±8.8 vs. 12.4±6.8, P<0.05) did not significantly improve after ASV treatment. Likewise, the proportion of patients whose diastolic dysfunction improved was non-significantly higher in the ASV than in the control group, respectively (37% vs. 15%, P=0.2).

**Conclusions**: ASV-treatment efficiently abolishes SDB in patients with stable systolic HF and concomitant diastolic dysfunction. These data provide estimates of effect size and justifications of the evaluation of the effects of ASV on diastolic function in larger randomized controlled trials.

**P883 Sleep disordered breathing and the incidence of inappropriate ICD discharges**

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**Introduction**: Hypersensitive ventilatory feedback loop has major impact on the manifestation of Cheyne-Stokes respiration (CSR) in chronic heart failure (CHF). As CSR mainly affects male CHF patients (pts), this study aims to clarify the role of respiratory stability in the evolution of CSR in men and women.

**Methods**: We investigated 563 pts with CHF (91 female, LVEF ≤45%, NYHA class ≥2) using echocardiography, cardiopulmonary exercise testing (CPX), cardiorespiratory polygraphy, measurement of hyperoxic, hypercapnic ventilatory response (HCVR), and standard laboratory. Adjusted for age (±2 years), body mass index (BMI, ±2), and LVEF (±3%) 79 matched pairs (male/female) were eligible for analysis.

**Results**: Obstructive sleep apnoea (AHI ≥5/h) was present in 12 female (15.2%) and 13 male (16.4%) pts (p=n.s.), CSA (AHI ≥5/h) in 30 (37.9%) female and 54 (68.4%) male pts (p<0.001). Parameters of respiratory instability (female vs. male: daytime PO2 36.7 (interquartile range) 34.4-39.4 vs. 36.7 (IQR 34.8-38.7), VE/VO2 slope during CPX 34 (IQR 30-40) vs. 35 (IQR 31-40), HCVR 2.32 (IQR 1.7-3.49) vs. 2.69 (IQR 2.01-4.45) did not show a significant difference. Adjusted for age, NYHA-class, BMI, heart rate, LVEF, CRP, creatinine, NT-proBNP step-wise regression analysis revealed HCVR (p=0.03) an independent predictor for CSA in male pts while NYHA-class (p=0.04) was the only independent predictor for CSA in female pts.

**Conclusion**: These data suggest gender-related differences in the evolution of CSR. Additional studies are warranted to figure out a more sophisticated pathophysiological concept that may elucidate these findings.

**P884 Obstructive sleep apnea syndrome and cardiovascular diseases risk in patients with COPD**

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**Purpose**: To define the correlation between obstructive sleep apnea syndrome (OSAS) and increasing of cardiovascular risk in patients with chronic obstructive pulmonary diseases (COPD).

**Design**: There were examined 33 patients in the age of 63.9±1.5 years with COPD stage 2 (85%) and stage 3 (15%). Duration of disease was: 10-14 years – 22 patients (67%) and 15-24 years–11 patients (33%). 60% of patients were smoking, 82% of patients had OSAS of mild stage and 38% - had OSAS of moderate stage (p<0.05). Duration of apnea cases varied from 259,0-1240,0 sec. There were revealed correlations between duration of apnea cases and cardiovascu-
lar diseases risk (r=0.7136; p<0.05), number of heart rhythm disorders (r=0.7373; p<0.05), high density cholesterol (r=0.7289; p<0.05). There was correlation between EHR during sleep and OSAS (r=-0.77; p<0.05). Patients had evidently increased risk for fatal complications according to the scale SCORE (Systematic Coronary Risk Evaluation). Patients received basic therapy according to the recommendations of GOLD, 2009.

**Results**: 62% of patients had OSAS of mild stage and 38% - had OSAS of moderate stage (p<0.05). Duration of apnea cases varied from 259,0±1240,0 sec. 82% of patients had from 90 to 13990 cases of cardiac rhythm disturbances within 24 hours. Extremity index of heart rate (EHR) varied during sleep - 2.143±0.19. There were revealed correlations between duration of apnea cases and cardiovascu-
lar diseases risk (r=0.7136; p<0.05), number of heart rhythm disorders (r=0.7373; p<0.05), high density cholesterol (r=0.7289; p<0.05). There was correlation between EHR during sleep and OSAS (r=-0.77; p<0.05). Patients had evidently increased risk for fatal complications according to the scale SCORE (r=0.8139; p<0.05); high risk level in 12,5% and very high - in 75% of cases.

