Retrograde intubation: an old new technique
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Abstract
Introduction
In the last decade, a new boom of scientific articles about retrograde intubation has been published. Case reports, applications, technique variations and comparison with other techniques re-introduce the scientific discussion of the technique, its indications, contraindications, complications and technical advances. Despite the complications and contraindications linked to retrograde intubation, its utility is incontestable in specific situations. Although the success rate of retrograde intubation is variable, some authors affirm that in the hands of those who use the technique frequently, retrograde intubation appears to have a high success rate. We believe that training in retrograde intubation would definitely be an advance that could increase the success rate of the technique as well as decrease the complications associated with it.

Conclusion
Recent developments are happening to enhance the retrograde intubation technique, such as the combination with laryngeal nerve block, fibre optic bronchoscopy and ultrasound guidance. During the booming phase of advances in airway management technologies, anaesthesiologists should sometimes return to the basics and learn and practice simple techniques like retrograde intubation that can save patient lives.

Introduction
Retrograde endotracheal intubation was first described by Butler and Cirillo1 in 1960 as a way to remove the tracheostomy tube in neck surgery. In this procedure, a catheter is passed towards cephalad through the tracheostomy site and emerged in the mouth; then, the catheter is sutured to an endotracheal tube and it is pulled into the trachea. Waters2 in 1963, described passing a plastic tube through the cricothyroid membrane and then using it as a guide to intubate patients.

Basically, retrograde intubation encompasses the introduction of a wire into the larynx through a Tuohy needle (Figure 1) in the cricothyroid membrane or membranous space between the cricoid cartilage and the first tracheal ring and blindly retrograde emerging in the mouth or nostril (Figure 2). Then, the technique proceeds with the antegrade guiding of a tracheal tube into the airway using the wire as a guide (Figure 3). Finally, with the orotracheal tube which is already present in the trachea, the wire is removed and the position of the tube is confirmed by capnography and auscultation.

The technique evolved between the 60s and 80s, and underwent a lot of developments to improve its effectiveness. It has been used in conscious, sedated or apnoeic patients3–5. It has been performed in the supine, prone and sitting positions6 and has been used successfully in both adults7–8 and the paediatric population9–11 as young as 4 months old. There is also a report about the successful placement of a double-lumen endotracheal tube using the retrograde intubation technique to perform an approach to a lesion in the right lung12. Retrograde intubation can be performed using local anaesthesia with or without sedation, or under general anaesthesia with or without spontaneous ventilation, depending upon the patient, the operator, and the clinical situation13,14.

One of the greatest enhancements in retrograde intubation has been the introduction of the Cook Retrograde Intubation Set8,12. It made possible the use of the technique not only in urgent situations, but also in unpredictable situations in which there is no time to assemble all the components necessary for the procedure from different kits.

The use of the retrograde wire technique to assist the management of difficult airway was first reported in 198115. Retrograde intubation is recognised as a useful technique in airway management, which is included in the difficult airway algorithm of the American Society of Anaesthesiologists16 in 1993 and maintained in the review of this algorithm 10 years later in 200317.

Owing to the emergence of new equipments for intubation such as laryngeal mask airway, fibre optic bronchoscope, airway bougie, lighted stylet, combitube and video laryngoscopy, the retrograde intubation was somehow put aside in the management of predictable and non-predictable difficult airways in the 90s. The evidence from a study conducted by Harris et al.13 suggests that the procedure is not widely taught and is felt by some to be an antiquated technique in a world of fibre optic visualisation tools. Regardless of the availability of more sophisticated tools, anaesthetists are occasionally faced with scenarios

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Review

In the last decade, a new boom of scientific articles about retrograde intubation has been published. Case reports, applications, technique variations and comparison with other techniques reintroduce the scientific discussion of the technique, its indications, contraindications, complications and technical advances. The aim of this review was to discuss retrograde intubation.

Discussion

The authors have referenced some of their own studies in this review. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964), and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed. All human subjects, in these referenced studies, gave informed consent to participate in these studies.

Several problems have been reported with retrograde intubation, which is the most frequently failed intubation caused by the tracheal tube springing into the oesophagus after the guide is removed. Most frequent complications are trauma to the larynx from the introduction of the needle or wire, bleeding, haematoma, inadvertent puncture of oesophagus, the wire may pass distally into the trachea rather than into the mouth, oral or nasal trauma from the wire or passage of the endotracheal tube, subcutaneous emphysema, pneumomediastinum, and infection.

Retrograde intubation is contraindicated in the presence of unfavourable anatomy in the area of the cricothyroid (non-palpable landmarks, pre-tracheal mass, severe flexion deformity of the neck), some laryngotracheal pathologic conditions, significant coagulopathy, and infection.

Despite the complications and contraindications described, the utility of

Figure 1: Placement of Touhy needle in airway and introduction of a wire into the larynx through the Tuohy needle.

Figure 2: Emerging of the wire in the mouth.
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Antegrade guiding of a tracheal tube into the airway using the wire as a guide.

