163. Exercise assessment in different diseases

P1530
Metabolic and cardiopulmonary responses to the incremental shuttle walk test vs. six-minute walk test in healthy older adults
Victor Dourado1, Ricardo Guerra1, Susana Tanni1, Letitia Antunes1, Irma Godoy2, 1Department of Health Sciences, Federal University of São Paulo (UNIFESP), Santos, Brazil; 2Department of Internal Medicine, Botucatu Medical School (UNESP), Botucatu, Brazil

Whether the incremental shuttle walk test (ISWT) induces a higher physiological stress compared to six-minute walk test (6MWT) in patients remains controversial. However, previous studies did not include healthy subjects. We compared physiological responses to the ISWT and 6MWT in healthy adults (38 men, aged 60±10). Secondarily, peak oxygen uptake (VO2) in these tests were compared to predict values of a maximal cycle-ergometer test. In a randomized order and alternate days, 80 participants completed three 6MWTs and three ISWTs. VO2, CO2 output (VCO2), minute ventilation (VE), and heart rate (HR) were monitored by a portable telemetric system during each third test. Physiological responses were linear during ISWT and exponential during 6MWT. We could calculate deficit-O2 (1072±622 mL) and VO2 time constant (tauVO2=56±19 s) in all participants by exponential fittings (R²=0.905±0.065). During the 6MWT, VO2 (1627±441 mL/min), VCO2 (1443±439 mL/min), VE (46±16 L/min), and HR (129±24 bpm) were not significantly different compared to ISWT (respectively 1714±544 mL/min; 1591±582 mL/min; 51±19 L/min; and 132±2 bpm). The distance covered correlated with peak VO2 for ISWT (r=0.738; p<0.001) and 6MWT (r=0.652; p<0.001) with no difference between correlation coefficients (p=0.234). Estimated peak VO2 (1541±422 mL/min) was not significantly different from measured peak VO2 obtained during ISWT and 6MWT. Although ISWT is considered to be closer to a maximal exercise test than 6MWT, ISWT does not induce a greater physiological responses in healthy adults. Larger studies should be performed in patients for better physiological comparisons between these walking tests.

P1531
Peculiarities of peripheral blood flow reaction during cold air bronchoprovocation
Juliy M. Perelman, Anna G. Prikhodko. Laboratory of Functional Research of Respiratory System, Far Eastern Scientific Center of Physiology and Pathology of Respiration SB RAMS, Blagoveschensk, Russian Federation

Background: Peripheral vessels reaction to different stimuli may be a sign of systemic vascular disturbances in chronic pulmonary diseases. It is unknown if cold air hyperresponsiveness (CAHR) accompanied by any changes in systemic peripheral circulation.

Aim: To study peculiarities of peripheral vasomotor reaction during local airway cooling.

Methods: The reaction of peripheral vessels of finger (àà digitales palmares proprie) during and after 3-min isocapnic cold (-20°C) air hyperventilation was studied in 11 healthy persons and 31 patients with chronic pulmonary diseases (bronchial asthma and chronic bronchitis) having CAHR. The amplitude of pulse wave (APW) was evaluated by photoplethysmography of finger.

Results: A phase reaction of finger artery to cold air inhalation was revealed in healthy persons. By the end of the 3rd min of hyperventilation there was a progressive drop of APW (-30.2±8.7%) as a result of vasoconstriction with further short-term vasodilatation proved by the growth of APW higher than the initial level (8.7±6.5%) immediately after provocation cessation and its additional fall on the 5th min of recovery (-15.5±7.3%), which meant a repeated vessel spasm. In group of patients cold air inhalation led to sustained APW drop both during provocation (-21.4±8.9%) and recovery period (1st and 5th min) -26.2±7.8% (p<0.01); -10.5±7.8%, respectively. There was a correlation among airway reaction, changes in peripheral blood flow, skin temperature at the beginning and at the end of the bronchoprovocation in patients.

Conclusions: Revealed abnormalities in peripheral microcirculation in patients with the changed airway responsiveness can be an early sign of systemic vascular dysfunction.

