206. The best abstracts in pulmonary rehabilitation

1668 Characterizing metabolic abnormality and adipose tissue infiltration in skeletal muscle of COPD patients using 31P MR spectroscopy and MRI imaging

Graziele Coissi 1, Gregory Shields 2, Pillar Jimenez-Royo 3, Giulio Gamborota 1, Raul Dumber 1, Nicholas Hopkinson 4, Paul Mattrews 2, Andrew Brown 1, Michael Polkey 1

Imagery Sciences, London, United Kingdom; 2GlaxoSmithKline Global Imaging controls. Quads IMAT was 32% greater in COPD patients than controls (p=0.033). Compared to controls. Biceps metabolism was not different between COPD patients and patients with low fat free mass. AM activation appears confined to the quads in COPD. We also hypothesised that AM would occur predominantly in the legs and that intermuscular adipose tissue (IMAT) infiltration would be a predictor of AM. Methods: 31P – MRs data for the quadriceps (quads) and biceps were obtained during 3 min. and 8 sec of endurance exercise and pre and post-exercise. Quads and its sub-muscle group cross-sectional area and IMAT were measured using Dixon MRI imaging. Quads maximal voluntary strength (QMVC), six minute walking test (6MWT) and fat free mass index (FFMI) were additionally performed. Results: Data were obtained for 14 patients with COPD (age 66±5.7) with a mean ±SD percentage predicted of forced expiratory volume in 1s (FEV1) of 36.5±12.7 and 14 age matched healthy controls (age 65±6, FEV1 pred/100±6.5). Patients with COPD had prolonged quads phosphocreatine recovery time [PCr (t25%)](p=0.006) and lower nadir intramuscular pH (p=0.002) as compared to controls. Biceps metabolism was not different between COPD patients and controls. Quads IMAT was 32% greater in COPD patients than controls (p=0.033). Conclusion: AM activation appears confined to the quads in COPD. We also suggest that IMAT, as measured by Dixon MRI, is a sensitive biomarker for AM.

1669 Reduced mitochondrial density in the vastus lateralis muscle of COPD patients with low fat free mass

Santiago Giavedoni, Ellen Droit, Ranzi Lakhdir, William MacNee, Roberto Rabinovich

ELEGI CoI Laboratory, Centre for Inflammation Research, The Queen’s Medical Research Institute, The University of Edinburgh, Scotland, United Kingdom

Muscle wasting affecting a subgroup of patients with COPD, is a predictor of health related quality of life and survival. These patients have a further reduction in exercise capacity and evidence of decreased limb muscle oxidative capacity. We hypothesise that a further decrease in mitochondrial density occurs in patients with muscle wasting and may contribute to a lower oxidative capacity of the muscle. Mitochondrial ultrastructure was analysed using transmission electron microscopy in the vastus lateralis of seventeen COPD patients, ten with low fat free mass index (FFMI) (COPD_L) (FEV1, 33±4.3%pred, FFMI 15.0±2.8 kg m-2), seven with preserved FFMI (COPD_H) (FEV1, 47±7.3%pred, FFMI 19.4±6.9 kg m-2) and compared with nine age and gender-matched healthy sedentary subjects (C) (FEV1: 98±1.0%pred, FFMI 20±0.9 kg m-2). Mitochondrial density was reduced in COPD_L in comparison to COPD_H (1.8±0.2±0.5% and 2.7±0.3±0.4% respectively, p<0.05). In comparison to C, only COPD_L showed a reduction in mitochondrial least diameter (0.15±0.02 μm and 0.13±0.00 μm respectively, p<0.05) reflecting a reduction in mitochondrial size. Mitochondrial density correlated with parameters of lung function, muscle function, exercise capacity and exacerbation frequency. Only exacerbations frequency remained independently related to mitochondrial density in a multiple regression analysis.

We conclude that peripheral muscle of COPD patients, have a reduced mitochondrial density that is likely to contribute to a decreased oxidative capacity of the muscle.

