

Paraglossal straight blade intubation in syndromic children

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Syndromic children have an increased association with difficult airways, which may lead to difficulties and dangers even when anticipated and planned for. Hypoxia, with its risk of brain injury, cardiac arrest and even death, may follow induction of anaesthesia with subsequent airway management failure.

Video-assisted devices have helped significantly with the management of difficult airways in children; however, these devices are not always available and have their own limitations. An alternative approach to the difficult airway, although seldom used, is the paraglossal straight blade approach. This technique, originally described by Jackson and Magill and later modified by Henderson, has successfully been used in both the paediatric and adult populations for the management of a difficult airway. The paraglossal intubation technique has frequently been used for successful intubation in Pierre Robin syndrome and cleft palate surgery, but only isolated case reports are available to indicate its effectiveness in other abnormalities such as tongue tie, macroglossia, arthrogryposis multiplex congenita, Treacher Collins syndrome and glossopalantine ankylosis.

Keywords: intubation in syndromic children, paraglossal intubation, straight blade intubation, syndromic children

Introduction

Syndromic children have an increased association with difficult airways, which may lead to difficulty in achieving intubation. Hypoxia, with its risk of brain injury, cardiac arrest and even death, may follow induction of anaesthesia with subsequent airway management failure.

The Macintosh laryngoscopy technique is usually atraumatic and gives a good view of the glottis. Because it is easy to use in most patients, if any difficulties arise during laryngoscopy the user is likely to believe that any problems encountered must be the fault of the patient or the user, and not the technique being used.

The high success rate associated with midline Macintosh laryngoscopy may lead to complacency regarding the role of alternative laryngoscopy blades and techniques, with consequent failure to develop skill in their use.

Video-assisted devices have helped significantly with the management of difficult airways in children, but these devices are not always available and have their own limitations. An alternative approach to the difficult airway using readily available equipment is the paraglossal straight blade approach.

Paraglossal intubation technique¹

For a right paraglossal laryngoscopy, a Miller or equivalent straight blade is passed from the right corner of the mouth. The blade is inserted at the far right-hand corner of the mouth and passed along the groove between the tongue and the tonsillar bed, as seen in [Figure 1](#).

Anterior and leftward lift is used to keep the tongue out of the line of vision. The blade tip is moved towards the midline and the blade is advanced on the right side of the tongue to its base. Advancement will lead to visualisation of the glottis. The tip of the blade is passed posteriorly to the glottis. With

subsequent direct anterior lift of the glottis, the vocal cords can be visualised as seen in [Figure 2](#).

In most patients the proximal part of the blade can then be moved towards the midline whilst keeping the distal tip in place. This will displace the tongue even more and lead to a wider view of the vocal cords. If the larynx cannot be properly visualised, it might be helpful to rotate the head to the left.

For a left paraglossal laryngoscopy, a Miller or equivalent straight blade is passed from the left corner of the mouth. The same technique and manoeuvres are applied as for the right paraglossal laryngoscopy, with the exception of the retraction of the corner of the mouth. Rotation of the head to the right might improve laryngeal visualisation.

Paraglossal straight blade intubation can be particularly helpful in children where the second molar has not yet erupted. This will provide an unobstructed window for the ETT to be passed retromolarly. The first permanent molar eruption happens at the age of 6 years with the second permanent molar eruption usually by the age of 12 years. Even after the eruption of the permanent first and the second molars, it has been shown that an ETT placed retromolarly will not be obstructed with centric occlusion.²

Theoretical basis of the improved view^{1,3,4}

The view of the larynx depends on achieving a line-of-sight from above the prominent part of the maxilla to the larynx. This is known as the anterior airway line.

The anterior airway line is determined by the relationship between three factors:

- (1) The anatomy of the larynx itself;
- (2) The ability of the laryngoscope to displace the tongue out of the line of view – conventional curved blades work by



Figure 1: Right-handed insertion of the straight blade and advancement to the glottis.



Figure 2: Direct anterior and leftward lift of the glottis to reveal the vocal cords.

displacing the tongue to one side, but will also displace some of the tongue muscle bulk into the submandibular space;

- (3) The most prominent part of the maxilla – depends on the maxillary and dental anatomy.

Table 1 summarises the mechanisms that are responsible for the improved laryngeal view with the paraglossal approach and the use of a straight blade.