P1532
Evaluation of two methods for measurement of cardiac output during exercise in patients with COPD
Ioannis Nasis1, Dimitris Athanasopoulos1, Evgenia Cherevou1, Zafiris Louvaris1, Maroula Vasilopoulou1, Helmut Habazettl3,4, Harriet Wagner5, Peter David Wagner5, Spyros Zakynthinos2, Ioannis Vogiatzis1,2, 1Department of Physical Education and Sport Sciences, National and Kapodistrian University of Athens, Athens, Greece; 2Department of Critical Care Medicine and Pulmonary Services, Evangelismos Hospital, M. Simou, and G.P. Livanos Laboratories, National and Kapodistrian University of Athens, Athens, Greece; 3Institute of Physiology, Charité Campus Benjamin Franklin, Berlin, Germany; 4Institute of

 estimated peak VO2 (1541±422 mL/min) was not significantly different from measured peak VO2 obtained during ISWT and 6MWT. Although ISWT is considered to be closer to a maximal exercise test than 6MWT, ISWT does not induce a greater physiological responses in healthy adults. Larger studies should be performed in patients for better physiological comparisons between these walking tests.
Evaluation of heliox or oxygen breathing on improved quadriceps muscle oxygen delivery during exercise in COPD

Vasilis Andrianopoulos¹, Zafeiris Louvaris², Eleni Kortianou¹,², Helmut Habazettl³, Spyros Zakynthinos¹, Peter D. Wagner⁴, Ioannis Vogiatzis¹,².

Introduction: It is known that both normoxic heliox and pure oxygen breathing enhance exercise tolerance and locomotor muscle O₂ availability during exercise.

Methods: Ten patients with COPD, (aged 60±7 years, FEV₁=50±6%predicted) were studied. Exercise consisted of four constant-load tests, for (5min at 25% and 20% postIMT 92,3 1,5* 29 12%pred) performed 3 constant-load exercise tests at 75-80% of peak-work rate measured during an incremental test to determine peak oxygen uptake. Among these tests, three of them were performed at 75% work rate with breathing air, normoxic heliox (He: 32±6% vs air: 18±5%), and pure oxygen (O₂: 1.1±0.4 vs Air: 3.9±0.6 ml/min/100gr).

Results: Patients with severely reduced exercise capacity (peak oxygen uptake < 654 ml/min) were characterized by the following: (i) exercise-induced rapid decrease of arterial oxygen pressure (PIo2-slope: –7.8±0.7 mmHg/100 ml); (ii) sympathetic activation at low-grade workload (plasma norepinephrine level, 1.4±0.94 ng/ml at 20 W); (iii) little change in lactic acids; (iv) a limitation in the increase of ventilation; and (v) impaired gas exchange. The norepinephrine increase exhibited during exercise was significantly correlated (r = 0.94±0.08) with the dyspnea ratings.

Conclusions: The COPD pathophysiology significantly varied among patients with different exercise capacities. Patients with lower exercise capacity suffered from severe gas exchange disorder, sympathetic overactivation, and ventilatory disturbance during exercise. CPET should consistently be performed to assess the factors that contribute to exercise limitation in COPD patients.

P1534 Dynamic pathophysiology in stable COPD patients with severely reduced exercise capacity

Ryoj Mrukura, Toru Hiraga, Keisuke Miki, Seigo Kitada, Kenji Yoshimura, Yoshitaka Takeishi. Respiratory Medicine, National Hospital Organization Toneyama Hospital, Toyonaka, Osaka, Japan

Introduction: The survival prognosis of COPD patients with severely reduced exercise capacity is extremely poor. However, the dynamic pathophysiology of these patients, including sympathetic activation and lactic acidosis, remains to be accurately established. Thus, we performed this study to clarify the differences in the dynamic pathophysiology of four COPD patient groups classified according to their exercise capacity.

Methods: Ninety-one COPD patients (82 males, 9 females; average age, 69.7±6.8 years) underwent incremental CPET using a cycle ergometer. During CPET, we measured the patient levels of arterial blood gases, lactate, and catecholamines.

Results: We found that the pathophysiology of the COPD patients was different among the groups. Patients with severely reduced exercise capacity (peak oxygen uptake < 654 ml/min) were characterized by the following: (i) exercise-induced rapid decrease of arterial oxygen pressure (PIo2-slope: –7.8±0.7 mmHg/100 ml); (ii) sympathetic activation at low-grade workload (plasma norepinephrine level, 1.4±0.94 ng/ml at 20 W); (iii) little change in lactic acids; (iv) a limitation in the increase of ventilation; and (v) impaired gas exchange. The norepinephrine increase exhibited during exercise was significantly correlated (r = 0.94±0.08) with the dyspnea ratings.

