Rigid indirect laryngoscopy and optical stylets

Revalidation FOR ANAESTHETISTS
RCA Revalidation matrix
Matrix reference 1A01, 2A02

Barry E McGuire MBChB FRCA MRCGP
Rhona A Younger MBChB FRCA

Key points

Rigid indirect laryngoscopy (RIL) is becoming a more common technique for performing tracheal intubation.

These devices may be categorized as 'guided' or 'non-guided' indirect laryngoscopes and optical stylets.

Rigid indirect laryngoscopes and optical stylets may provide better intubating conditions in comparison with established direct laryngoscopy (DL) and flexible fibreoptic techniques during predicted and unpredicted difficult intubation.

A clear view of the larynx is essential, but Cormack and Lehane grading of the laryngoscopic view may not correlate well with the ease of intubation.

Successful airway management using these devices depends on training, skill maintenance, and selection of the appropriate intubating technique for a given clinical scenario.

Barry E McGuire MBChB FRCA MRCGP

Consultant Anaesthetist
Ninewells Hospital
Dundee DD1 9SY
UK
Tel: +44 1382 632175
Fax: +44 1382 644914
E-mail: b.mcguire@nhs.net
(for correspondence)

Rhona A Younger MBChB FRCA

SpR Anaesthesia and Intensive Care
Ninewells Hospital
Dundee DD1 9SY
UK

Indirect laryngoscopy, in the form of flexible fibreoscopy, is the established 'gold standard' for the management of the *predicted* difficult airway.[1] Rigid indirect laryngoscopy (RIL) is not new. The Bullard laryngoscope, for example, has been used by a small number of airway enthusiasts for around 20 yr. The practice of RIL has markedly increased in recent years, with availability and use of devices appearing to be greater than any robust evidence of their efficacy.[2, 3] In light of this relative lack of evidence, direct laryngoscopy (DL) remains the technique most taught and practised for the management of the *unpredicted* difficult intubation (DI). This is despite a 1 in 75 failure rate.[3] In time, it may be that RIL will 'fill the gap' between DL and flexible fibreoscopy and perhaps even replace one or both of them. These new devices use modern technology to look around the anatomical 'corners' of the upper airway to provide a view of the glottis, the visual axis being closer to 60°, rather than the direct line of sight of MacIntosh laryngoscopy. In general, devices are categorized in relation to the method of image transmission back to the viewfinder. For some, this is based on reflection, involving prisms, mirrors, or most commonly, fibreoptics. In others, digital images are transmitted electronically from a distal tip video camera back to a monitor screen. However, the classification outlined below is based on the method of passing the tracheal tube (TT) through the glottis.

Classification

(i) Non-guided devices—provide an indirect view of the larynx, but require direction of the TT towards the larynx.
(ii) Guided devices—provide an indirect view of the larynx and a conduit for passage of the TT.
(iii) Optical stylets—provide an indirect view via a rigid or semi-rigid stylet, with a 'loaded' TT for railroading.

These devices are usually inserted in the mid-line, without deviation of the tongue, with exception of the optical stylets where a retromolar approach may provide better intubating conditions. Knowledge and practice of the specific insertion techniques are essential. Several of the key features of the more recently released and commonly used instruments are highlighted in Table 1.

Indications

RIL and optical stylets are used by many anaesthetists worldwide in the management of both the unpredicted *and* the predicted DI. An adequate glottic view is usually achieved, frequently superior to that obtained using DL, but passage of the TT may be more difficult. The success or failure in using such devices is multi-factorial, being dependent upon the efficacy of the device itself, the skill of the operator, and his/her familiarity with using the instrument. Most anaesthetists would favour an awake technique in the predicted DI scenario. Frequently, this means awake flexible fibrescopic intubation (AFFI), but this technique is not without risk of complications such as failure, hypoxaemia, and increasing airway obstruction.[4] There are other 'awake' alternatives, including cricothyrotomy, blind nasal intubation, the intubating laryngeal mask airway,[5] and even awake RIL.[6] If AFFI is not possible (e.g. lack of equipment, insufficient operator skill, or an uncooperative patient), then RIL performed under general anaesthesia may provide an alternative technique for tracheal intubation. Indeed, in certain clinical scenarios (e.g. acute airway obstruction at the level of the larynx), RIL may be preferable.[7]

