**Author’s response to reviews**

**Title:** Role of tube size and intranasal compression of the nasotracheal tube in respiratory pressure loss during nasotracheal intubation: a laboratory study

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Reviewer reports:

Alexander Kuo (Reviewer 3): Consider the follow revisions for organization and readability:

Be more concise and clear in the conclusions, for example consider this revision:

**Conclusion:**

The most significant factor in pressure loss to flow is decreasing NTT diameter. Slip joint transition and the curvature of the NTT were contributing factors and were worse in smaller tube diameters. External compression of NTT in the intranasal cavity also cause a small but measurable increase in pressure loss, especially in small diameter NTT. This increased flow resistance could significantly increase work of breathing compared to oral tracheal tubes, especially at high peak flows.

Re: Thank you for your suggestion. As described in Background, we hypothesized that use of a small NTT for nasotracheal intubation and/or partial compression of the NTT in the nasal passage may lead to a considerable increase in airway resistance. We assumed that consequent increased work of breathing can have severe consequences, particularly in patients with compromised lung function.

We think that the clinical importance of this study as well as the results should be described in Conclusion as mentioned in Editor’s comment for revision #4. Thus, in revision #5, we revised
Conclusion following Editor’s comment. I think that it is important to indicate the importance of increase work of breathing due to using a small NTTs as you mentioned. The Conclusion was changed as follows:

In conclusion, the results of the present study indicate that pressure losses through smaller-sized NTTs are greater than those through larger-sized NTTs. Although larger-sized NTTs may increase the risk of epistaxis, from the perspective of the work of breathing, the use of larger-sized NTTs should be considered in patients that require nasotracheal intubation, especially among patients with abnormal respiratory mechanics that may require larger mechanical support during or weaning from mechanical ventilation.

Introduction:

Pg 6 Ln 4:
"...various sizes were measured on the physical simulation model and calculated fluid dynamically."

This is grammatically awkward. Consider revising to "...various sizes were measured on the physical simulation model and calculated using established fluid dynamic equations."

Re: Thank you for your suggestion. The sentence was changed following your suggestion.

Pg 6 Ln 7

The last 2 paragraphs of the introduction provide more detailed information on the theoretical underpinnings of the experiments. These would be better moved to the Discussion section.

Re: In revision #2, we wrote the reason why the methods and principles for measuring the pressure loss across the tube were chosen in this study in Background. Although the description may be excessive for Background, we think the description in Background will help the reader to understand the content of this study, especially the predicting formula using in Methods. Reviewer 2 noted as “The explanation in the background was changed to make the content of this study easier to understand”. Thus, we did not move the last 2 paragraphs of Background.

Results:

Pg 16 Ln 4: I would re-iterate the important point that these calculations give the pressure drop through a "Straight tube." I.e Calculated pressure losses through a non-curved 6.0-, 6.5-, 7.0-, 7.5-, and 8.0-mm ID uncompressed tubular parts were 359.6, 253.3, 184.9, 135.6, and 101.3 Pa,
respectively. The pressure losses through the partially compressed parts of each tube were predicted to increase by approximately 10 Pa at a minor axis of more than 5 mm and approximately 20 Pa at a minor axis of 4 mm; the predicted pressure losses through NTTs of 6.0-, 6.5-, 7.0-, 7.5-, and 8.0-mm ID compressed to a minor axis of 3 mm were 82.0, 64.6, 57.5, 51.3, and 45.8 Pa larger than those in the corresponding uncompressed NTTs of each size, respectively.

Pressure losses through a non-curved compressed 6.0-, 6.5-, 7.0-, 7.5-, and 8.0-mm ID NTTs with minor axes of 3.0, 3.5, 3.9, 4.2, and 4.8 mm, respectively, resulting from application of the maximum intranasal compression force of 34.1 N, were calculated as 82.0, 38.0, 23.5, 16.6, and 9.3 Pa, respectively."

Re: The former sentence was revised following your suggestion. Since pressure losses through NTTs with maximum compression were measured using actual tubes in the physical simulation, the latter sentence was unchanged.

I would also re-emphasize the point of the calculation is the pressure loss in a non-curved tube:

Appendix Pg 20 Ln 45:
"Calculation of the pressure losses through a non-curved tubular tube with partial compression"

Re: The title of APPENDIX was revised following your suggestion.

Again, be more concise and clear in the first paragraph of the discussion:

Pg 17 Ln 1

Re: Discussion:

In this study we demonstrated that pressure loss through NTT was greater than through a standard oral endotracheal tube at sizes of 6.0, 6.5, 7.0, 7.5 and 8.0-mm ID NTT. We found that diameter was the largest factor in NTT pressure loss, with a 6.0 mm NTT having more than 3 times the pressure loss of an 8.0 mm NTT at air flow rates of 30 L/min. The acute curvature of NTT contributed to approximately 10% to 15% of this pressure loss. External compression of the NTT similar to in the nasal cavity further increased the NTT pressure loss by approximately 10% to 15%, with a larger absolute increase for smaller NTT.

I quite agree to your revision. The contribution of external compression to total pressure loss was recalculated. The first paragraph of the discussion was changed following your revision, and the contribution of slip joint to pressure loss was added as follows:
In this study we demonstrated that pressure loss through NTT was greater than through a standard oral endotracheal tube at sizes of 6.0, 6.5, 7.0, 7.5 and 8.0-mm ID NTT. We found that diameter was the largest factor in NTT pressure loss, with a 6.0 mm NTT having more than 3 times the pressure loss of an 8.0 mm NTT at air flow rates of 30 L/min. The slip joints and the acute curvature of NTT contributed to approximately 20–35% and 10–15% of this pressure loss, respectively, and were worse in smaller tube diameters. External compression of the NTT similar to in the nasal cavity further increased the NTT pressure loss by approximately 5–10%, with a larger absolute increase for smaller NTT.