Conclusions: The COPD pathophysiology significantly varied among patients with different exercise capacities. Patients with lower exercise capacity suffered from severe gas exchange disorder, sympathetic overactivation, and ventilatory disturbance during exercise. CPET should consistently be performed to assess the factors that contribute to exercise limitation in COPD patients.

P1535 Inspiratory muscle training (IMT) with normocapnic hyperventilation (NH) improves respiratory muscle strength, exercise performance and ventilatory pattern in COPD patients

Luca Pomidori, Eva Bernardi, Gianluca Grassi, Enzo Melloni, Gaia Mandolesi, Annalisa Cogo. Biomedical Sport Studies Center, University of Ferrara, Ferrara, FE, Italy

Introduction: IMT by means of NH is effective in improving exercise endurance in healthy subjects but few data are available for COPD patients.

Aim: To evaluate the effect of 4 weeks NH training (Spirestiger®) on respiratory function and exercise capacity in 21 moderate/severe COPD patients.

Materials and methods: 19 M, 2 F; aged 42-80. Respiratory function tests (FEV₁, FVC, Pinax), QoL (St George’s Questionnaire), 6MWT and endurance exercise performed at 75-80% of peak-work rate during an incremental test to determine the limit of tolerance (tLIM). 7 of 21 patients were instrumented with a portable inductive plethysmography (Lifeshirt System) to evaluate breathing pattern during tLIM. After 1 month of weekly supervised training, the patients trained at home for 4 weeks: 10 min twice a day at a breathing rate 12-24/min with a tidal volume (TV) equal to 50% of CV. Results: 6 patients dropped out (poor compliance). IMT significantly improved FRC, QoL, exercise capacity. Ventilatory pattern after IMT is characterized by a significantly higher TV with no change in VE.

Table 1

<table>
<thead>
<tr>
<th>FEV₁ (%)</th>
<th>FVC (%)</th>
<th>Pinax (kPa)</th>
<th>QoL (tot)</th>
<th>tLIM (min)</th>
<th>6MWT (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>preIMT 55.2±16.9</td>
<td>82.3±22.8</td>
<td>8.9±3.3</td>
<td>22.7±16.2</td>
<td>6.4±4.3</td>
<td>46.7±7.4</td>
</tr>
<tr>
<td>postIMT 57.6±15.8</td>
<td>82.7±24.1</td>
<td>9.6±2.4</td>
<td>17.5±12.2</td>
<td>10.3±7.4</td>
<td>46.6±7.9</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Spo2mean (%)</th>
<th>VE (L/min)</th>
<th>TV (L/min)</th>
<th>Br (b/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>preIMT 91±2.2</td>
<td>28.6±16.1</td>
<td>0.8±0.4</td>
<td>33±4.2</td>
</tr>
<tr>
<td>postIMT 92.3±1.5*</td>
<td>29±16.4</td>
<td>0.9±0.6*</td>
<td>30.8±4.5</td>
</tr>
</tbody>
</table>

*p<0.05 (statistical analysis: T test and Wilcoxon signed rank test).

Conclusion: After a short IMT with NH, COPD patients show a higher exercise capacity and an intriguing change in ventilatory pattern which improves oxygen saturation.
of patients during AECOPD. The aim of this study was to evaluate the impact of decreased blood hemoglobin level to results of six minute walking test in patients during after AECOPD.

Materials and methods: A retrospective analysis of data collected from long term study on AECOPD was performed. Haemoglobin level from the first obtainable hospital measurement was included in the assessment. 6MWD was performed after clinical improvement of the patient. Dyspnea at baseline and after exercise was measured. Oxygen saturation (SpO2) during exercise was measured.

Results: 404 patients with AE COPD were analyzed. GOLD stages, hemoglobin level and results of 6MWD are shown in Table 1. Results are means ± SD. *p<0.05. The hemoglobin level did not correlate with 6MWD, dyspnea after 6MWT, exercise oxygenation and blood desaturation after exercise.

Conclusion: Decreased blood hemoglobin level didn’t influence the results of 6MWT in patients after AECOPD.

