

5. Nseir S, Marquette CH: Diagnosis of hospital-acquired pneumonia: Postmortem studies. *Infect Dis Clin North Am* 2003; 17:707–16
6. Jaillette E, Martin-Loeches I, Artigas A, Nseir S: Optimal care and design of the tracheal cuff in the critically ill patient. *Ann Intensive Care* 2014; 4:7
7. Jaillette E, Brunin G, Girault C, Zerimech F, Chiche A, Brouqsault-Dedrie C, Fayolle C, Minacori F, Alves I, Barrailler S, Robriquet L, Tamion F, Delaporte E, Thellier D, Delcourte C, Duhamel A, Nseir S: Impact of tracheal cuff shape on microaspiration of gastric contents in intubated critically ill patients: Study protocol for a randomized controlled trial. *Trials* 2015; 16:429

(Accepted for publication August 8, 2016.)

### In Reply:

We appreciate the interest of Rouzé *et al.* in our recent article on the role played by tapered-cuff endotracheal tube in preventing early postoperative pneumonia and microaspiration after major vascular surgery.<sup>1</sup>

We are aware of the pioneering work by Nseir and colleagues<sup>3,4</sup> suggesting that sealing properties of endotracheal tube cuffs might be enhanced by the tapered-shape design. We agree that the ongoing randomized controlled multicenter BestCuff study,<sup>2</sup> carried out by the same team, will be essential to fully evaluate the efficacy of tapered cuffs to prevent microaspiration. However, two major differences with our work deserve to be highlighted. First, their previous prospective study<sup>3,4</sup> compared tapered *versus* cylindrical cuff made of polyurethane and not polyvinyl chloride. Second, both previous studies were carried out in a medical intensive care unit enrolling patients with median mechanical ventilation for more than 15 days. In our clinical controlled randomized Tapered Endotracheal Tube to prevent Respiratory Infections (TETRIS) trial, the median duration of mechanical ventilation was lower than 30 h in patients exclusively enrolled after major vascular surgery. In other words, they properly designed studies mainly focusing on ventilator-associated pneumonia, while we designed ours focus on early postoperative pneumonia. This divergence in the primary endpoint of our respective research may have yielded different results in terms of the impact of tapered-shape cuff on microaspiration or pneumonia rate.

We agree that the percentage of time spent with underinflation was low in both groups in our study and that the difference did not reach significance (median, 25 to 75%; interquartile range, 0% [0 to 0%] for standard spherical cuff *vs.* 0% [0 to 18.5%] for tapered cuff;  $P = 0.057$ ; data from our article<sup>1</sup>). This absence of difference may be due to a lack of power since we did not design our sample size based on this endpoint. However, this absence of difference does not eclipse that our study clearly pointed out a higher  $P_{\max}$ , a lower  $P_{\min}$ , a 27-fold higher percentage of time spent with overinflation, and a 2.5-fold higher variation in  $P_{\text{cuff}}$  in the tapered group compared with the standard group. Aside from a nonclinically relevant difference in positive

end-expiratory pressure between groups (median, 25 to 75%; interquartile range, 5 [5 to 6] *vs.* 5.6 [5 to 6.3] cm H<sub>2</sub>O;  $P = 0.03$ , data from our article<sup>1</sup>), both groups were comparable with respect to other characteristics. Thus, we believe that cuff shape was the single variable leading to these differences observed in cuff pressures between groups. However, Rouzé *et al.* expressed their concerns about a potential difference in airway pressure between groups, which could have led to a bias in our study. We had the opportunity to extract respiratory data from the medical records of the patients included in our trial that were automatically and continuously recorded on the intensive care unit electronic medical records system. Per-operative airway pressure from 42 of 52 patients in the tapered group and 41 of 57 patients in the control group could be newly compared. No difference between groups was found (mean  $\pm$  SD, 20.3  $\pm$  5.1 cm H<sub>2</sub>O for standard spherical cuff *vs.* 21.0  $\pm$  5.7 cm H<sub>2</sub>O for tapered cuff;  $P = 0.36$  by Student's *t* test, subsequently generated data). Therefore, we do believe that the tapered shape impacted cuff pressures in our study.

