

The Risk of Gastric Insufflation with THRIVE

Report of THRIVE-Safe nasal Cannula

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Introduction

Transnasal humidified rapid insufflation ventilatory exchange (THRIVE) is a novel method of preoxygenation.

Utilising high flow warmed nasal cannula delivered oxygen (at 60-80 l min⁻¹), THRIVE remains in situ during laryngoscopy, providing apnoeic oxygen and extending safe apnoeic time to over an 1 hour.¹

There is a risk that continuous high flow oxygen during apnoea may lead to gastric insufflation if a tight fitting face mask is used concurrently.

We report a mannequin study of pressures in and flow through the oesophagus with THRIVE, with and without a tight fitting face mask.

We also report a novel device adapted for safe use of a facemask with THRIVE.

The THRIVE-safe Nasal Cannula

A wide bore nasal cannula with collapsible tubing and a pressure relief valve (Figure 3).

Use of a face mask automatically occludes flow through the cannula, with venting occurring through the pressure relief valve. With mask removal flow resumes as the collapsible tubing reopens

Methods

A resuscitation mannequin (MegaCode Kelly, Laerdal Medical Limited, Orpington, UK) was adapted by addition of a Wright's respirometer, pressure gauge and adjustable pressure limiting valve (APLV) to the oesophagus.

The APLV was calibrated to open at 20 cmH₂O, simulating the lower oesophageal sphincter.² The Wright's respirometer measured flow through the models oesophagus equating to the rate of gastric insufflation. THRIVE was applied with and without a facemask with the anaesthetic machine (Drager Primus, Draeger Medical UK Ltd, Hemel Hempstead UK) APLV set at open, 5cmH₂O and fully closed. The study was repeat using the THRIVE-safe cannula. 10 measurements were made for each set up. Fisher exact test was used to compare between conventional THRIVE and THRIVE-safe groups.

Local R&D approval and ethical waiver were granted.

