

Laboratory & Animal Work

Bench-top testing on manikins in the airway laboratory was undertaken to optimize shaft length, techniques using rigid bronchoscope, insertion endotracheal laryngoscopy, suspension and tracheostomy tubes, and supraglottic airways using flexible endoscopy. After establishing ventilation techniques, an ovine in vivo study was performed with animal ethics approval to **confirm adequate** oxygenation and ventilation without significant changes in airway pressures.¹





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Rigid

bronchoscopy;

Inhalational

anaesthesia

innovations combined Non-occlusive balloon dilatation Flexible endoscope plus wire guidance Access to entire airway using SGA

Tracheal stenosis is common, challenging, and causes significant morbidity, especially in low-resource settings. Resection and reconstruction requires tertiary services including ICU. Dilatation can be used as a temporizing or curative therapy, but traditional techniques carry risks of hypoxia, barotrauma or iatrogenic injury. Balloon dilatation exerts only radial force but is limited by the safe duration of apnoea. We developed strategies to manage tracheal stenosis which combine an innovative, non-occlusive balloon with a flexible endoscopic technique performed through a supraglottic airway, that allows continuous oxygenation and ventilation throughout the procedure.

Endoscopic via

endotracheal

tube; TIVA













Human Trial & Ongoing Studies

After approval, we undertook the first trial in humans, performing 20 procedures in patients with tracheal stenosis (ClinicalTrials.gov NTC02796326).² Satisfactory ventilation was achieved throughout. Peripheral saturation remained >94% at all times in 95% (19/20) of procedures. In one case a saturation nadir of 82% occurred, on the background of severe respiratory disease. Median (IQR) stenosis diameter increased from 5 (4-6) to 12 (11-14) mm (p<0.001). Median **Cotton-**Myer grade improved from 3 to 1. Two patients had minor reversible adverse events (coughing and laryngospasm), which did not prevent completion of the procedure. The ability to perform dilatation with continuous ventilation/oxygenation was proven.

Due to effectiveness and control of the airway, we shifted nearly exclusively to endoscopic-guided dilatation through a supraglottic airway under total intravenous anaesthesia. Subsequently, we have continued performing this technique routinely in our institution, extending the indications to patients with multilevel tracheal and bronchial stenosis. This allows controlled management at any level of the airway.

No serious adverse events have been recorded. Furthermore, since adopting the technique, we have not required tracheostomy for any patient presenting acutely with tracheal stenosis. Several patients who have been deemed to have inoperable pathology (particularly multilevel tracheobronchial stenosis) have been successfully managed.³