Background

- Cuffed endotracheal tubes (cETT) have become standard practice in pediatric patients.\(^1\)\(^3\)
- Hyperinflation of the cuff compromises the tracheal mucosa while an incompetent seal impacts ventilation and increases the risk of aspiration.
- The air-leak test is frequently used to inflate the cuff; however, it may not avoid hyperinflation of the cuff.\(^4\)\(^5\)
- Another method is to adjust the volume of air in the cuff and tracheal seal based on inspired and expired tidal volumes ratio (TVe/TVi).\(^6\)
- This in vitro study evaluates these two methods in relation to the intracuff pressure (CP).

Methods

- In vitro set up: Artificial trachea (stem portion of a size 5 Ambu LMA with ID of 12mm), 1 liter artificial test lung, Drager Avance anesthesia machine, Microcuff® cETT (size 4.5 and 5.0 ID).
- After placing each cETT inside the artificial trachea, a tracheal seal was achieved using the air-leak test at a CPAP of 20 cm H\(_2\)O.
- The artificial lung was ventilated using volume-controlled ventilation at settings of TV: 100 or 200 mL at 20 or 15 breaths/min, PEEP: 5 cm H\(_2\)O and gas flow rate: 6 L/min.
- With each breath, the TVe was recorded and the TVe/TVi ratio determined.

Results

- As air was added to the cuff to modify the TVe/TVi ratio, the CP increased significantly with higher TVe/TVi ratios (Table 1).

| Trial conditions | Mean ± SD of CP (cmH\(_2\)O) at specified TVe/TVi ratio | P-
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<td>0.7</td>
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<tr>
<td>4.5 mm cETT, 100 mL TV</td>
<td>18 (5)</td>
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<tr>
<td>4.5 mm cETT, 200 mL TV</td>
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<td>5 mm cETT, 100 mL TV</td>
<td>8 (2)</td>
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<tr>
<td>5 mm cETT, 200 mL TV</td>
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* F-test of any difference across TVe/TVi ratios, by ANOVA.
CP = intracuff pressure; TVe = expired tidal volume; TVi = inspired tidal volume

Conclusions

- The air leak test alone may not be enough to achieve a safe CP.
- The TVe/TVi ratio may be used to achieve a safe CP.
- As the TVe/TVi ratio increases, there is an increase in the CP.
- When a TVe/TVi ratio of 0.8 is maintained, the CP is within the recommended range.

Table 1: CP according to TVe/TVi ratio at each combination of cETT size and TV.

References