

## RESEARCH LETTER

## Handgrip weakness and mortality risk in COPD: a multicentre analysis

Handgrip strength is a simple measure of upper limb muscle function that is associated with mortality in the general population and in patients with COPD.<sup>1 2</sup> Recently, normative values for handgrip strength have been proposed based on centile scores in >224 000 healthy adults between 39 and 73 years of age, adjusted for age, sex, height and measurement side.<sup>3</sup> As an illustration, in a typical 65-year-old male patient 5th and 10th centile of right handgrip strength range 18–28 kg and 20–30 kg, respectively, depending on the patient's height. It is unclear whether the identification of handgrip weakness based on these centiles has prognostic value in addition to known prognostic parameters like FEV<sub>1</sub>, age, dyspnoea symptoms (combined in the validated ADO index<sup>4</sup>) and body mass index (BMI).

Therefore, we performed an a posteriori analysis of prospectively collected multicentre data in patients with stable COPD, followed for a median of 3.9 years.<sup>2 5–7</sup>

Handgrip strength was assessed using a Jamar Hydraulic Hand Dynamometer (JA Preston Corporation, Jackson, Michigan, USA) in all centres. Patients were seated in a chair with the elbow in 90° of flexion and touching the chest. In our analysis, both 5th and 10th centile of the normal population were used as cut-offs to define handgrip weakness. Patients were defined

as weak if one side (left or right) was below the respective cut-off.

Descriptive data are reported as mean (SD) or median (25th–75th centile). Cox proportional hazard models were used to assess the relationship between handgrip weakness and mortality. HRs and 95% CI were calculated. Analyses were adjusted for ADO index (age, Modified Medical Research Council Dyspnea Scale (MMRC) and FEV<sub>1</sub>) and BMI.

In total, 998 patients (age 67 (9) years; 72% male; FEV<sub>1</sub> 53 (18) %pred; BMI 27 (5) kg/m<sup>2</sup>; MMRC 2 (1–3)) were included in the analysis. Handgrip force at baseline was 34 (11) kg on the right side and 31 (10) kg on the left side. Handgrip weakness was observed in 89 (9%) and 152 (15%) patients based on the 5th and 10th centile, respectively.

Median follow-up time was 47 months (range 24–60 months). During follow-up, 162 patients (16%) died. The proportion of patients with handgrip weakness was 26% (10th centile) and 15% (5th centile) in patients who died compared with 13% (5th centile) and 8% (10th centile) in survivors.

Characteristics and outcomes in different centres are provided in online supplementary table E1.

Unadjusted analysis reveals an association between handgrip weakness based on 10th centile and 5th centile cut-offs and mortality (HR 1.80 (1.25 to 2.54; p=0.002) and HR 1.71 (0.99 to 2.40; p=0.02), respectively).

After adjustment for ADO index and BMI, weakness based on 10th centile (HR 1.53 (1.07 to 2.12; p=0.02)) but not 5th centile (HR 1.50 (0.96 to 2.27; p=0.08))

remained significantly related to mortality (table 1A and B, respectively). Kaplan–Meier survival curves of the adjusted analysis can be found in online supplementary figure E1A, B.

Based on our findings, we propose to use the 10th centile of recently published normative values as a cut-off to define handgrip weakness in patients with COPD. The identification of handgrip weakness is easy, provides prognostic information in addition to known predictors as ADO index and BMI and may have a role in a quick multidimensional assessment of patients with COPD.

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**Table 1** Cox proportional hazard models to define the association of handgrip weakness with mortality using 10th centile (A) and 5th centile (B) of the healthy population as ref. 3

	HR (95% CI)	p Value
<b>(A)</b>		
Unadjusted		
Handgrip weakness (reference: >C10)	1.80 (1.25 to 2.54)	0.002
Adjusted for ADO index and BMI		
Handgrip weakness (reference: >C10)	1.53 (1.07 to 2.12)	0.02
ADO index (continuous)	1.50 (1.36 to 1.66)	<0.0001
BMI (continuous)	0.92 (0.89 to 0.95)	<0.0001
<b>(B)</b>		
Unadjusted		
Handgrip weakness (reference: >C5)	1.71 (1.08 to 2.58)	0.024
Adjusted for ADO index and BMI		
Handgrip weakness (reference: >C5)	1.50 (0.96 to 2.27)	0.08
ADO index (continuous)	1.51 (1.37 to 1.67)	<0.0001
BMI (continuous)	0.92 (0.89 to 0.96)	<0.0001

ADO index, multidimensional disease index based on age, dyspnoea symptoms and FEV<sub>1</sub> (range 0–10); BMI, body mass index; C10, centile 10; C5, 5th centile.

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