P1537
Association between physical activity and asthma exacerbations
Silvia Pascual1, Isabel Urrutia1, Cristobal Esteban1, Aitor Ballaraz2, Javier Moraza3, Urko Aguirre4, Inaki Larre4, Iztar Arritzeta1, Maribel Cascon2, 1Pneumology, Galadako Hospital, Galadako, Vizcaya, Spain; 2Research and Epidemiology Unit. CIBERESP, Galadako Hospital, Galadako, Vizcaya, Spain; 3Pneumology, San Elion Hospital, San Eloy, Vizcaya, Spain

Introduction: There are some evidences that suggest regular physical activity reduces the risk of exacerbations in asthma, regardless of the asthma severity and other factors. The aim of this paper is to measure the association between physical activity levels in asthma exacerbations, adjusted by FEV1, age and body mass index (BMI).

Methodology: This is a multicenter transversal study where has been included a population of asthmatics of Pneumology consultations of two hospitals in Vizcaya. It has been included patients with previous diagnosis of asthma and monitored population of asthmatics of Pneumology consultations of two hospitals in Vizcaya. The hemoglobin level did not correlate with 6MWD, dyspnea after 6MWT, exercise oxygenation and blood desaturation after exercise.

Results: 354 patients (54% men). 115 of these (32%) were younger than 30, 32 (33%) between 30 and 55 and 116 (33%) over 55 years. 250 patients (70% of the BMI) below 30, 63 patients (18%) had had asthma exacerbations during the past 6 months. 15 patients (4%) had a FEV1 value below 60%, 39 (11%) between 60 and 80%, and 300 (85%) greater than 80%. Physical activity during the past 6 months. 15 patients (4%) had a FEV1 value below 60%, 39 (11%) between 60 and 80%, and 300 (85%) greater than 80%. Physical activity might change due to development of a septal shift.

Methodologies: Spiroergometry testing was performed in 20 healthy volunteers and 21 patients with IPAH. Cardiac performance was determined using a cardiac bioimpedance instrument.

Conclusion: In patients with IPAH, stroke volume and CI were reduced. The diminished filling is represented by reduced EDV, resulting in less increase of contractility as shown by reduced peak flow and ACI. Patients with IPAH were not able to compensate the lack of contractility by heart rate, resulting in lower CI. Left ventricular underfilling affects cardiac performance during exercise, and inotropic response is reduced in patients with IPAH.

P1538
The usefulness of ventilatory gas analysis during low intensity exercise to define pulmonary hypertension
Paul Woods, Robert Frantz, Bryan Taylor, Thomas Olson, Bruce Johnson. Division of Cardiovascular Disease, Mayo Clinic, Rochester, MN, United States

The 6-minute walk test is widely utilized to characterize activity tolerance and response to therapy in pulmonary arterial hypertension (PAH), but provides little information about cardiopulmonary pathophysiology. Previous studies employing maximal exercise testing suggest that ventilatory gas analysis may be a useful tool to help determine the presence and severity of PAH. The aim of the present study was to determine whether measures of pulmonary gas exchange during a simplified low intensity step test can be used to differentiate between PAH patients and healthy individuals, and also stratify disease severity. Forty PAH patients and 25 matched controls completed a novel submaximal exercise test that consisted of 2-min rest, 3-min step exercise and 1-min recovery. Ventilation, pulmonary gas exchange, arterial oxygen saturation (SaO 2) and heart rate were measured throughout using a simplified gas analysis system. A number of gas exchange variables separated PAH patients from controls. End-tidal CO2 (PETCO2) and SaO2 were lower in PAH vs. controls (31±7 vs. 39±5 mmHg and 89±5 vs. 95±2%, respectively, p<0.05) while breathing efficiency (Vp/VCO2) ratio was higher in PAH vs. controls (42±10 vs. 33±5, p<0.05). PETCO2 and Vp/VCO2 also discriminated between different severities of PAH. Gas exchange variables obtained during light exercise clearly discriminated PAH patients from healthy controls and also between different severities of PAH. A simplified submaximal step test incorporating non invasive gas exchange may be a useful measure to help quantify and track disease severity in PAH. This study was supported by Gilead and NIH HL71478.

P1539
Cardiac bioimpedance during exercise testing in patients with idiopathic pulmonary arterial hypertension
Ralf Kaiser, Christian Frants, Kerstin Hadasch, Christian Lensch, Robert Bals, Heinrike Wilkens. Inneren Medizin V, University Hospital Saarland, Homburg/Saar, Germany

Purpose: In idiopathic pulmonary arterial hypertension (IPAH) right ventricular insufficiency develops due to pressure overload. Furthermore left ventricular function is reduced by chronic underfilling.