Table 1: Theoretical basis for the improved laryngeal view

Mechanism*	Contribution of the paraglossal technique	Contribution of a straight blade
Central compartment of the line of sight	Reduces tongue compression when the blade is inserted on the side of the tongue	Reduced bulk of a Miller blade decreases soft tissue compression This translates into a 30% decrease in lifting force needed compared with a Macintosh blade ^{1,3}
Lowering the proximal end of the line of sight	Blade inserted lateral to the incisors, thereby avoiding space occupation by large central incisors, a small submandibular space and a large tongue	No curvature to obstruct the glottic view (compared with a Macintosh blade) Neck extension will improve view with a straight blade
Distance to glottis opening	Shorter distance compared to the conventional midline technique	

*The first two mechanisms decrease the extent of soft tissue compression.

Difficulties encountered during paraglossal laryngoscopy^{1,5,6}

Paraglossal laryngoscopy is likely to improve the view of the larynx, but at the expense of less space that can be used to manoeuvre the endotracheal tube.⁷ In a right paraglossal approach, this can be easily overcome by asking an assistant to retract the right corner of the mouth. Alternatively careful placement of an appropriately sized bougie or styletted endotracheal tube can be used, but care should be taken not to cause trauma, especially in the paediatric population.

Bulging of the tongue is often encountered when the left paraglossal approach is used. This could potentially lead to an obscured view of the larynx, but in practice this rarely obscures direct visualisation of the glottis.⁸

A straight blade (Miller or equivalent) should be used, because of the low bulk of these blades. Additional advantage of this low bulk is evident in patients with decreased mouth opening. Currently there is limited comparative data on Macintosh blades compared with straight blades in the use of paraglossal laryngoscopy in the paediatric population.

Difficulty may arise in positioning the tip of the laryngoscope blade correctly. If the tip of the blade is lying in the piriform fossa, the aryepiglottic fold can obscure the view of the glottis. The laryngeal view will not improve with more anterior lift. This difficulty can be overcome by sweeping the tip of the blade laterally. If this does not improve the view, the blade should be pulled back to recognisable anatomical landmarks, like the base of the tongue, and advanced again.

Other problems can arise due to the design of straight blades*:

- (1) Control of the glottis can be more difficult – this can be compounded by the use of the paraglossal approach where the glottis is approached from a lateral not a midline position;
- (2) The light source can be obscured by soft tissue, especially a large tongue;
- (3) The fibre-optic channel in some straight blades may reduce space in the oral cavity to manipulate the endotracheal tube.

*Straight blades are grouped as a whole – different straight blade designs can have additional properties with added difficulties encountered.

Evidence and case reports

Table 2 summarises the trials that have been done to compare laryngeal views with the paraglossal straight blade technique

Table 2: Comparative laryngeal views of paraglossal and midline approaches

Authors*	Study design	Result	Statistical significance
Reiterer <i>et al.</i> ⁷	Randomised crossover study of 100 adult patients Both approaches used on the same patient	Details not accessible	Retromolar technique achieved lower Cormack–Lehane scores compared with the conventional technique ($p < 0.0001$)
Jindal <i>et al.</i> ⁹	Randomised controlled trial of 140 patients randomly divided into the paraglossal or conventional group	Cormack–Lehane grade 1 view in 68 patients (97.1%) with the paraglossal approach compared with 47 patients (67.1%) in the conventional group	Paraglossal approach improves the glottic visualisation compared with midline Macintosh approach ($p = 0.02$)
Achen <i>et al.</i> ¹⁰	Randomised controlled trial of 161 adult patients randomly divided into the Macintosh or Miller group	Cormack–Lehane grade 1 in 96.5% with the paraglossal approach compared with 85% in conventional group	Direct laryngoscopy using the Miller blade and paraglossal approach results in much improved view of the larynx in the majority of cases ($p = 0.02$)
Yamamoto <i>et al.</i> ⁸	Comparative series of 1 015 adult patients After a difficult airway was identified, both left and right molar approaches were evaluated	Difficult laryngoscopy with a midline approach encountered in 66 cases Left molar approach decreased this to 7 cases Right molar approach decreased this to 18 cases	Difficult laryngoscopy encountered with a conventional midline position was improved with a left > right paraglossal technique ($p < 0.05$)
Bozdogan <i>et al.</i> ¹¹	Comparative series of 1 386 adult patients After a difficult airway was identified, the left molar laryngoscopy was also evaluated	20 patients were identified with a Cormack–Lehane view grade 3–4 In 18 patients the laryngeal view improved with the paraglossal approach	Left molar laryngoscopy can make unexpected difficult intubation easier ($p < 0.01$)

*Operator bias could not be eliminated in these studies.

and conventional midline Macintosh technique in adults. These patients had no features that might indicate a possible difficult airway. Unfortunately, there are no equivalent trials for the paediatric population.