When DL is not expected to be truly difficult, but instead is considered to be potentially awkward, many anaesthetists now favour RIL under general anaesthesia to save time and minimize patient distress. However, the evidence for this as 'best practice' does not exist

doi:10.1093/bjaceaccp/mkq027 Advance Access publication 30 July, 2010

Table 1 Key features of commonly used RIL/optical stylets. (For further details on the use of these devices, refer to manufacturer's instructions)

Device	Glidescope GVL	McGrath	Airtraq	Airway Scope	CTrach	Bonfils	Shikani
Classification	Non-guided	Non-guided	Guided	Guided	Guided	Optical stylet	Optical stylet
Power source	Rechargeable battery/ext. AC	1×AA battery	Internal battery	2×AA battery	Rechargeable battery	External battery/light cable	External battery/ L'scope handle
Additional equipment	Gliderite rigid stylet	TT stylet (or bougie)	None	None	Specific TT CTrach Viewer	None	None
Viewing element	Separate free standing monitor	Wide angle LCD screen on handle	Wide angle eye piece	61 mm LCD screen on handle	86 mm LCD CTrach Viewer	Eye piece or can attach camera/ monitor	Eye piece or can attach camera/ monitor
Size of scopes	Four	One	Four	One	One	One	One
Disposability	Disposable blade	Disposable blade	Single use	Disposable blade	TT. Autoclave rest	None—autoclave	None—autoclave
Key features	Camera resistant to fogging 60° angle blade	Low profile, variable length blade good if limited space	Anti-fog disposable low cost multiple available	Blade accepts size 6.0–8.0 TT. Blade has a suction channel	Allows continuous ventilation and oxygenation	45° angulation (rigid) tip	Malleable tip

and may introduce the potential for clinicians to choose this technique when an awake technique may be advisable.

Up to 50% of DIs are not predicted.[8] Faced with an unexpected DI, the use of a flexible fibrescope can be challenging because under general anaesthesia, the fibrescopic technique itself and oxygenation are more difficult. The option of using an 'alternative laryngoscope' is recommended in both UK and US guidelines,[9, 10] but, arguably, more explicit guidance on the use of an alternative to a Macintosh laryngoscope is now required.

Many anaesthetic departments now stock RILs for this unplanned scenario, but the device chosen for use currently seems to relate more to departmental availability rather than the superiority of one device over another. Unfamiliarity and poor device selection, however, may contribute to poor outcome. For example, a device that is placed in the vallecula may not be the ideal choice in a patient known to have pathology in this area. In skilled hands, however, RIL may prove to be superior in terms of success and fewer complications, such as trauma, when compared with DL. During difficult laryngoscopy, it allows visualization of the TT passage, rather than the 'blind' approach of DL and a bougie. This ability to view the larynx is particularly useful in patients requiring a change of their TT, such as those in the intensive care unit, where an inability to visualize the glottis on DL is common. This may be due to a number of factors, including upper airway oedema and suboptimal positioning. The risk of losing control of the airway in this group of patients is compounded by poor oxygenation and high ventilatory pressure requirements. Another specific clinical scenario where RIL is likely to offer benefit is in patients with unstable cervical spinal pathology requiring intubation, as the technique is associated with less atlanto-occipital movement.

Potential benefits of RIL/optical stylets

Improved laryngeal visualization.
Improved intubation success.
Reduced trauma (from improved visualization).
A reduction in intubation forces resulting in less cervical spine movement and haemodynamic stress.
Generally easy to learn and maintain the skill.
Improved portability and cost when compared with flexible fibreoscopy.
Useful in airway management training (demonstration of anatomy).

Potential disadvantages of RIL/optical stylets

Reduced intubation success and *increased* complications, including hypoxaemia and trauma.
Reduced skill in 'gold standard' techniques—Macintosh laryngoscopy and flexible fibreoscopy.
Economic issues over stock acquisition and maintenance.