Moreover, Nseir *et al.*<sup>3</sup> also found a 1.5-fold higher coefficient of variation within the tapered group compared with the cylindrical group ( $P = 0.002$ ) and stated in their discussion that “this result could be explained by the different cuff shape.” In the same study, they also observed an increased percentage of time spent with underinflation in the tapered group. Similarly, in their second trial,<sup>4</sup> a two-fold higher percentage of time spent with underinflation was retrieved in the tapered group *versus* the cylindrical group (median, 25 to 75%; interquartile range, 41% [17 to 62%] *vs.* 21% [8 to 47%];  $P = 0.049$ ). Again, our results are perfectly in line with these findings.

Finally, we wholeheartedly agree with Rouzé *et al.* stating that the accuracy in quantifying microaspiration remains crucial to properly assess the efficacy of any preventive measure. Unfortunately, regarding the short duration of postoperative mechanical ventilation (less than 30 h) and the high percentage of extubated patients at day 2, we could not repeat the pepsin and amylase quantification within tracheal aspirate at further time points.

The results of our study, the first to test prospectively the impact of the polyvinyl chloride tapered-cuff endotracheal tube on early postoperative pneumonia, provide evidence that the tapered shape can induce higher variation in cuff pressure and higher percentage of time spent with overinflation, with cuff pressure manually controlled every 6 h. Further evaluation is required to determine whether continuous tapered-cuff-pressure control can decrease the time spent with underinflation and overinflation and reduce microaspiration.

### Competing Interests

The authors declare no competing interests.

**Antoine Monsel, M.D., M.Sc., Marine Le Corre, M.D., M.Sc., Hélène Brisson, M.D., M.Sc., Charlotte Arbelot, M.D., Corinne Vezinet, M.D., Marie-Hélène Fléron, M.D., Qin Lu, M.D., Ph.D., Olivier Langeron, M.D., Ph.D., Jean-Jacques Rouby, M.D., Ph.D.** Multidisciplinary Intensive Care Unit, Department of Anesthesiology and Critical Care, La Pitié-Salpêtrière Hospital, Assistance Publique-Hôpitaux de Paris, UPMC Université, Paris, France (A.M.). antoine.monsel@gmail.com. Information on purchasing reprints may be found at [www.anesthesiology.org](http://www.anesthesiology.org) or on the masthead page at the beginning of this issue. ANESTHESIOLOGY's articles are made freely accessible to all readers, for personal use only, 6 months from the cover date of the issue.

## References

1. Monsel A, Lu Q, Le Corre M, Brisson H, Arbelot C, Vezinet C, Fléron MH, Ibanez-Estève C, Zerimech F, Balduyck M, Dexheimer F, Wang C, Langeron O, Rouby JJ, Bodin L, Deransy R, Garçon P, Douiri H, Khalifa I, Pons A, Gu WJ, Koskas F, Gaudric J; TETRIS Study Group: Tapered-cuff endotracheal tube does not prevent early postoperative pneumonia compared with spherical-cuff endotracheal tube after major vascular surgery: A randomized controlled trial. *ANESTHESIOLOGY* 2016; 124:1041–52
2. Jaillette E, Brunin G, Girault C, Zerimech F, Chiche A, Broucqsault-Dedrie C, Fayolle C, Minacori F, Alves I, Barrailler S, Robriquet L, Tamion F, Delaporte E, Thellier D, Delcourte C, Duhamel A, Nseir S: Impact of tracheal cuff shape on microaspiration of gastric contents in intubated critically ill patients: Study protocol for a randomized controlled trial. *Trials* 2015; 16:429
3. Nseir S, Zerimech F, De Jonckheere J, Alves I, Balduyck M, Durocher A: Impact of polyurethane on variations in tracheal cuff pressure in critically ill patients: A prospective observational study. *Intensive Care Med* 2010; 36:1156–63
4. Jaillette E, Zerimech F, De Jonckheere J, Makris D, Balduyck M, Durocher A, Duhamel A, Nseir S: Efficiency of a pneumatic device in controlling cuff pressure of polyurethane-cuffed tracheal tubes: A randomized controlled study. *BMC Anesthesiol* 2013; 13:50

*(Accepted for publication August 8, 2016.)*