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STATEMENT OF INTEREST

None declared.

REFERENCES

- 1 Gomez-Merino E, Bach JR. Duchenne muscular dystrophy: prolongation of life by noninvasive ventilation and mechanically assisted coughing. *Am J Phys Med Rehabil* 2002; 81: 411–415.
- **2** Toussaint M, Steens M, Wasteels G, Soudon P. Diurnal ventilation *via* mouthpiece: survival in end-stage Duchenne patients. *Eur Respir J* 2006; 28: 549–555.
- **3** Lofaso F, Orlikowski D, Raphael JC. Ventilatory assistance in patients with Duchenne muscular dystrophy. *Eur Respir J* 2006; 28: 468–469.
- **4** Ishikawa Y, Bach JR, Minami R. Cardioprotection for Duchenne's muscular dystrophy. *Am Heart J* 1999; 137: 895–902.
- **5** Bach JR, Ishikawa Y, Kim H. Prevention of the pulmonary morbidity for patients with Duchenne muscular dystrophy. *Chest* 1997; 112: 1024–1028.
- **6** Servera E, Sancho J, Zafra MJ, Catala A, Vergara P, Marin J. Alternatives to endotracheal intubation for patients with neuromuscular diseases. *Am J Phys Med Rehabil* 2005; 84: 851–857.
- **7** Bach JR, Alba AS, Saporito LR. Intermittent positive pressure ventilation *via* the mouth as an alternative to tracheotomy for 257 ventilator users. *Chest* 1993; 103: 174–182.
- **8** Finder J, Birnkrant D, Carl J, *et al.* Respiratory care of the patient with Duchenne muscular dystrophy: ATS consensus statement. *Am J Respir Crit Care Med* 2004; 170: 456–465.
- **9** Respiratory muscle aids: Patient evaluation, respiratory aid protocol, and outcomes. *In*: Bach JR, ed. Management of Patients with Neuromuscular Disease. Philadelphia, Hanley & Belfus, 2004; pp. 271–308.
- **10** Bach JR, Bianchi C, Aufiero E. Oximetry and indications for tracheotomy for amyotrophic lateral sclerosis. *Chest* 2004; 126: 1502–1507.

- 11 Bach JR. Mechanical insufflation–exsufflation: comparison of peak expiratory flows with manually assisted and unassisted coughing techniques. *Chest* 1993; 104: 1553–1562.
- **12** Home mechanical ventilation for neuromuscular ventilatory failure: conventional approaches and their outcomes. *In*: Bach JR, ed. Noninvasive Mechanical Ventilation. Philadelphia, Hanley & Belfus, 2002; pp. 103–128.
- **13** Bach JR. A comparison of long-term ventilatory support alternatives from the perspective of the patient and care giver. *Chest* 1993; 104: 1702–1706.
- **14** Bach J, Goncalves M. Ventilator weaning by lung expansion and decannulation. *Am J Phys Med Rehabil* 2004; 83: 560–568.

DOI: 10.1183/09031936.00156806

From the authors:

We would like to thank J.R. Bach and co-workers for their interest in our editorial. While we note their comments, our experience based on more than 500 neuromuscular patients, 60% of whom are receiving long-term noninvasive mechanical ventilation (NIMV) with manually and mechanically assisted coughing techniques [1] and 40% of whom are tracheostomised, differs from theirs.

NIMV is not always tolerated and does not avoid some severe complications, including acute respiratory failure followed by death, as observed by Toussaint *et al.* [2] despite their undoubted competency in the field.

Our intensive care unit experience allowed us to demystify tracheostomy and to reduce tracheostomy complications. It probably explains why some patients, when asked, considered tracheostomy as a more secure ventilator interface when they had no respiratory reserve, poor tolerance of the different NIMV interfaces and/or the risk of severe complications in nonmedical settings, in particular at home. These points concur with the recent American Thoracic Society consensus [3] mentioned in the letter by J.R. Bach and co-workers. Moreover, we note that when acute respiratory failure is not present tracheostomy can be performed under local anaesthesia while the patient is undergoing noninvasive ventilation [4].

In contrast with the comments of J.R. Bach and co-workers, we believe that respiratory autonomy was better after tracheostomy, probably due to the reduction of dead space and work of breathing as we demonstrated [5]. Furthermore, we use the less resistive phonation valve [6] and try to avoid the suppression of respiratory effort in order to prevent an additional worsening of inspiratory muscle strength [7] by virtue of ventilator-induced diaphragm dysfunction. In addition, we observed improved speech after tracheostomy. This is probably due to our competency in adjusting the ventilator parameters in order to allow patients to speak [8].