Non-guided devices

These 'bladed' devices, for example, McGrath Laryngoscope (Fig. 1), are closest to Macintosh laryngoscopy in design and technique, although the manipulation of the laryngoscope is subtly different. A clear view of the larynx must be achieved before passage of the tube, which often involves use of an intubation aid, such as a TT stylet or introducer (bougie) to direct the tube anteriorly. This latter step may prove to be the most difficult part of the technique, although an exception to this appears to be nasal intubation, where passage of the TT is aided by the angle it approaches from the nasopharynx. Techniques used to aid successful oral intubation include the partial withdrawal of the stylet, gentle rotation of the TT on passage of the tip of the tube through the vocal cords and simultaneous limited withdrawal or relaxation of the tip of the device in the vallecula, or both.

Guided devices

These devices, for example, Airtraq (Fig. 2), have the additional feature of a 'conduit' to aid successful intubation and so have a potential benefit over the non-guided instruments in not requiring independent tube placement. However, the laryngoscopic technique is quite different from DL and this unfamiliarity may result in less control of the tube, other than via the conduit (although, the use of a bougie in difficult cases has been described anecdotally). Passage of the scope tip *beyond* the epiglottis often seems to facilitate intubation. The CTrach is arguably not an indirect laryngoscope, but it does provide an indirect view of the larynx to facilitate intubation. Its unique feature is that it also allows concomitant ventilation and oxygenation.

Optical stylets

Optical stylets, for example, Bonfils/Shikani (Fig. 3), incorporate fibreoptic technology similar to flexible fibreoscopy, have been available for several years and are becoming increasingly popular.

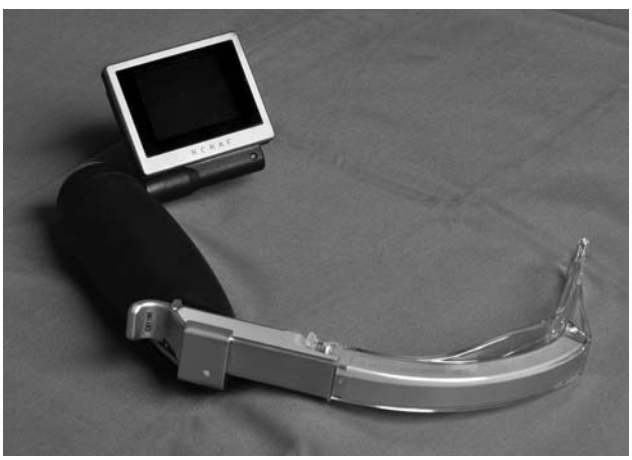

Fig 1 McGrath laryngoscope.

Fig 2 Airtraq laryngoscope.

Some practitioners use these devices in conjunction with direct or indirect laryngoscopes. Most fibreoptic stylets have a proximal focusing lens in the eyepiece. A camera can be attached to the eyepiece, in the same way as with flexible fibreoptic endoscopes, for viewing on a monitor, but this will increase the stylet weight, making it more difficult to manoeuvre with one hand. Some stylets are malleable, whereas others are rigid—the latter ones have a degree of anterior tip curvature instead. Unlike flexible fibreoptic scopes, the rigid devices tend not to have a channel for oxygen insufflation or suctioning because this would increase stylet diameter, limiting the size of the TT that can be mounted, and potentially provide a route for infection transmission. Because they are less familiar than direct laryngoscopic techniques, these devices are associated with a steeper learning curve for most clinicians than the so-called 'video laryngoscopes'. Furthermore, the TT is advanced 'blindly' over the optical stylets, which may contribute

Fig 3 Bonfils (above) and Shikani (below).

to iatrogenic trauma. There are likely to be certain specific clinical scenarios where these non-bladed devices are superior. For example, patients with large base of tongue lesions or those with significantly reduced mouth opening.