**Conclusions**: Patients with both COPD and OSAS have evidently increased risk for fatal complications.

**P886 The frequency of overlap syndrome in patients who were evaluated in sleep laboratory and its effects on severity of obstructive sleep apnea syndrome and quality of sleep**

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‘Overlap Syndrome’ is the combination of Obstructive Sleep Apnea Syndrome (OSAS) with Chronic Obstructive Pulmonary Disease (COPD) and asthma. We aimed to determine frequency of COPD and Asthma in OSAPatients and effect of these diseases on quality of sleep and severity of OSAS in patients evaluated...
in the sleep laboratory in January 2005-January 2010 were analysed. All cases were examined for COPD, Asthma and severe daytime sleepiness according to Epworth Sleepiness Scale (ESS).Pulmonary function tests and polysomnographic tests were administered to all. For diagnosis of COPD, GOLD criteria; for EGG scoring, Rechtschaffen - Kales criteria and for respiratory scoring, AASM 1999 criteria were used. Out of 998 cases 98.2% were diagnosed as OSAS. 11.1% COPD, 6.6% asthma, 11.2% of OSAS cases had COPD. Age, frequency of male sex and ESS were significantly higher in patients with OSAS and COPD than patients with OSAS without COPD. no significant differences in terms of BMI and sleep parameters were found in OSAS+asthma cases (6.7%). BMI, frequency of female sex and ESS were found to be significantly higher in than patients with OSAS- without asthma, no statistical differences were found in terms of sleep parameters. In older male patients with OSAS+COPD is more frequent than in younger female patients. Asthma is more frequently seen in OSAS than general population. In asthmatics, sleep efficiency is lower: the ESS is higher. No relation between severity of OSAS and presence of COPD or asthma was determined. In patients with OSAS, symptoms of COPD and asthma must be questioned and pulmonary function tests administered.

### P887

#### Risk factors of hypercapnia in patient with obstructive sleep apnea

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The severe obesity sometimes leads to a chronic alveolar hyperventilation: obesity hyperventilation syndrome (OHS). The association with OSAS is frequent. **Aim:** The aim of the present study is to specify favorisants factors that lead to hyperventilation in a population of obese persons with SAS and to deduct the type of association between OHS and SAS.

**Methods:** 62 patients were enrolled. We excluded patient with bronchial obstruction and we have compared anthropometric, functional, and polysomnographic details of the group (G1): OHS+9 and of the group (G2): obesity without hyperventilation=53.

**Results:** We haven’t identified a difference between the two groups concerning age, sex, frequency of smokers, nasopharynx region abnormalities, AHI/SAS severity and the respiratory functional exploration. We noted that there is a positive inter-relation between BMI and PaCO2. We identify severe gazometric perturbation in G1 (PaCO2>49 mmHg, PaCO2>50.7 mmHg) versus G2 we noted a moderate hypoxemia. Patients of the group 1 make minimal desaturation of 63%±17% and a SaO2 average of 81±20% what is meaningfully important than in the G2.

**Conclusion:** The alveolar hyperventilation in SAS seems to be in correlation with the degree of obesity. The hypercapnia in the OHS is in relation neither with the SASOAS-SAS association is usual but not synonym. The OHS is an autonomous disease.

### P888

#### The impact of OSA on nocturnal hypoxia in obese patients with chronic asthma

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**Background:** There is increasing evidence that asthma, obesity and OSA co-exit with resulting increased usage of health care resources. This cohort may have worse asthma control due to increased nocturnal hypoxia augmenting airway and systemic inflammation. The prevalence of OSA and degree of hypoxia in obese patients with asthma remains unclear.

**Methods:** A retrospective survey of obese patients with chronic asthma referred to our sleep clinic between 2009-2010 undergoing overnight sleep monitoring for EGG scoring was undertaken using RemLogic software (in-house polysomnography). Scoring of the respiratory data was as per American Academy of Sleep Medicine (AASM) guidelines 2007. OSA was defined as an apnoea/hypopnoea index of ≥5/hour and moderate-severe as ≥15/h.