Hemodynamics are monitored by echocardiography and cardiac catherisation. This may describe cardiac function only insufficient, as hemodynamics may change during exercise and balance between right and left ventricular function might change due to development of a septal shift.

Methods: Spiroergometry testing was performed in 20 healthy volunteers and 21 patients with IPAH. Cardiac performance was determined using a cardiac bioimpedance instrument.

Conclusion: In patients with IPAH, stroke volume and CI were reduced. The diminished filling is represented by reduced EDV, resulting in less increase of contractility as shown by reduced peak flow and ACI. Patients with IPAH were not able to compensate the lack of contractility by heart rate, resulting in lower CI. Left ventricular underfilling affects cardiac performance during exercise, and inotropic response is reduced in patients with IPAH.

P1540
Effects of continuous vs. interval aerobic training on PetCO2 response during graded exercise test in patients with coronary artery disease
Eneco Rocco1, Danilo Marcello Prado1,2,3, Alexandre Silva1, Jaqueline Lazzari1, Pedro Bortz1,2, Debora Roccase3, Amanda Campolin1, Carla Rosa1, Valor Furlan1, 1Cardiorespiratory Rehabilitation, Amil- International Medical Assistance, São Paulo, Brazil; 2Rheumathology Department, University of São Paulo- Medical School, São Paulo, Brazil; 3Exercise Physiology, Santa Cecilia University, Santos, São Paulo, Brazil

Background: Previous studies have demonstrated in patients with coronary artery disease (CAD) that lower values in end-tidal CO2 pressure (PetCO2) during graded exercise test (GET) have been associated with ventilation perfusion (V/Q) mismatch.

Purpose: 1) to evaluate the effects of the continuous (CT) and interval aerobic training (IT) on PetCO2 responses during GET in CAD patients; and 2) examine the relationships between PetCO2 at ventilatory anaerobic threshold (PetCO2AT) and cardiorespiratory parameters after interventions.

Methods: 37 patients with CAD (59±7±1.7 years) were divided into 2 groups: CT (n=20; 28±1.1 kg/m2) and IT (n=17; 28±5.1 kg/m2). All patients performed a GET on treadmill to determine VAT and peak oxygen consumption (V02 peak).

Results: CT and IT groups showed increased in relative aerobic fitness (AT2/VO2peak = 4.1± 0.4 and 4.4±0.3 ml/kg/m and CT and IT, respectively, p<0.05).
P1541
Quantifying oscillatory ventilation during exercise in patients with heart failure

Thomas Olson, Kenneth Beck, Bruce Johnson. Cardiovascular Diseases, Mayo Clinic, Rochester, MN, United States

Background: This study tested the validity of a data analysis scheme to quantify measures of oscillatory ventilation at rest and during exercise in heart failure patients.

Methods: Eleven patients (ages 53±8yrs, LVEF=17±4%, NYHA Class II) (IV (4) were recruited. Ventilation (VE) and gas exchange were measured. Amplitude and period of oscillations in VE, tidal volume (VT), end-tidal carbon dioxide (PETCO2), and oxygen consumption (VO2) were measured manually (MAN), using novel software which included a peak detection algorithm (PK), sine wave fitting algorithm (SINE), and Fourier analysis (FOUR).

Results: During PE, there were no differences between MAN and PK for amplitude of VE, VT, PETCO2, or VO2 or in periods of oscillations between MAN and SINE or FOUR. During exercise, there were no differences between MAN and PK for amplitude of VE, VT, PETCO2, or VO2. Similarly, there were no differences between MAN and SINE for amplitude of VE or VT although PETCO2 and VO2 were lower with SINE (p<0.05). The PK demonstrated shorter periods for VE, VT, PETCO2, and VO2 compared to MAN (p<0.05) whereas there were no differences in periods of oscillations between MAN and SINE or FOUR. During exercise, there were no differences between MAN and PK for amplitude of VE, VT, PETCO2, or VO2. SINE demonstrated lower amplitudes for VE, PETCO2, and VT (p<0.05) although VE was not different. PK demonstrated shorter periods for all variables (p<0.05) whereas there were no differences between MAN and SINE or FOUR for all variables during exercise.

