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Exercise capacity as predictor for anaemia or iron deficiency in patients with chronic heart failure

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Background: Anaemia and iron deficiency (ID) are important factors for muscle function and exercise capacity in patients with chronic heart failure (HF). Their interaction in HF remains to be defined.

Methods: A total of 280 out-patients with stable chronic HF were enrolled with mean age of 67.0±10.7 years, 21%female, mean left ventricular ejection fraction (LVEF) was 38.9±13.4%, mean Body Mass Index (BMI) 29.3±5.5 kg/m^2]. Anaemia was defined according to World Health Organization criteria [Haemoglobin (Hb) <13 g/dL in men and <12 g/dL in women]. ID was defined as ferritin <100 μg/L or ferritin <100 <300 μg/L than with transferrin saturation (TSAT) <20%. Exercise capacity was assessed by spiroergometry (peakVO2), 6 minute walk test (6MWT), short physical performance battery test (SPPB), hang grip strength (HGS) and leg force (LF). All patients were followed up for a mean of 8 month.

Results: A total of 89 (32%) chronic HF patients had anaemia and 142 (51%) had iron deficiency at baseline. Patients with anaemia showed significant lower exercise capacity compared to patients without anaemia (peak VO2: 15.3±4.6 vs. 18.5±4.8 kg/min p<0.0001, 6MWT: 365.2±135.5 vs. 461.6±127.4 m p<0.0001, SPPB: 9.4±2.3 vs. 11.0±1.6 total points p<0.0001, HGS: 32.5±10.0 vs. 38.8±12.4 kg p<0.0001, LF: 31.4±11.0 vs. 41.3±21.6 kg p<0.0001). The same we found in patients with ID compared to patients without ID (peak VO2: 16.3±5.1 vs. 18.6±4.5 kg/min p=0.001, 6MWT: 400.0±140.8 vs. 458.8±128.4 m p=0.0008, SPPB: 10.0±2.1 vs. 10.9±1.7 total points p=0.0003, HGS: 34.5±11.9 vs. 39.3±11.7 kg p=0.001, LF: 35.7±23.4 vs. 40.5±13.6 kg p=0.04). After a Follow up of mean 8 month 53 patients develop a new onset of either anaemia (n=24) or ID (n=29). Logistic regression analysis showed that gender, 6 minute walk distance, SPPB, HGS and presence of diabetes mellitus at baseline are significantly associated with the development of anaemia or ID (all p<0.05). The strongest predictor was lower SPPB (p=0.0008). Interestingly known determinates lower peak VO2, higher age, higher NYHA class, Creatinine, and hsCRP were not predictive in our cohort to develop anaemia or ID after 8 month (all p>0.05).

Conclusion: Both anaemia and ID are strongly associated with reduced exercise capacity in patients with HF. The effect of anaemia and iron deficiency together is stronger than that of anemia and ID alone. Reduced SPPB, 6MWT, and HGS are important risk factors for the development of anaemia or ID.