

# Six minute walking test: an old tool with new applications

## Il test del cammino di 6 minuti: una nuova applicazione per un test consolidato

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In 1976 McGavin and colleagues invented a simple, easy to apply and reproducible test assessing exercise capacity in patients with chronic bronchitis [1]. McGavin, at that time registrar at the City Hospital in Edinburgh, probably did not expect such a promising future for his timed walk test. The test not only stood well the advent of sophisticated cardiopulmonary exercise testing but also has been used by other medical specialties serving many purposes up to the 21<sup>st</sup> century.

The main, routine use of the test is to assess exercise capacity in patients with chronic lung disease especially COPD. More recently, the prognostic value of the test has been recognized by Bartolome Celli who included the six-minute walking test (6MWT) as one of the four variables characterizing prognosis in patients with COPD, giving what is known as the BODE score [2]. The 6MWT has been used by cardiologists to assess exercise capacity in patients with heart failure [3]. In the last decade the test has become a principal end-point in numerous clinical trials assessing effects of new vasodilating drugs in patients with arterial pulmonary hypertension [4]. Indications and contraindications to lung volume reduction surgery in patients with emphysema are based, among other indices, on effects of a preoperative rehabilitation program including distance covered during the 6MWT [5].

In the current issue of *Multidisciplinary Respiratory Medicine* Karakurt and colleagues (pag. 244-249) publish results of their interesting investigations assessing the relationship between 6MWT and a variety of variables characterizing functional status of patients with kyphoscoliosis [6]. The authors investigated 25 patients with severe kyphoscoliosis pre-

senting chronic respiratory failure treated with non-invasive ventilation. All patients underwent the 6MWT. The authors found that the distance walked (6MWD) was reduced in the studied group by more than 50% of predicted. The results of the test were related to spirometry, arterial blood gases, dyspnea before and after the test and systolic pulmonary arterial pressure assessed by echocardiography. The 6MWD in meters correlated better with spirometry results than with distance expressed as percent of predicted. In the conclusion the authors state that dyspnea score before the test is an important predictor of 6MWD.

Some points of the Karakurt investigations warrant comment. Results of spirometric tests (Table 1) showed (means) FVC 27% of predicted, FEV<sub>1</sub> 28% of predicted, and FVC/FEV<sub>1</sub> 84%. The presented values are typical of a restrictive pattern of ventilatory impairment. The authors interpreted those results as "severe airflow obstruction with restriction". Although high resolution computed tomography (HRCT) of the studied patients showed signs of emphysema in 16 out of 25 subjects the mean FEV<sub>1</sub>/FVC ratio was normal, ruling out a diagnosis of airflow obstruction. It is possible that some patients presented with FEV<sub>1</sub>/FVC below the lower limit of normal but the authors did not show individual data.

Also the methodology of spirometric testing raises some questions. There is no mention which predicted normal values were used, and no information that the height of the investigated subjects, an important part of the prediction algorithm, has been corrected. Scoliosis of the vertebral column reduces the height of the affected person making actual

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height measurement invalid. Correction of the height for spirometric measurements in kyphoscoliotic patients was introduced many years ago [7]. One may assume that spirometry results evaluated with no correction of height for predicted normal values resulted in the authors' observation that correlation of FVC and FEV<sub>1</sub> with 6MWD resulted better with the measured values (meters) than with the predicted (percent of expected).

The same reservation applies for the calculation of the BMI. Calculation of the BMI in kyphoscoliotics should be performed not from measurement of height but of the arm span, which has proved useful in elderly people [8].

It would be interesting if the authors had measured arterial blood saturation during the 6MWT (pulse oximetry method) also in patients with baseline PaO<sub>2</sub> > 60 mmHg and SaO<sub>2</sub> > 90%. Most probably those patients would also have shown significant desaturation on exercise. In patients with kyphoscoliosis chest wall compliance is reduced, and the stiffened chest wall places the resting position of the respiratory system at a lower lung volume [9]. To compensate for reduced compliance of the chest

wall patients with kyphoscoliosis recruit the inspiratory muscle of the rib cage [10] and may adopt a rapid shallow breathing pattern consisting of low tidal volume and shortened inspiratory time [11], keeping minute ventilation normal. One advantage of breathing with low tidal volume is a reduction of the work of breathing. A second advantage is prevention of inspiratory muscle fatigue.

At rest, such an adaptive mechanism is sufficient to keep the ventilation to perfusion ratio ( $\dot{V}/\dot{Q}$ ) relatively normal avoiding, for many years, hypoxemia. However, on exercise the  $\dot{V}/\dot{Q}$  mismatch increases leading to severe hypoxemia.

Interestingly, despite chronic hypercapnic respiratory failure only 6 out of the 26 subjects studied presented with elevated pulmonary arterial systolic pressure, a sign of hypoxic pulmonary hypertension leading to cor pulmonale. This positive finding may be taken as one of the benefits of the proper care of the investigated group. Early use of noninvasive ventilation with oxygen supplementation if necessary prevents hypoxemia. Prevention of hypoxemia has been shown to prevent progression of pulmonary hypertension in patients with COPD [12].

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