Conclusion: These data suggest 1) PK consistently captures amplitudes but underestimate periods, 2) SINE and FOUR consistently capture period although SINE underestimates amplitude. Thus, an optimal algorithm for quantifying oscillatory ventilation in HF might combine multiple analysis methods. NIH grants HL71478/KL2-RR024151

P1542
The pattern and timing of breathing during graded exercise test in systemic lupus erythematosus

Danilo Marcelo Prado 1, Renata Miozzo 1, Fernanda Lima 1, Bruno Guarnolo 2, Hamilton Roschel 3, Eduardo Borba 1, Elisia Bonfa 1, Ana Lucia Sá Pinto 1.

Background: Systemic lupus erythematosus (SLE) is an inflammatory autoimmune disease that affects all organs including the respiratory system. Abnormal control of breathing during maximal voluntary ventilation has been recently identified in this disease.

Purpose: To evaluate the pattern and timing of breathing at selected submaximal ventilatory stress in SLE.

Methods: Twenty consecutive women (age: 28±8±1.0 years) with SLE were selected and compared to an age and BMI matched group of 19 healthy women (CTRL) (age: 26±2±1.3 years). All of the subjects performed a progressive treadmill cardiopulmonary test until exhaustion. Data were analyzed at absolute isoventilation (40, 60 and 80 L/min).

Results: SLE presented lower relative aerobic fitness (VO2peak) (26.8±1.2 vs. 35.9±1.2 mL kg⁻¹ min⁻¹, p<0.001) than their healthy peers.

Ventilatory parameters at different absolute isoventilation

<table>
<thead>
<tr>
<th>Ventilation</th>
<th>40 L/min</th>
<th>60 L/min</th>
<th>80 L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>VE (L/min)</td>
<td>16.2±1.5</td>
<td>23.2±2.8</td>
<td>30.2±3.8</td>
</tr>
<tr>
<td>VE/TI (L)</td>
<td>1.41±0.0</td>
<td>2.09±0.5</td>
<td>2.94±0.4</td>
</tr>
<tr>
<td>VE/VT (L)</td>
<td>0.39±0.0</td>
<td>0.47±0.0</td>
<td>0.60±0.0</td>
</tr>
<tr>
<td>VE/PETCO2</td>
<td>0.21±0.0</td>
<td>0.29±0.0</td>
<td>0.34±0.0</td>
</tr>
<tr>
<td>VE/VO2</td>
<td>0.22±0.0</td>
<td>0.29±0.0</td>
<td>0.34±0.0</td>
</tr>
</tbody>
</table>

Conclusion: These results demonstrated a thachypneic breathing pattern and shorter timing of ventilation in SLE woman during exercise. This suggests that the reduced aerobic capacity observed in SLE patients may be accompanied by ventilation-perfusion mismatches.

P1543
Utility of ergospirometry in the diagnosis of hyperventilation syndrome (HVS)

Angélica Tiotiu 1, André Nosedal 2, Sophia Abdellakh 1.

Department of Pneumology, CHU Nancy, Nancy, France; 2Department of Pneumology, CHU Brugmann, Brussels, Belgium

The hyperventilation syndrome (HVS) is characterized by several somatic and psychological symptoms due to hypocapnia not secondary to any underlying organic disease. The purpose of the present study was to evaluate the place of exercise-induced hyperventilation in the diagnosis of HVS.

Twenty-three patients with normal spirometry, referred for suspicion of HVS on the basis of a Nijmegen’s questionnaire (score ≥23) were eligible. Asthma was documented in 15 patients. The mean score of anxiety by the Spielberger’s State-Trait Anxiety Inventory for Adults was 53.5 which are suggestive of moderate anxiety. During the hyperventilation provocation test (HVPT), at least two symptoms of Nijmegen’s questionnaire were reproduced in 14 patients. The mean level of PetCO2 at baseline was 27.6 mm Hg and decreased to 15.2 mm Hg for a maximal ventilation of 57 l/min. No patient recovered the baseline level of PetCO2 at 5 min after the end of the HVPT (mean ratio PetCO2 after/before p < 0.05). Exercise-induced maximal ventilation (V̇Emax) was 52 l/min and was accompanied by a PetCO2 level of 35±8 mm Hg and an EqCO2 of 32±8 mm Hg. No significant difference in the ventilatory variable (V̇Emax, PetCO2, EqCO2) was found between HVS group (n=8) and the asthma and HVS group (n=15). In conclusion, in our group of patients with HVS, with or without asthma, the hyperventilation during exercise did not induce abnormal reduction in PetCO2 or abnormal increase in EqCO2. Our results suggest that, unexpectedly, the exercise could be a therapeutic tool in the HVS. It could be hypothesized that anxiety plays a role in the genesis of symptoms at rest but not during exercise where the patient has to be concentrated on his effort.

