

# Inspiratory work capacity is more severely depressed than inspiratory muscle strength in patients with heart failure: Novel applications for inspiratory muscle training.

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## Abstract

### BACKGROUND:

We hypothesized that the ability to sustain maximal inspiratory pressure (SPlmax) over time as a measure of work capacity may be more severely affected than inspiratory muscle strength (Plmax) in patients with heart failure (HF).

### METHODS:

We retrospectively investigated eighty patients with HF, NYHA II/III/ ambulatoryIV and a (mean±SD) LVEF 27±8%, and compared them to 25 healthy subjects (HS). During a maximal inspiratory manoeuvre from residual volume (RV) to total lung capacity, Plmax was measured as the maximum mouth pressure at RV, inspiratory contraction time (ICT) as the time from RV to end of inspiration and SPlmax as the area under a pressure-time curve using an electronic pressure manometer with designed-purpose software (Trainair(®), Project Electronics Ltd., London, UK). Exercise capacity was assessed with cardiopulmonary exercise testing and the 6-minute walk test (6MWT).

### RESULTS:

Patients achieved a (mean±SD) peak VO<sub>2</sub>=15.7±3.4ml/kg/min and 6MWT=338±88m. Plmax, ICT and SPlmax were reduced in HF pts at 75%\*\*\*, 61%\*\*\* and 52%\*\*\* of HS, and correlated with NYHA (r=-0.485\*\*\*), (r=-0.507\*\*), (r=-0.500\*\*\*), peakVO<sub>2</sub> (r=0.501\*\*\*), (r=0.655\*\*\*), (r=0.508\*\*\*) and 6MWT (r=0.477\*\*\*), (r=0.345\*\*), (r=0.530\*\*\*), respectively (\*p<0.05, \*\*p<0.01, \*\*\*p<0.001).

### CONCLUSION:

Plmax, ICT and SPlmax were impaired in HF patients compared to HS and may be important determinants of exercise capacity. SPlmax was severely depressed even in patients with relatively preserved Plmax and should be considered as an additional target index for inspiratory muscle training. Equations are provided to predict SPlmax in relation to age and exercise capacity in HF.