**Results:** 26 patients (19 females) were analysed. Mean (SD) BMI =45.2 (10.8)kg/m². Mean (SD) age=45.1 (12.2)years. Six had Type 2 Diabetes Mellitus and had hypertension. OSA was found in 12 (46.2%) patients with OSAS and COPD. Group 1 (n=9) Group 2 (n=53) p

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>p</th>
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<tr>
<td>Age (year)</td>
<td>47,861±12,59</td>
<td>51,49±12,27</td>
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<tr>
<td>Sex</td>
<td>Female 44,4% Male 55,6%</td>
<td>Female 32,1% Male 67,9%</td>
</tr>
<tr>
<td>Tabacco (PA)</td>
<td>9,67±12,91</td>
<td>11,72±17,41</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>45,86±8,53</td>
<td>37,01±5,75</td>
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<td>BMI &gt;40</td>
<td>77,8%</td>
<td>24,5%</td>
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<tr>
<td>Smoking</td>
<td>88,9%</td>
<td>96,2%</td>
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<tr>
<td>Epworth Score</td>
<td>14,26±6,56</td>
<td>12,6±6,08</td>
</tr>
<tr>
<td>Nasopharynx region abnormalities</td>
<td>44,4%</td>
<td>50,9%</td>
</tr>
</tbody>
</table>

**Conclusion:** The alveolar hyperventilation in SAS seems to be in correlation with the degree of obesity. The hypercapnia in the OHS is in relation neither with the SASOAS-SAS association is usual but not synonym. The OHS is an autonomous disease.

### P890

#### Cardiopulmonary exercise response in children with obstructive sleep apnea syndrome

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**Introduction:** Cardiopulmonary exercise testing (CPET) is a valuable tool in the evaluation of cardiac and pulmonary function. In adults’ patients with obstructive sleep apnea syndrome (OSAS), recent studies addressed reduced exercise capacity, but there is no data in literature for pediatric patient.

**Aim:** To evaluate cardiopulmonary exercise response to exercise in children with OSAS. Materials and methods: 60 patients with severe asthma were divided into 2 groups: 1 group of patients with OSAS were 30 patients (16 women and 14 men age (58±2.2) years) and II group patients without OSAS consisted of 17 women and 13 men age (50.5±2.1) years. In both groups FEV1 ranged from (54.8±3.1) to (58.2±2.6)hos. The following studies were performed: respiratory function, polysomnography, dyspnea, blood pressure measurement, Holter recording of ECG.

**Results:** Asthma Control Test score revealed that patients with OSAS have poor control of asthma symptoms (15±4.4) compared to patients without OSAS (18±4.7) and higher scores for breathlessness scale MRCDS. Results of the questionnaire also show that patients with OSAS had more symptoms due to asthma and significant limitation of activity (67±1.3) than patients without OSAS (60±2.4) (p <0.05). Patients with OSAS had an increase in pulse blood pressure, minimum of daily, a maximum of night, and a marked increase in the average heart rate per night, the increase variability in blood pressure. in the night period, compared with patients without OSAS, p <0.05.

**Conclusion:** The use of a wide range of diagnostic methods will allow for an adequate pathogenetic treatment and improvement of disease control in patients with severe asthma and in combination with OSA.
Obstructive sleep apnea in patients with idiopathic pulmonary fibrosis
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Background: The outcome of patients with idiopathic pulmonary fibrosis (IPF) is poor. Breathlessness and coughing are usually progressive and about 50% of the patients die within 3 years after diagnosis. The role sleep-disordered breathing in IPF should be investigated.

Objective: The aim of this study was to investigate obstructive sleep apnea and associated daytime sleepiness in IPF patients and investigate the correlation between IPF and OSA.

Subjects and methods: 28 patients with IPF and 10 control subjects matched on age and BMI were included in the study. Sleep quality and its daytime consequences were assessed by the Epworth Sleepiness Scale and all-night polysomnography.

Results: 23 patients had an abnormal ESS (82.1%). 24 IPF patients (85.71%) had OSA; 21 patients (75%) had mild-to-moderate OSA, and 3 patients (10.71%) had severe OSA. AHI was statistically significant correlated with ESS, FVC, and TLC.