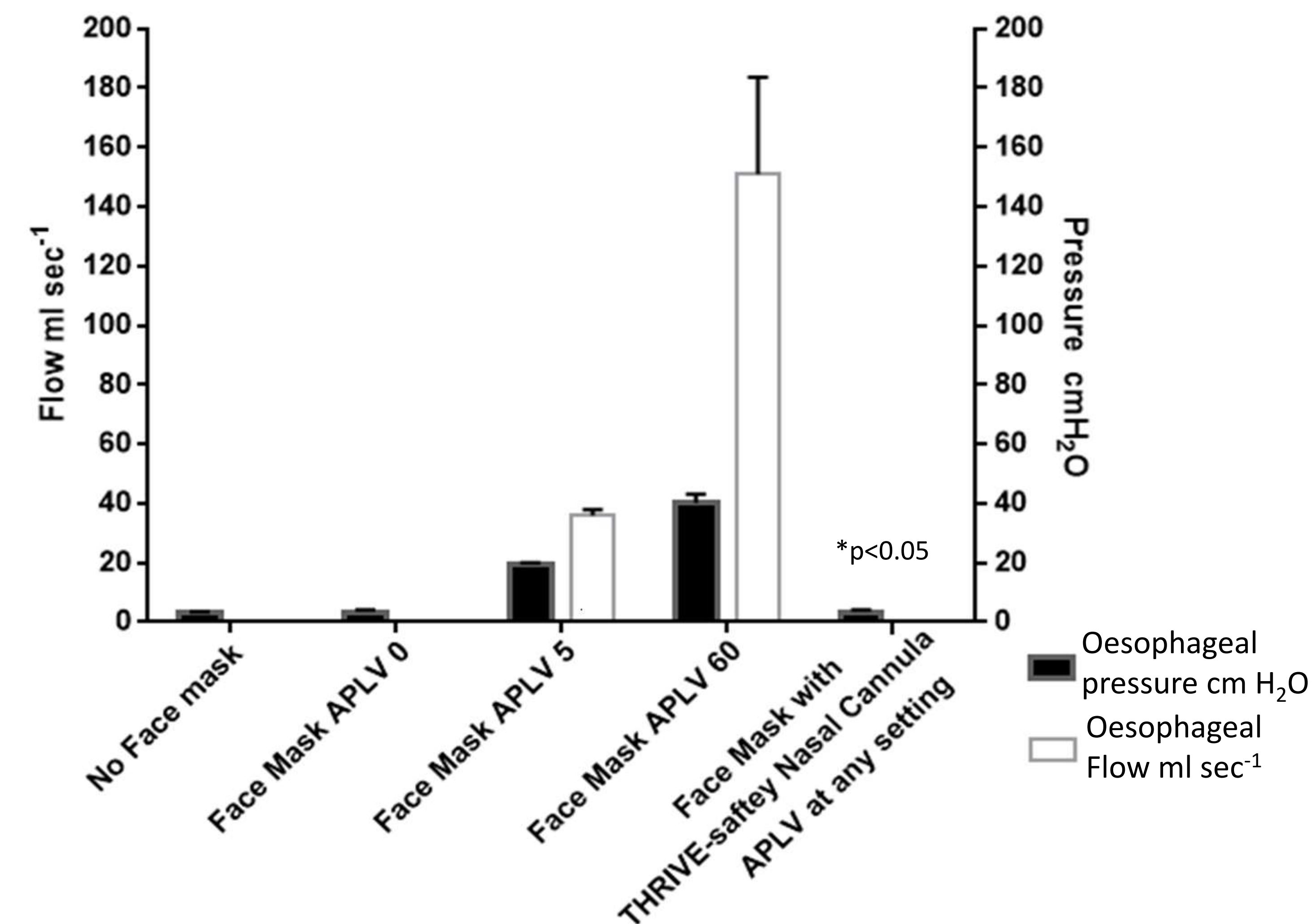


Figure 1. Model Mean (SD) oesophageal pressures and flows during THRIVE with and without a facemask and THRIVE-safe nasal cannula

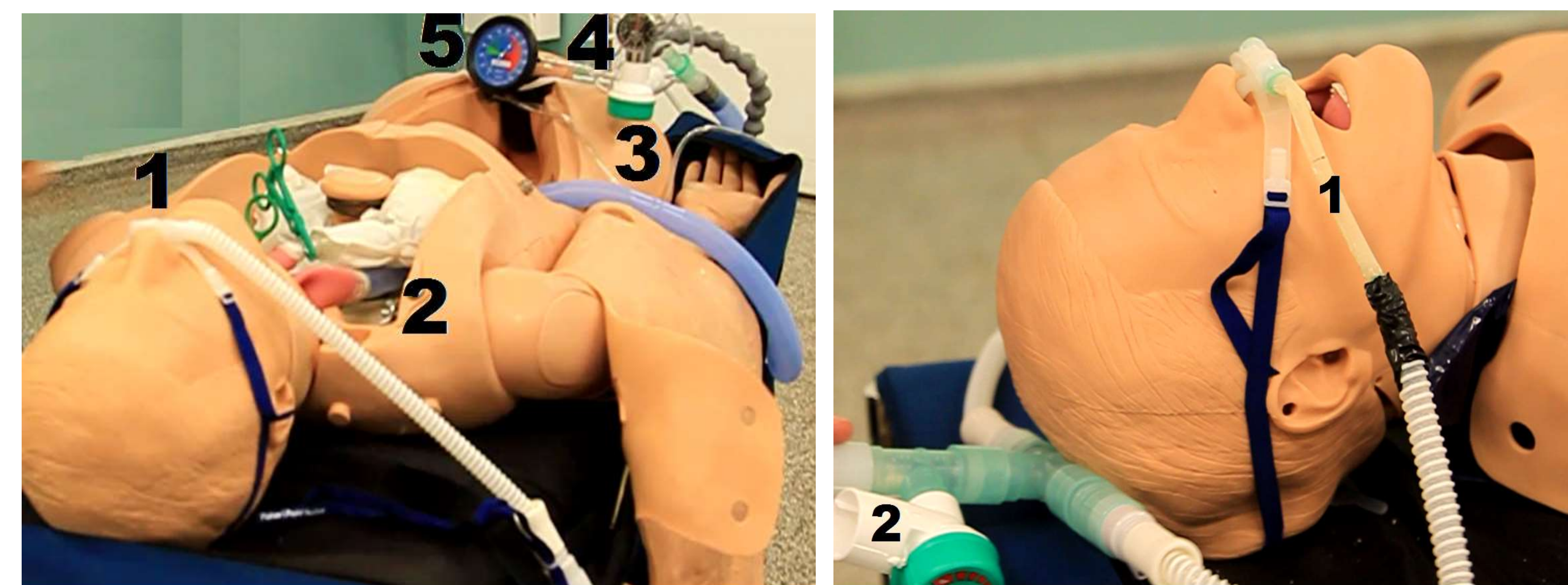


Figure 2 Mannequin set up.

- 1 Conventional THRIVE with rigid tubing
- 2 Mannequin Oesophagus
- 3 APLV calibrated to 20cmH₂O creating models oesophageal sphincter
4. Wright's respirometer measuring oesophageal flow
5. Aneroid pressure gauge measuring oesophageal pressure