P1544
Exercise capacity as an index of progress of lung disease among children and adolescents with CF

Elpis Hatziagorou 1, Vassiliki Georgopoulou2, Kalliopi Kontoudi 1, Vassiliki Arradou 1, Fotis Karvassilas1, John Tsakalidis 1, Pardiac Pulmonology Unit 1, 3rd Paediatric Dept, Hippokration Hospital, Aristotle University, Thessaloniki, Greece; 2Radiology Dept, Hippokration Hospital, Thessaloniki, Greece

Background: Spirometry, high resolution computed tomography (HRCT) and exercise testing provide additional information about lung disease among children with cystic fibrosis (CF). There is significant correlation between levels of aerobic fitness (VO2 peak) and survival rate.

Aim: To compare decline of exercise capacity, HRCT scores and lung function among children with CF over a period of two years.

Method: Sixteen stable children and adolescents with CF, aged 8–19 years, performed spirometry and maximal incremental cardiopulmonary exercise testing using a cycle ergometer, as part of their annual review. At the same time the patients underwent low dose of radiation chest HRCT scans, with a Bhalla score assessment.

Results: Sixteen stable children and adolescents with CF were evaluated (mean age 15.6±3.2 years and FEV1 89±4% predicted). There was evidence of mild exercise limitation during the cardiopulmonary exercise test, with mean Peak Aerobic Capacity (V̇O2peak) 71.8±14.07% predicted. Evaluation of the study population two years later, showed that Bhalla total score, Peak Aerobic Capacity (V̇O2peak) and Anaerobic Threshold(AT) deteriorated significantly (mean difference ±SD, p: 1.4±1.7, p: 0.029, -6.4±4.9, p: 0.022, -7.8±4.9, p: 0.006, respectively). Ventilatory equivalent for CO2 (V̇E/VO2) and Dead space/Tidal Volume Ratio (VD/VT) and FEV1, didn’t deteriorate significantly (p: 0.321, p: 0.165 and p: 0.135, respectively).

Conclusions: The maximal incremental cardiopulmonary exercise test correlates well with HRCT scans; it is a very sensitive method for measuring progression of lung disease in children with CF.

P1545
Children with bronchopulmonary dysplasia (BPD) have increased dynamic flow limitation and an altered ventilatory response to exercise

Christopher O’Dea 1,2, Karla Logan 1, Andrew Wilson 1,2, Andrew Mayronza 2,6, Jane Pillmore 4, Graham Hall 1,3, Respiratory Medicine, Princess Margaret Hospital, Perth, WA, Australia; 2Faculty of Health Science, Curtin University, Perth, WA, Australia; 3School of Paediatric and Child Health, University of Western Australia, Perth, WA, Australia; 4School of Women’s and Infants’ Health, University of Western Australia, Perth, WA, Australia; 5Paediatric Respiratory Physiology, Telethon Institute for Child Health Research, Perth, WA, Australia; 6Cardiac Transplant Unit, Royal Perth Hospital, Perth, WA, Australia

Introduction: Children born preterm are known to have altered lung structure and function. These changes may lead to dynamic flow limitation (DFL) during
exercise. This study aimed to determine the prevalence of DFL and the ventilatory response to exercise in preterm children aged 9-11 yrs with and without BPD.

Methods: Preterm children (>32 w gestation) with and without BPD (>28 d supplemental O2 at 36 w post menstrual age) and term born healthy controls performed an incremental treadmill exercise test to volitional exhaustion with breath by breath analysis and exercise tidal flow volume loops.

Results: To date 89 children (33 BPD, 25 nonBPD and 31 controls) performed acceptable exercise tests. Children with BPD were more likely to have DFL (n=15, 36%) compared to nonBPD (n=3, 1%) and term controls (n=2, 6.3%) p<0.05. The pre-term children had a significantly lower peak V'O₂ than the term born controls (43.8 ± 49.8 mL/kg/min, p<0.001). Children with BPD had a reduced O₂ pulse (p<0.001), tidal volume and V'Ì (p<0.001) compared to nonBPD and term controls. Preterm children with dynamic flow limitation had lower FEV₁ z-scores compared to those without (p<0.02) with other ventilatory responses to exercise not altered in the presence of DFL.