Conclusion: Patients with IPF are at high risk for OSA that may account for reversible daytime fatigue, wrongly ascribed to IPF. Further, without treatment the sleep deprivation and lack of oxygen caused by sleep apnea increases health risks that have a significant negative effect on prognosis of IPF that already carries a poor prognosis.

Recommendation: Sleep evaluation should be extended to IPF patients routinely and the scientific work should focus on the improvement of sleep quality during sleep in these patients.


CPAP versus adaptive servoventilator (ASV) in patient with congestive heart failure and sleep disorder breathing
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Introduction: The aim of this study was to evaluate the effects of nocturnal ventilation by two different ventilatory support: CPAP or Adaptive Servo Ventilator (ASV) in patients with heart failure and sleep disorder breathing, in particular on echocardiographic parameters.

Methods: Ambulatory patients with congestive heart failure were screened for presence of Sleep Disorder Breathing (SDB). After a full night polysomnography the patients were divided in OSA, CSA-CSF or noSDB. All patients with SDB were titrated at the begin by CPAP but if CSA-CSF occurred or was not resolved they were switch to ASV.

All patients were evaluated at baseline and after six month of treatment by echocardiography study and clinical evaluation.

Results: 52 patients were enrolled, age was 63.2±10.06, FE 31±28. Of them 13 patients (25%) were noSDB, 21 were OSA (40%) 18 were CSA-CSR (35%). There was no differences among groups according to age, FE, TAPSE and NT-proBNP. All patients with SDB were admitted to nocturnal ventilation: 14 received CPAP, 16 received ASV while 9 refused treatment. After 6 months, any change was obtained in FE and NT-pro-BNP and in TAPSE, as well as on the other echocardiographic parameters in all groups.

Conclusion: In patients with CHF sleep disorder breathing are very common, however CPAP or ASV nocturnal ventilation have no impact on improvement of echocardiographic parameters.

Correlation of pulmonary function and sleep disordered breathing parameters in patients with idiopathic pulmonary fibrosis
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Background: Restrictive pulmonary diseases like Idiopathic Pulmonary Fibrosis (IPF) are characterized by decreased lung volumes that can reduce the upper airway stability and potentially predispose to SDB.

Aims and objectives: Therefore our aim was to correlate pulmonary function testing (PFT) parameters with Apnea-Hypopnea Indices (AHI), overall and during NREM and REM sleep, in newly diagnosed IPF patients.

Methods: Twenty consequent patients (16 males/4 females, age 68.5±11 yrs) with newly diagnosed IPF were included. All had a formal in lab sleep study as well as PFT’s before the initiation of any therapy for IPF.

Results: Twelve patients had an AHI above 5 per hour of sleep indicating underlying SDB. A statistical significant trend was observed between RV and RV/TLC values and REM AHI (p=0.07, r=0.44 and p=0.08, r=0.43 respectively). No statistical significant correlations were observed between the other PFT parameters (FEV1%, FVC%, FEV1/FVC, TLC, T/LC) and AHI indices. DLCOV/A values showed a statistical significant negative correlation with overall AHI (r=0.58, p=0.05), NREM AHI (p=0.04, r=0.51) and REM AHI (p=0.05, r=0.52).

Conclusion: Our results suggest that there is a statistical significant trend between reduced lung volumes and AHI during the vulnerable period of REM sleep. The lack of strong statistical correlations between PFT’s and SDB parameters might related to the fact that PFT’s routinely are performed with the patient in the upright and not the supine position.
Prevalence of obstructive airway disease in patients with obstructive sleep apnea

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Introduction: Obstructive sleep apnea (OSA; mainly chronic obstructive pulmonary disease and asthma) and obstructive sleep apnea (OSA) are common diseases, but data on prevalence of OAD in OSA are scarce. We aimed to assess the prevalence of OAD in patients with OSA.

Methods: Medical records of all patients who underwent diagnostic polysomnography in University Clinic Golnik from 2005 to 2010 were retrospectively reviewed. Only patients with available pulmonary function tests were included (89% of all). Patients were divided in two groups: controls (apnea-hypopnea index – AHI < 5) and OSA patients. OAD was defined as FEV1/FVC < 70%.