Supported by Chief Scientist Office (CSO) Scotland 09/S10/05 and The British Lung Foundation (Trevor Clay, Te3709). SG was supported by an ERS long term research fellowship.

1670 Blunted muscle angiogenic response after exercise training in COPD patients

Elena Gorgi 1, Christian Pr€efau 2, Adijia Abdellaoui 2, Emilie Roultier 1, Philippe de Rigal 1, Nicolas Molinari 1, Dalila Laoudj-Chenvesse 1, Jacques Mercey 1, Olivier Borot 2, Maurice Hayot 3, 1Department of Clinical Physiology, INSERM U-1046, CHRU Montpellier I and II, Montpellier, France, Metropolitan; 2 Pulmonary Rehabilitation, Pulmonary Rehabilitation Center “La Solane”, Fontalvie Group, Ost€e, France, Metropolitan; 3 Pulmonary Rehabilitation, Pulmonary Rehabilitation Center “La Solane”, Fontalvie Group, Lodève, France, Metropolitan; 4 Angiogenesis Research Group, York University, Faculty of Health, Toronto, ON, Canada; 5 Department of Medical Information, CHRU Montpellier, UMR 729 MISTEA, University of Montpellier I, Montpellier, France, Metropolitan.

In chronic obstructive pulmonary disease (COPD) patients, the skeletal muscle impairment reduces the exercise capacity. Systemic factors (i.e oxidative stress, low grade inflammation ...) have been incriminated. Then, as for the muscle oxidative fibers, the muscle angiogenic-adaptive response to training could also be blunted in COPD, like in other chronic conditions. Therefore, we aimed to compare the muscle functional response, myofiber remodeling and angi-adaptations to training in COPD patients and sedentary healthy subjects (SHS). 21 COPD patients and 23 SHS completed a 6-week rehabilitation program based on individualized moderate-intensity endurance and resistance training. Histomorphological muscle analysis and measurements of pro-angiogenic vascular endothelial factor-A (VEGF-A) and antiangiogenic thrombospondin-1 (TSP-1) were conducted before and after training. Both COPD patients and SHS improved their peak oxygen consumption (respectively, +0.96±2.4 and +2.92±2.6 ml/kg/min, p<0.0011) and muscle endurance (respectively, +6.5% and +10.8%, p<0.001). Although improvements were lower in COPD patients (group-time interaction p=0.05 and p=0.06 respectively). Whereas the capillary-to-fiber ratio (C/F) and the angi-adaptive VEGF-A/TSP-1 ratio increased in COPD patients and SHS (C/F: p=0.01 and VEGF-A/TSP-1: p<0.05), the improvement in C/F was significantly reduced in COPD patients vs. SHS (p<0.05), and no fiber type switch occurred in patients. Absolute changes in C/F and in VO2max, were correlated (r=0.51, p<0.05). The angiogenic response may drive the functional improvements. In addition to a lack of fiber switch, the angiogenic response to training was blunted in COPD patients.

1671 Effects of a 3-week inpatient pulmonary rehabilitation (PR) on muscle remodelling in patients with emphysema

Inga Heinzellmann 1, Sebastian Gehlert 2, Axel Clever 2, Christian Wingels 2, Bernd Szepsanisz 1, Bloch Wilhelm 1, Kern Klaus 1, 1Department of Pulmonology, Schoen Klinik Berchtesgadener Land, Schoenau am Konigssee, Germany; 2 Department of Molecular and Cellular Sports Medicine, German Sport University, Cologne, Germany.

Rationale: Exercise training of at least 10 weeks duration induces significant changes in myofiber size, capillarization and distribution in patients with emphysema. Up to date it is unknown which changes in muscle structure can be achieved by a German inpatient PR with a standard duration of 3 weeks. Methods: Ten patients with emphysema (age: 57±6y; BMI: 24±4 kg/m²; FEV1: 31±9%pred. )were included in this prospective trial. All patients performed an individualized moderate-intensity endurance and resistance training. Histomorphological muscle analysis was performed before and after training. Furthermore, muscle biopsy samples obtained from the vastus lateralis muscle were incriminated. Results: PWR improved significantly during PR (+17Watt [95% CI, 6.3 to 27.7] p<0.01). We observed a significant increase in the capillary to fibre ratio in fibre types I and IIa respectively (+0.5% [95% CI, 0.1 to 1.0] p=0.03; +1.0% [95% CI, 0.6 to 1.4] p<0.01) in skeletal muscle. We found a significant negative correlation between FEV1% pred. and the change in capillary to fibre I ratio (p=0.633, p<0.05).