Conclusion: Children born preterm have a lower aerobic exercise capacity and those with BPD exhibit both cardiac and respiratory limitation to exercise. The presence of DFL in children born pre-term with BPD is a novel finding and further research on its potential impact is required.

P1546
Consequences of obesity on gas exchange during exercise
Bohumil Matula, Stanislav Majerník, Plamen Kabaiyanov, Daniel Magula, Ján Plutinský. Functional Diagnostics, Specialized Hospital of St. Zoéardus Zohor, Nitra, Slovak Republic

Obesity produces an increment in total blood volume and cardiac output and a decrease in lung compliance as a result of increased pulmonary blood volume and alveolar collapse in the lung bases.

Aim: To evaluate gas exchange parameters under incremental exercise in "healthy" obese patients (pts).

Methods: Analysis of symptom limited incremental cardiopulmonary exercise tests in supine position of 115 pts (36M, 79F) with FEV₁<VC and TLC ≥ 80% predicted (ECCS) and without history of cardiovascular disease. Pulmires of arteria radialis were made to evaluate arterial oxygen and carbon dioxide pressure (PaO₂, PaCO₂) at peak exercise (PE) and to calculate dead-space to tidal volume ratio at PE (VD/VT) and alveolar-arterial oxygen pressure difference (PA-aO₂).

Results: Slope of heart rate to oxygen uptake (DHR/DVO₂ beat. l/min) was determined. Results are presented as mean ± SD. Results are presented as mean ± SD.

SaO₂ min (%) 79
HR max (bpm) 117±16
HR at rest (bpm) 91±12
Fatigue end (Borg scale) 2±3
Fatigue end (Borg scale) 2±3

SaO₂ min (%) 85–90% SaO₂ 91–95% SaO₂ >95% p value
FEV₁ (%predicted) 46±64 51±52 56±22 67±19 0.01
PaO₂ (mmHg) 61±10 69±10 74±11 83±11 0.01
Distance (m) 337±125 385±109 419±104 427±113 0.01
SaO₂ at rest (%) 91±3 94±2 96±1 98±1 0.01
SaO₂ max (%) 79±6 84±2 91±1 97±1 0.01
HR at rest (bpm) 91±12 84±14 84±14 76±6 0.37
HR max (bpm) 117±16 111±17 110±15 104±19 0.01
Dyspnea end (Borg scale) 2±3 2±3 2±3 3±3 0.01

Conclusion: Hyperventilation and pulmonary over-perfusion may be an important factor of gas exchange impairment under exercise in obese patients.

P1547
Oxygen saturation response during the six-minute walk test in patients with chronic respiratory disease
Raúl Carrión-Sevilla1, Elena Gimeno-Santos 1,2, Diego A. Rodriguez 3, Alba Ramirez-Sarmiento 4, Joaquim Gea 4, Josep Roca 3, Mauricio Orozco-Levi 4, Jerki Vilaro 3,4, 1Respiratory Physiotherapy, Odías, Physiotherapy Services, Barcelona, Spain; 2Centre for Research in Environmental Epidemiology (CREAL), Hospital del Mar Research Institute (IMIM), CIBERESP, Barcelona, Spain; 3Respiratory Medicine Service, Parc de Salut Mar-MIM, Barcelona, Spain; 4FCS Blanquerna, GREF, Universitat Ramon Llull, Barcelona, Spain

Methods: Retrospectively, we analyzed 6MWT from two respiratory medicine services from tertiary hospitals: Hospital del Mar and Hospital Clinic, Spain, from 2006 to 2010. We did not stop 6MWT using SaO₂ <85% criteria. We analyzed the data in 4 groups according SaO₂.

Results: 796 patients (68±10 years) were analyzed. The results of ANOVA are: Only 2 (0.5%) patients showed complications (leg pain and leg paresthesias) within groups (p=0.43). Few patients stopped during 6MWT in all groups (p=0.15).

Conclusions: Patients with SaO₂<85% during 6MWT showed less distance walked and poor functional parameters. However, this group did not show differences neither in number of patients who stopped during the test nor presence of clinical complications during and after 6MWT. Our results confirm there are not critical effects in this kind of patients to stop the test using the SaO₂<85% criteria.

Poster Discussion
Abstract printing supported by Chiesi. Visit Chiesi at Stand D.30