Results: Out of 865 patients 718 (83%) had OSA (80.5% men, age 53.2±10.4y, BMI 34.3±6.8, AHI 41.8±24.9) and 147 (17%) were controls (69.4% men, age 50.5±12.3y, BMI 30.2±6.7, AHI 2.4±1.7). Prevalence of OAD was 141 (19.6%) in OSA patients vs. 9 (6.2%) in controls (p=0.005). There was no difference between groups regarding FEV1/FVC (64.1±7.4% vs. 62.5±6.7%, p=0.293) and FEV1 predicted (75.8±20.1% vs. 72.9±19.4%, p=0.485). Severe airway obstruction (FEV1<50% predicted) was present in 17 (12.1%) OSA patients and in 3 (11.1%) controls, p=0.890. In multivariate logistic regression adjusted for age, sex, BMI and chronic heart failure (CHF), age (OR 1.07; CI 1.01-1.10), male gender (OR 0.47, CI 0.26-0.80), and CHF (OR 2.13, CI 1.14-3.98) predicted OAD in OSA.

Conclusions: OAD was common and underdiagnosed in OSA patients, which was significantly correlated with CHF (OR 2.13, CI 1.14-3.98) predicted OAD in OSA.

Increased toll-like receptor 4 expression in mice lung tissue under intermittent hypoxia

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Background: Asthma-related quality of life is significantly decreased in adult asthmatics and correlated with QLQAKA score. Visceral fat area were significantly higher in the high OSA risk group, and showed lower ACT score than low OSA risk group. Lung functions and FeNO were not different between groups. The possible role of obstructive sleep apnea (OSA) contributing to OAD in OSA is of interest as a predisposing factor for respiratory diseases and sleep disturbances.

Methods: We aimed to investigate clinical features including asthma control status, quality of life and airflow inflammation in adult asthmatics with high OSA risk.

Results: Recent data suggested that obstructive sleep apnea (OSA) is an independent risk factor for severe uncontrolled asthma. This study was aimed to investigate clinical features including asthma control status, quality of life and airflow inflammation in adult asthmatics with high OSA risk.

Methods: A total of 217 patients with asthma who visited tertiary-care clinic were randomly recruited in this study. They completed Berlin-questionnaire validated for screening of OSA risk, asthma control test (ACT), and quality of life questionnaire for adult Korean asthmatics (QLQAKA). Fraction of exhaled nitric oxide (FeNO), lung functions, and blood test for lipid profile were evaluated simultaneously. Body impedance test were also performed for analysis of body composition.

Results: Mean age of study subjects was 58.4 yr and 41.9% were male. Eighty nine subjects (41.0%) were classified as high risk of OSA from Berlin questionnaire. Patients with high OSA risk showed significantly older age, higher prevalence of hypertension, higher BMI and non-atopic predisposition. High risk OSA group showed lower ACT score than low OSA risk group, but it was not significant. QLQAKA score was significantly lower in the high OSA risk group compared to low OSA risk group. Lung functions and FeNO were not different between groups. Visceral fat area were significantly higher in the high OSA risk group, and showed lower ACT score than low OSA risk group.

Conclusion: Asthma-related quality of life is significantly decreased in adult asthmatics with high risk of obstructive sleep apnea.

Methods: Participants in the Burden of Obstructive Lung Disease (BOLD) initiative in Iceland and Sweden, a random sample from the general population of 1325 adults aged 40+ (±70% response rate), were compared by pre- and post-bronchodilator spirometry, answers to questionnaires about OSA and respiratory symptoms, health, and symptoms of GER.

Results: Altogether 102 (7.7%) reported nGER and 249 had used medication against GER. The participants were divided into three groups: 1) No nGER (n=1040), 2) treated GER without nGER (n=183) and 3) nGER (n=102). The nGER group had a significantly higher prevalence of respiratory and OSA symptoms compared to the subjects without nGER. The nGER group also had a higher prevalence of COPD (GOLD stage I+), (25.0% vs. 15.6%) (p=0.02) and lower FEV1/FVC ratio (95.9% vs. 98.9% of the predicted, p=0.01). These associations remained significant after adjusting for smoking, weight and other possible confounders. No independent association was found between treated GER and lung function, respiratory or OSA symptoms.

Conclusions: In our cross-sectional epidemiological study, untreated nGER is strongly associated with both respiratory and OSA symptoms as well as airflow obstruction.