One advantage of the retrograde technique is that unlike most intubation techniques, it can be accomplished without requiring visible airway landmarks. The advantages of retrograde intubation over fibre optic bronchoscope-guided intubation include its applicability when blood and secretions are present in the upper airway, shorter procedural duration and a lower risk of subglottic oedema and stenosis. Retrograde intubation is less invasive than needle cricothyrotomy and surgical cricothyrotomy, and if the intubation or ventilation scenarios are not possible, it can achieve the primary objective of oxygen delivery to the trachea.

Unfortunately, the success rate of retrograde intubation is variable. Nevertheless, Barriot and Riou have reported that physicians trained in retrograde intubation can perform it in <5 minutes and in the same article, they concluded that retrograde intubation is a technique that is easy to learn and that should be developed for pre-hospital care of trauma patients. van Stralen et al. reported that after training in retrograde intubation by modelling, every subject successfully completed intubation at the first time. The mean time to perform the technique was 71 seconds (95% confidence interval ±4 seconds), with a range of 42–129 seconds. They concluded that retrograde intubation can be taught easily with a mannequin. Tüfek et al. stated that retrograde intubation is a simple quick procedure when performed by experienced practitioners. Some authors affirm that in the hands of those who use the technique frequently, retrograde intubation appears to have a high success rate. A Canadian National Survey demonstrated that older anaesthesiologists had more experience with the retrograde technique and were more comfortable using it. Limited teaching of retrograde intubation is due to two factors: the misperceived, exaggerated invasive nature of the procedure and the proximity of the cricothyroid puncture site to the vocal cords. We believe that training in retrograde intubation would definitely be an advance that could increase the success rate of the technique as well as decrease the complications associated with it. This belief was expressed by Harris et al. also who mentioned that retrograde intubation should be included in any thorough anaesthesiology curriculum.

Recent developments are happening to enhance the retrograde intubation technique. The success of retrograde intubation and other intubation techniques when performed with the patient who is awake depends on the patient’s collaboration. Thereby, there are several ways to make the procedure less aggressive to the patient. Superior laryngeal nerve block, ultrasound guided or not, is frequently used to facilitate endotracheal intubation in patients who are awake. In a case report made by the authors of this review, they have described the use of ultrasound-guided superior laryngeal nerve block (Figure 4) and transcricothyroid membrane block (Figure 5) to suppress reflexes from the larynx, vocal cords and trachea above to smooth a retrograde intubation procedure in a patient who is awake.

Some authors bring out the combination of retrograde intubation and fibre optic bronchoscopy. Fibre optic-aided retrograde intubation uses a long guide wire that emerges in the nostril; then the wire is inserted at the distal end of the working channel.
to come out through the proximal end of the working channel. The fibre optic bronchoscope with a preloaded tracheal tube is then rail-roaded through the nostril to the trachea, with direct visualisation of the tube with the fibre optic bronchoscope. This combination of techniques probably enhances the success rate of intubation.

A case report published by the authors of this review\[^22\] describes the use of ultrasound guidance in retrograde intubation in a patient with ulcer-vegetating neoformation of the oropharynx and hypopharynx that required tracheostomy. In this case, ultrasound visualisation of the trachea and surrounding structures secure the location of the needle (Figure 6 and Figure 7) in the tracheal lumen, possibly to allow to reducing some of the complications that arise when retrograde intubation is “blindly” performed, like injury to blood vessels, subcutaneous emphysema or caudal migration of the guide wire. In a study conducted about the use of ultrasound in placing the cannula for tracheostomy, it was confirmed that the ultrasound had increased the success rate (43–83\%) and decreased the time (110 s to 57 s) required for successful placement\[^35\].

By performing the ultrasound guided intubation, authors have concluded that ultrasound guidance may be an upgrade in the retrograde intubation technique and may decrease the likelihood of complications and increase the success rate when compared with ‘blind’ retrograde intubation\[^22\].

As the Anaesthesiology Scientific Society is interested in the resurgence of retrograde tracheal intubation, more developments are expected in the near future which will possibly decrease the complications and increase the efficiency of the procedure.

While retrograde intubation may never have the popularity of other airway management techniques, we believe that it is a useful alternative in some difficult intubation situations.

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Conclusion

In this review, the authors are not recommending retrograde intubation as the method of choice for coping with difficult tracheal intubation. They only suggest that in times when advances in airway management technologies are booming, anaesthesiologists should sometimes return to the basics and learn and practice simple techniques like retrograde intubation that can save patients' lives. With no doubt, we can affirm that being comfortable with retrograde intubation is a valuable addition in airway management and should definitely be a part of the capabilities of all anaesthesiologists.

References

7. Raval C, Patel H, Patel P, Kharod U. Retrograde intubation in a case of ankylosing spondylitis posted for correction of specialized kits, that can be performed smoothly, easily and safely in experienced hands and it may prevent hypoxia, airway trauma, open cricothyrotomy or tracheostomy and can save patients' lives in a range of situations.

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