

VAL 71 – Multiple-frequency bioelectrical impedance analysis and quadriceps strength in COPD patients.

OBJECTIVE: Our aim was to evaluate the association between multiple frequency bioelectrical impedance analysis and quadriceps strength in stable COPD patients.

DESIGN: Quadriceps weakness is well recognised in COPD and predicts mortality in severe disease. Single frequency (usually 50kHz) bioelectrical impedance values depend on cell membranes acting as incomplete capacitors and on conduction through body water. Regression equations which include height, weight and gender can then be used to calculate fat free mass (FFM). At low frequencies (5kHz) current does not penetrate cell membranes however at high frequencies (200kHz) both intracellular and extracellular spaces are penetrated. Therefore, the ratio of the impedance at these frequencies is thought to give an index of extracellular and total body water. This ratio may be influenced by acute or chronic illness.

SUBJECTS / METHODS: We measured fat free mass and whole-body bioelectrical impedance at four frequencies (5, 50, 100 and 200 kHz) using a **BodyStat QuadScan 4000**, in stable COPD patients and healthy controls. The ratio of impedance at 200kHz and at 5kHz (Z_{200}/Z_5) was recorded. Quadriceps strength was measured by maximal voluntary contraction (QMVC). FFM was determined using impedance at 50kHz and a disease specific regression equation.

RESULTS: We studied 35 patients with stable COPD (mean (SD) FEV₁ 43.5(24.7)% predicted) and 23 age-matched controls. Patients were significantly weaker than controls (mean (SD) QMVC 26.8(9.7)kg; 38.3(11.7)kg, $p < 0.0001$) but there was no significant difference in Z_{200}/Z_5 (mean 0.813; 0.798, $p = 0.14$). There was a correlation between QMVC and Z_{200}/Z_5 in all subjects ($n = 58$) $r^2 = 0.41$, $p < 0.0001$; in the COPD group ($n = 35$) $r^2 = 0.52$, $p < 0.0001$ and in controls ($n = 23$) $r^2 = 0.29$, $p = 0.008$. QMVC also correlated with FFM in the COPD group: $r^2 = 0.497$, $p < 0.0001$ and in controls: $r^2 = 0.404$, $p = 0.001$. A model containing both FFM and Z_{200}/Z_5 explained 76% of the variance in QMVC in COPD patients, 57% in healthy controls and 72% in the whole population.

CONCLUSION: Z_{200}/Z_5 is associated with quadriceps weakness both in patients and healthy subjects independent of FFM. Further work is needed to confirm the physiological basis of this relationship and establish the value of this non-invasive technique in the clinical setting.

PUBLISHED: Presented as an Abstract at the British Thoracic Society (BTS) Winter Meeting in London, UK, 2-4 December 2009.

ORGANISATION: Muscle Laboratory, Royal Brompton Hospital, London, UK.

RESEARCHERS: Shrikrishna D, Kelly JL, Mendoza L, Jackson AS, Kemp SV, Lord V, Polkey MI, Hopkinson NS



Bodystat Ltd

Tel: +44 (0)1624-629 571 Fax: +44 (0)1624-611 544

E-mail: Info@bodystat.com

Papers available in full on request.