284s
285s

Abstract printing supported by Chiesi Visit Chiesi at Stand B2.10

### 1672

**Changes in fatigue index during an 8 week quadriceps resistance training programme for patients with COPD & healthy controls**

**Authors:** Houchen L, Harrison S, Cardiwal S, Hithersay R, Steiner M.

**Purpose:** To evaluate the effect of home-based PR on active-walking time in elderly patients with COPD.

**Methods:** 70 patients (mean (SD) age 68.6 (9.1)yr, FEV1 44.8(15.2)% pr, 42 men & 22 controls [age 66.6 (5.1)yr, FEV1 103.4(15.9)% pr, 12 men] completed quadriceps RT for 8 weeks. RT was 5x30 knee extensions; times/week on a cycle dynamometer (speed=180°/sec). PT (Newton-metres-Nm) & TW (Joules-J) were recorded for each set & FI was calculated as: set/5x1x100 for the right leg (weekly average). A high FI indicates fatigue.

**Results:** There were no significant differences between/within groups for PT FI over 8 weeks (FI approx 90% in both groups for all weeks). TW, FI in the COPD group did not significantly change over 8 weeks. Control subjects displayed improvements in TW & FI in FI at week 8 was significant compared to baseline & week 4. However there were no significant differences between the 2 groups for TW FI (Fig. 1).

**Conclusions:** Healthy controls experienced less fatigue in TW or RT progressed. This did not occur in the COPD group & may be related to muscle dysfunction. TWor seems a more sensitive measure than PT.

### 1673

**Effects of home-based pulmonary rehabilitation on the time spent in active- and passive-walking in elderly patients with COPD**

**Authors:** Kawai T, Nakagawa K, Misawa H, Kiyokawa J, Sugawara K, Takahashi H, Kashima K, Matsumura S, Ono Y, Anzai H, Inagi M.

**Purpose:** The objective of this study was to evaluate the effect of home-based pulmonary rehabilitation (PR) including a chair-walking exercise and lower muscle training on daily active- and passive-walking time in elderly patients with COPD.

**Methods:** We assessed walking time according to the walking speed using a newly developed triaxial accelerometer (A-MES activity monitor, Kumamoto, Japan), which could measure the time spent in walking, standing, sitting and lying separately and also could discriminate active walking (>2 km/hour) from passive walking (<2 km/hour). Twenty elderly patients with COPD (Age 76±7 years; FEV1 56.6±18.7% pred) were evaluated using this activity monitor for 3 consecutive days before and after PR. The home-based PR program included a chair-walking exercise, lower muscle training, stretching of body trunk, respiratory muscle training and education of self management. Pulmonary function, exercise capacity (6-min walking distance; 6MWD), quadriceps muscle force (QF), and health-related QOL (CRQ) were evaluated before and after PR.

**Results:** Active-walking time increased (pre PR: 27±3 vs post PR: 52±31 min/day) and lying time decreased (pre PR: 53±18 vs post PR: 38±18 min/day) significantly after PR. Frequency of standing increased (pre PR: 8±4 vs post PR: 117±63 times/day) significantly after PR. The degree of improvement of active-walking time after PR was correlated with 6MWD and QF.

**Conclusions:** These data suggested that home-based PR consisting of a chair-walking exercise and lower muscle training was effective in improving active-walking time in elderly patients with COPD.
Conclusion: In addition to traditional cardiovascular risk factors, such as obesity, older age, higher blood pressure and higher fasting triglycerides, atherosclerosis (c-IMT) is independently predicted by increasing airflow limitation in patients with COPD.