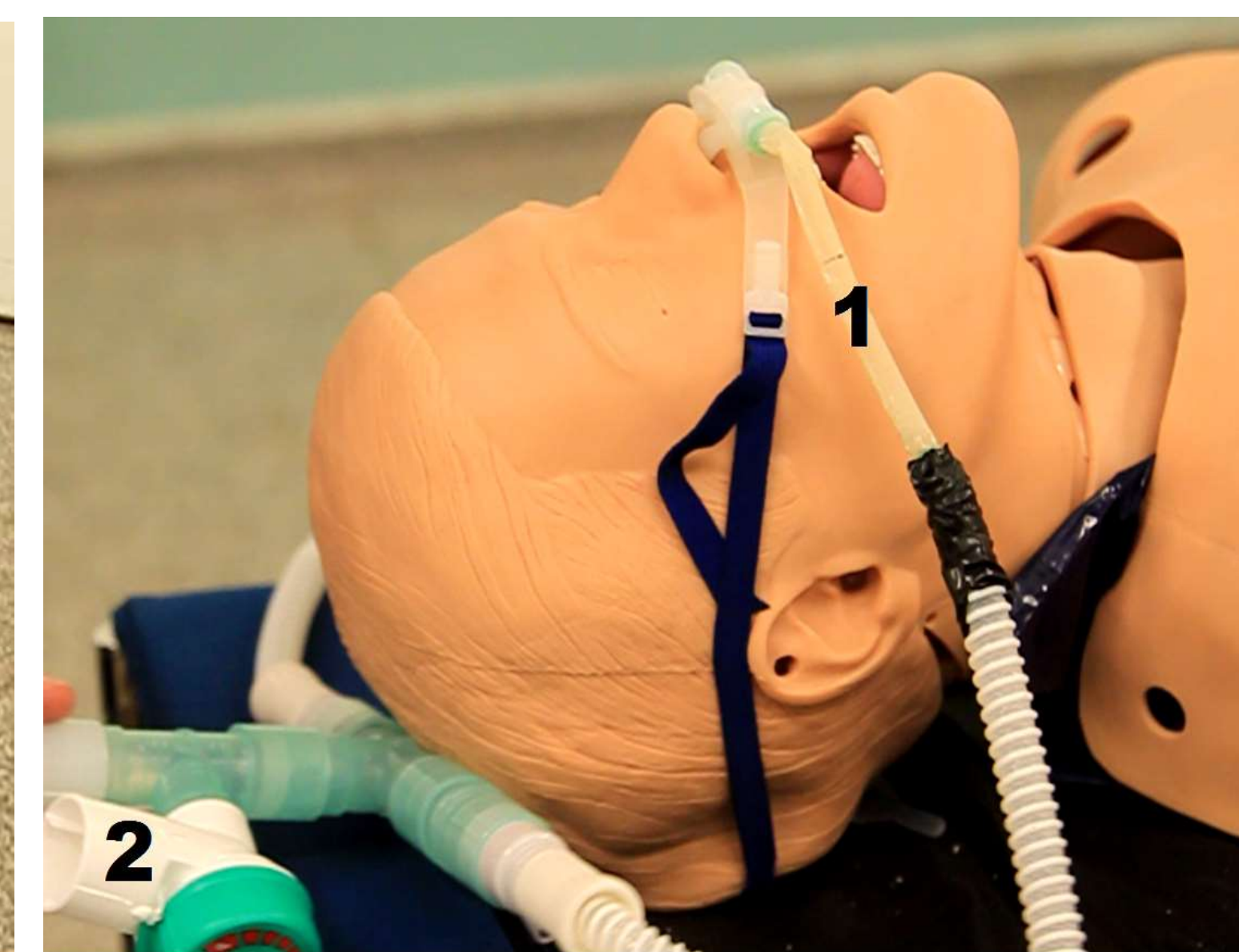


Figure 3. THRIVE-Safe Nasal cannula

- 1 Wide bore nasal cannula with collapsible 2 tubing
- 2 Pressure relief valve

References

1. A. Patel, A.R.Nouraei Transnasal Humidified Rapid-insufflation Ventilatory Exchange (THRIVE): a physiological method of increasing apnoea time in patients with difficult airways. *Anaesthesia* 2015;70:323-329
2. Gideon RM, Manometry: Technical issues. *Gastrointest Endoscopy Clin N Am* 2005;15:243255

Results

Results are shown in Figure 1.

Without a facemask oesophageal pressures remain low (3cmH₂O) and no flow occurs through the model's oesophagus. The same is true if a tight fitting face mask is applied but only if the anaesthetic machine APLV is fully open.

If the Anaesthetic machine APLV is closed (even partially at 5cmH₂O), a statistically significant increase in pressure and flow is seen. The pressure generated overcoming the models lower oesophageal sphincter, leading to significant flow through the oesophagus. With the valve fully closed pressure reached 40cmH₂O and a flow of 150ml sec⁻¹ was generated.

Compared with conventional THRIVE, oesophageal pressures remained low and no flow was seen with THRIVE-Safe cannula whether the anaesthetic machine APLV was closed or open. This was statistically significant (p<0.05).

Conclusion

- **THRIVE is an exciting new method of providing pre-oxygenation and apnoeic oxygenation during laryngoscopy.**
- **With normal use, THRIVE has a low risk of gastric insufflation.**
- **With concurrent facemask use THRIVE risks rapid gastric insufflation.**
- **The THRIVE-safe Nasal Cannula enables safe use concurrent facemask use with THRIVE**

The Risk of Gastric Insufflation with THRIVE

Assessing the safety with THRIVE in a high fidelity model

- THRIVE is an exciting new method of providing pre-oxygenation and apnoeic oxygenation during laryngoscopy.
- The the risk of gastric insufflation was assessed in a high fidelity model
- With normal use, THRIVE has zero/low risk of gastric insufflation.
- With concurrent facemask use THRIVE risks rapid gastric insufflation.
- The THRIVE-safe Nasal Cannula enables safe use concurrent facemask use with THRIVE, opening new ways to use THRIVE e.g. with Non Invasive Ventilation