Mechanical Insufflation-Exsufflation: The Good, the Bad, and the Ugly

Mechanical insufflation-exsufflation is a vital component in the management of respiratory symptoms in individuals with neuromuscular disease.[1,2] This therapy is often the primary treatment modality long before additional support such as ventilator assistance is indicated. Although there are only 2 devices approved in the United States, there are several devices that have been approved in Europe. The existence of different devices raises the question of whether they should be used interchangeably or not. A previous study comparing 2 commercially available mechanical in-exsufflation devices in Europe found differences in peak expiratory flow (PEF).[3] In this issue of RESPIRATORY CARE, Frigerio et al[4] reported the findings of an in vitro comparison of 5 mechanical in-exsufflation devices available in Europe. They found discrepancies between the preset and actual inspiratory and expiratory pressures and time. Tidal volume and PEF were also affected by different simulated conditions. A reduction in tidal volume resulted in a lower pre-tussive volume, potentially leading to a less effective artificial cough. A decrease in PEF could potentially have similar effects. The authors also found that air leaks negatively impacted the performance of the devices. The clinical implication is that practitioners should verify that caregivers can correctly operate the device while minimizing the presence of air leaks. Although the reported differences are statistically significant, new studies are necessary to establish whether they are clinically important as well. A clinical trial with a crossover design utilizing the best and worse in vitro performer could be used to determine the impact of using different devices on frequency of respiratory infections and hospitalizations in a population with neuromuscular disease. It also important to point out that the reported findings should be confined to the testing conditions that were utilized in the study. Namely, these results cannot be extrapolated to either pediatric patients/models or different settings. In addition to performance of mechanical in-exsufflation devices, the authors also evaluated ease of use by ICU physicians. They found that the device with an analog interface resulted in more errors. User-friendliness is a characteristic that should not be overlooked when respiratory devices are prescribed for home. Home caregivers with no medical background are often trained in a short period of time to provide care at home.

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Dependence on medical technology influences multiple psychosocial domains, including emotional, social, relationship, educational, and quality of life.[5] Just the mere presence of medical equipment in the home can be a source of stress, and as the authors revealed, new devices are often viewed as a sign of disease progression. Caregivers also experience role conflict when the lines become blurred between parental duties and providing medical care.[6] Clinicians typically do not consider the psychological impact of adding new therapies and devices to the home regimen for patients. In this issue of RESPIRATORY CARE, Moran et al[7] described the lifestyle implications of home mechanical in-exsufflation for children with neuromuscular disease and their caregivers. They identified common themes that are consistent with the literature regarding quality of life, coping, and resilience for both technology-dependent children and their caregivers.[5] Although the authors described an important and often disregarded aspect of the lifestyle implications of home mechanical in-exsufflation, knowledge of pulmonary function data (ie, FVC and cough peak flow) and information regarding use of other, if any, respiratory devices or techniques would have been useful to put the findings in the context of the subjects' medical severity and complexity. We speculate that the results might have been different depending on the disease stage of the interviewed subjects. Future studies should include these data to facilitate generalization of the findings.

Dr Berlinski has disclosed relationships with Vertex Pharmaceuticals, AbbVie, Aptalis, Genentech, Janssen Research & Development, Gilead Sciences, Teva Pharmaceutical Industries, Philips Respironics, and the Therapeutics Development Network. Ms Willis has disclosed no conflicts of interest.

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DOI: 10.4187/respcare.04272

Although both papers[4,7] on mechanical in-exsufflation address different attributes within the realm of respiratory care, the authors present relevant information that should be considered in clinical practice. When selecting which mechanical in-exsufflation device to use for patients with neuromuscular disease, performance data are available that may help guide in selecting which device would be best for a particular patient given the clinical condition. As new devices become available, more studies are needed to compare their performance, including data using pediatric parameters and use with tracheostomy tubes. In addition, in vitro/in vivo correlation using clinically acceptable outcome measures and user studies during the device development process to minimize user error and increase patient safety are needed. Also, step-by-step voice-guided instructions and positive feedback might be helpful in reducing errors and retraining caregivers on appropriate device use. Health-care providers should be more aware of the psychological impact new devices may have on patients and families and balance it against the clinical condition of the patient and the culture and context of the family.

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REFERENCES

1. Birnkrant DJ, Bushby KM, Amin RS, Bach JR, Benditt JO, Eagle M, et al. The respiratory management of patients with Duchenne muscular dystrophy: a DMD care considerations working group specialty article. Pediatr Pulmonol 2010;45(8):739-748.
2. Wang CH, Finkel RS, Bertini ES, Schroth M, Simonds A, Wong B, et al. Consensus statement for standard of care in spinal muscular atrophy. J Child Neurol 2007;22(8):1027-1049.
3. Porot V, Guérin C. Bench assessment of a new insufflation-exsufflation device. Respir Care 2013;58(9):1536-1540.
4. Frigerio P, Longhini F, Sommariva M, Stagni EG, Curto F, Redaelli T, et al. Bench comparative assessment of mechanically assisted cough devices. Respir Care 2015;(7):975-982.
5. Mesman GR, Kuo DZ, Carroll JL, Ward WL. The impact of technology dependence on families and their children. J Pediatr Health Care 2013;27(6):451-459.
6. Kirk S, Glendinning C, Callery P. Parent or nurse? The experience of being the parent of a technology-dependent child. J Adv Nurs 2005;51(5):456-464.
7. Moran, FC, Spittle AJ, Delany C. Lifestyle implications of home mechanical insufflation-exsufflation for children with neuromuscular disease and their families. Respir Care 2015;(7):967-974.