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CPAP alone best estimates post-extubation effort during spontaneous breathing trials in children

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Dear Editor

We would like to thank Dr. Kida et al. [1] for their letter regarding our paper about pressure support (PS) during pediatric extubation readiness testing [2]. We demonstrated that effort of breathing on CPAP alone for most children was significantly lower than post-extubation effort, regardless of endotracheal tube size. The authors questioned the PS level of 10 cmH₂O, the influence of cuffed versus uncuffed endotracheal tubes, and covariates. They argue these factors may affect weaning success.

We agree these factors may affect weaning success, but that was not the target of our paper. We focused on children *who were clinically ready to extubate (i.e., they had already weaned)*. Nearly all children had passed a CPAP spontaneous breathing trial (SBT) for a minimum of 30 minutes, but on average 2 hours (89.7% of patients, see discussion). We then performed measurements on PS 10/5 cmH₂O, followed by CPAP 5 cmH₂O alone, comparing effort of breathing on these settings to post-extubation. We found CPAP alone, without any PS, over-estimated post extubation effort for 78% of patients, and PS 10/5 cmH₂O over-estimated post extubation effort for 95.6% of patients. Given CPAP over-estimates post extubation effort for ¾ of patients, it is unclear what information would be gained from testing other PS levels. Our calculations of resistance were based on flow measured on CPAP, demonstrating that resistance did not “need to be overcome” with PS because at the time of extubation, flow is often low. We are not arguing against using PS during weaning, but rather that SBTs to determine extubation readiness should use CPAP alone. If the patient has high work of breathing on CPAP, 78% of the time their work will be *higher* after extubation, making them likely to fail extubation.

There was no difference in the rate of patients whose post-extubation effort was higher than it was on CPAP between cuffed versus uncuffed endotracheal tubes (79.2% uncuffed, 77.5% cuffed), nor was there a difference in the percent change in PRP on CPAP compared to post extubation between those with cuffed versus uncuffed endotracheal tubes ($p=0.7$). There was also no relationship between pre versus post extubation effort (on CPAP or PS) and leak percentage with uncuffed endotracheal tubes. Finally, none of the proposed confounding

factors (pneumonia, length of ventilation, chronic lung disease, sedation, fluid balance, and PEEP level) were different between the 78% of patients who had higher effort of breathing after extubation than on CPAP, compared to the 22% of patients who had lower or equal effort of breathing after extubation than on CPAP (all $p>0.1$).

We reiterate that *any* level of PS leads to an under-estimate of post-extubation effort of breathing. While PS may have value during ventilator weaning, it should not be used when deciding if a patient is ready to extubate, regardless of the endotracheal tube size, or the presence of a leak (with an uncuffed endotracheal tube).

References

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