The study of swallowing performance did not demonstrate a negative effect of tracheostomy [9]. Moreover, we are currently testing swallowing performances before and after tracheostomy and our first results in three patients suggest that invasive mechanical ventilation may improve swallowing efficacy

(unpublished data). Furthermore, invasive ventilation does not limit the use of electrically powered wheelchairs [10].

MARKSTRÖM *et al.* [11] observed a better quality of life in tracheostomised neuromuscular patients. However, this is contested by BACH [12]. In accordance with MARKSTRÖM *et al.* [11], and although our tracheostomised Duchenne muscular dystrophy (DMD) patients were more severe than our DMD patients under NIMV, quality of life was similar in both groups [13]. We trained families to perform airway suctioning and to change tracheostomy in order to allow them to face anxiety over airway occlusion.

Therefore, in these conditions, tracheostomy may avoid, rather than facilitate, institutionalisation for some patients and we consider that it is dangerous to state that there is no indication that tracheostomy is effective in DMD patients. Each case has to be considered on its merits, without any dogma.

We would like to thank the editors for allowing us to extend this important debate about tracheostomy in neuromuscular patients which underlines that the team's experience and expertise is an important determinant of the choice of the time to switch to tracheostomy.

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STATEMENT OF INTEREST

None declared.

REFERENCES

- **1** Trebbia G, Lacombe M, Fermanian C, *et al.* Cough determinants in patients with neuromuscular disease. *Respir Physiol Neurobiol* 2005; 146: 291–300.
- **2** Toussaint M, Steens M, Wasteels G, Soudon P. Diurnal ventilation *via* mouthpiece: survival in end-stage Duchenne patients. *Eur Respir J* 2006; 28: 549–555.

- **3** American Thoracic Society/European Respiratory Society, ATS/ERS Statement on respiratory muscle testing. *Am J Respir Crit Care Med* 2002; 166: 518–624.
- **4** Orlikowski D, Prigent H, Gonzalez-Bermejo J, *et al.* Noninvasive ventilation as alternative to endotracheal intubation for tracheostomy in advanced neuromuscular disease. *Respir Care* 2007 (in revision).
- **5** Chadda K, Louis B, Benaissa L, *et al.* Physiological effects of decannulation in tracheostomized patients. *Intensive Care Med* 2002; 28: 1761–1767.
- 6 Prigent H, Orlikowski D, Blumen MB, et al. Characteristics of tracheostomy phonation valves. Eur Respir J 2006; 27: 992–996
- **7** Vassilakopoulos T, Petrof BJ. Ventilator-induced diaphragmatic dysfunction. *Am J Respir Crit Care Med* 2004; 169: 336–341.
- **8** Prigent H, Samuel C, Louis B, *et al.* Comparative effects of two ventilatory modes on speech in tracheostomized patients with neuromuscular disease. *Am J Respir Crit Care Med* 2003; 167: 114–119.
- **9** Terzi N, Orlikowski D, Aegerter P, *et al.* Breathingswallowing interaction in neuromuscular patients: a physiological evaluation. *Am J Respir Crit Care Med* 2007; 175: 269–276.
- **10** Pellegrini N, Guillon B, Prigent H, *et al.* Optimization of power wheelchair control for patients with severe Duchenne muscular dystrophy. *Neuromuscul Disord* 2004; 14: 297–300.
- **11** Markström A, Sundell K, Lysdahl M, Andersson G, Schedin U, Klang B. Quality-of-life evaluation of patients with neuromuscular and skeletal diseases treated with noninvasive and invasive home mechanical ventilation. *Chest* 2002: 122: 1695–1700.
- **12** Bach JR. Noninvasive ventilation is more than mask ventilation. *Chest* 2003; 123: 2156–2157.
- **13** Raphael JC, Dazord A, Jaillard P, *et al.* Indices de satisfaction des patients atteints d'une dystrophie musculaire de Duchenne de Boulogne et ventilés à domicile. [Assessment of quality of life for home ventilated patients with Duchenne muscular dystrophy.] *Rev Neurol (Paris)* 2002; 158: 453–460.

DOI: 10.1183/09031936.00027307

Exercise recovery phase: unrecovered part of the recommendations

To the Editors:

As the implications of cardiopulmonary exercise testing (CPET) are continually growing, Palange *et al.* [1] are to be congratulated for their paper entitled "Recommendations on use of exercise testing in clinical practice". It has been long awaited, as extensive research in the area simply outdated previous European [2] and American guidelines [3]. As Palange *et al.* [1] mentioned that assessment requires

integrative interpretation of a "cluster of response variables", it seemed surprising that no parameter describing the recovery period was discussed.

We would like to highlight the recovery period as an integral part of CPET, which is important for the sufficiency of data [2]. Although on- and off-kinetics are in close relation, they are not always symmetrical, due to altered tissue metabolism after exercise, which alone is a strong argument for incorporating



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