Pierre Robin syndrome

The basis for airway obstruction in Pierre Robin syndrome is micrognathia, retrognathia and glossoptosis. These abnormalities can also be accompanied by a cleft palate in up to 50% of patients. Because of this combination of facial abnormalities, conventional midline laryngoscopy is often unsuccessful and can cause soft tissue trauma. The efficacy of paraglossal straight blade laryngoscopy was shown in a series of neonates with severe Pierre Robin syndrome undergoing elective glossoptomy.¹² Further case reports have also demonstrated the

efficacy of paraglossal laryngoscopy in this subset of patients.¹³

Cleft palate

A paraglossal approach will help to prevent some of the difficulties encountered during airway management in patients with oro-facial cleft abnormalities. One of the commonest obstacles encountered during laryngoscopy is the body of the Macintosh blade slipping into the midline defect and causing iatrogenic tissue trauma. A left paraglossal technique has been demonstrated to improve intubation conditions in children with bilateral cleft palates.¹⁴

Table 3 summarises case reports where paraglossal laryngoscopy has been beneficial in obtaining an improved laryngeal view.

Table 3: Case reports where paraglossal laryngoscopy has been beneficial

Authors	Clinical setting	Technique used	Experience
Ahlawat <i>et al.</i> ¹⁵	Absolute macroglossia in a 6-year-old boy	Left paraglossal laryngoscopy with a Macintosh blade	External laryngeal manipulation needed to improve view
Mittal <i>et al.</i> ¹⁶	Lymphangioma/cystic mass of the tongue in a 24-day-old neonate	Right paraglossal laryngoscopy with a Macintosh blade	Unsuccessful intubation with conventional midline laryngoscopy Successful with paraglossal approach
Asthana <i>et al.</i> ¹⁷	Arthrogryposis multiplex congenita in a 5-year-old girl	Right paraglossal laryngoscopy with an unspecified straight blade	Cormack–Lehane grade 3 on conventional midline approach Successful intubation with the paraglossal approach
Mukharjee <i>et al.</i> ¹⁸	Glossopalantine ankylosis in a 7-day-old girl	Right paraglossal laryngoscopy with a Miller blade	Significant improvement in the glottic view compared with the initial conventional midline approach
Jain <i>et al.</i> ¹⁹	Second stage palatal fistula repair in a 7-year-old boy	Right paraglossal laryngoscopy with a Miller blade	Successful intubation after numerous failed attempts at blind nasal intubation
Agrawal <i>et al.</i> ²⁰	Treacher Collins syndrome in a 9-year-old boy with tonsillar hypertrophy	Right paraglossal laryngoscopy with an unspecified straight blade	Cormack–Lehane grade 3 glottic view with a midline Macintosh blade Improved to a grade 2 view with paraglossal straight blade technique
Kose <i>et al.</i> ²¹	Walker–Warburg syndrome in a 2-month-old boy	Right paraglossal laryngoscopy with a Miller blade	Cormack–Lehane grade 4 glottic view with a midline approach – curved blade unspecified View improved with paraglossal straight blade approach; however, a blind intubation was required

Prevention of dental injuries

Poor or abnormal dentition is regularly encountered in syndromic children, making them vulnerable to dental trauma. The paraglossal straight blade approach reduces the tendency to lever on the maxillary dentures in order to achieve a view of the larynx (a practice often encountered with midline Macintosh laryngoscopy, particularly amongst inexperienced laryngoscopists); this may reduce the likelihood of iatrogenic dental injury.

Conclusion

Although the paraglossal laryngoscopy technique is well described in the airway management of Pierre Robin syndrome and cleft palate surgery, only isolated case reports are available to indicate its effectiveness in the airway management of other syndromes or children with syndromic features that are associated with difficult endotracheal intubation.

There is insufficient evidence to suggest that the paraglossal straight blade intubation is the answer to every scenario of difficult endotracheal intubation. However, this technique does seem capable of overcoming most of the obstacles that are frequently encountered during difficult intubations. Its use of readily available simple airway equipment makes widespread application of this technique possible.

This technique should regularly be practised on normal, uncomplicated airway anatomy before it is used in the difficult, sometimes emergency scenario.

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