Evidence

As yet, the evidence available to recommend the use of these devices in specific clinical scenarios is limited and is drawn from manikin studies, case reports, and studies performed by enthusiasts on patients with predominantly *normal* airways. Much of the published data refer to the quality of laryngoscopic view achieved, which for indirect laryngoscopy do not correlate well with the ease of intubation, and so are misleading.[11]

The future

Other than the introduction of flexible fibreoscopy, laryngoscopy and intubation have changed surprisingly little over the past 60 yr. This is despite a persistent failure rate of DL, and an unknown level of morbidity and mortality. Flexible fibrescopic intubation (FFI) is often cited as the gold standard technique for DI, but despite its many advantages, success is not always guaranteed and there are a number of disadvantages. These include the acquisition and maintenance of correct FFI techniques, the need for skilled assistance, the 'blind' introduction of the TT over the fibrescope, and the high costs of cleaning and maintaining the equipment. There are also specific clinical difficult airway scenarios where FFI may not be the technique of choice, such as upper airway obstruction secondary to laryngeal pathology.[7] More recently, the use of supraglottic devices as a conduit for intubation has become established in advanced airway management.[10] RIL is one of many recent advances in anaesthetic practice, but it remains to be seen if it will have a similar level of impact on both routine and difficult airway management. Airway assessment before anaesthesia and the grading of laryngoscopy using the Cormack and Lehane classification need revisiting as they do not apply to indirect laryngoscopy. Arguably, there is an urgent need for a system based on the ease of intubation rather than laryngoscopy.

Preliminary data from The Royal College of Anaesthetists NAP4 survey, which were presented at the 2009 Difficult Airway Society annual conference, would suggest that serious morbidity and mortality relating to airway management is an ongoing issue in UK anaesthesia. It seems very likely that the use of RILs and optical stylets will continue to grow and be used in a wide variety of predicted and unpredicted difficult airway scenarios. This will be enhanced by much needed evidence that suggests improved success and fewer complications with these techniques. Airway trauma associated with DL, particularly when blind introducer techniques are required, may be significantly reduced by techniques that maximize laryngeal visualization.[12] Trauma relating to the use of an indirect laryngoscope, however, has been described[13] and one of the reasons for this relates to the short period during intubation where the TT is not visible (before appearing on the viewfinder). It is possible that the skill of using an RIL will become a 'core competency', but with so many devices available, this goal will be very difficult to implement. It is likely that the practice of DL to facilitate tracheal intubation will gradually decrease and indirect laryngoscopy will replace it as 'gold standard' practice.

Formal evaluation of the efficacy of rigid indirect laryngoscopes and optical stylets is required. The Airway Equipment Evaluation Group (a Difficult Airway Society working party) is currently collecting data on the use of RILs in the UK and may contribute to this evidence. The important question is whether one type of indirect laryngoscopic technique is superior to another. It seems likely that no single device is perfect in all clinical scenarios and that clinicians may wish to establish skill in two or more different instruments. If the efficacy of these devices is to be maximized and, their complications minimized, then practitioners must become as familiar with these devices as with the Macintosh blade, which means using them routinely on 'normal' airways.

Conflict of interest

None declared.

References

1. Benumof JL. Management of the difficult adult airway. With special emphasis on awake tracheal intubation. *Anesthesiology* 1991; **75**: 1087–110
2. Mihai R, Blair E, Kay H, Cook TM. A quantitative review and meta-analysis of performance of non-standard laryngoscopes and rigid fibreoptic aids. *Anaesthesia* 2008; **63**: 745–60
3. Frerk CM, Lee G. Laryngoscopy: time to change our view. *Anaesthesia* 2009; **64**: 351–4
4. McGuire G, El-Beheiry H. Complete upper airway obstruction during awake fibreoptic intubation in patients with unstable cervical spine fractures. *Can J Anaesth* 1999; **46**: 176–8
5. Wong JK, Tongier WK, Armbruster SC, White PF. Use of the intubating laryngeal mask airway to facilitate awake orotracheal intubation in patients with cervical spine disorders. *J Clin Anesth* 1999; **11**: 346–8
6. Doyle DJ. Awake intubation using the GlideScope® video laryngoscope: initial experience in four cases (letter). *Can J Anaesth* 2004; **51**: 520–1
7. McGuire BE. Use of the McGrath video laryngoscope in awake patients. *Anaesthesia* 2009; **64**: 912–4
8. Wilson ME. Predicting difficult intubation. *Br J Anaesth* 1993; **71**: 333–4
9. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. *Anesthesiology* 2003; **98**: 1269–77
10. Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult Airway Society guidelines for the management of the unanticipated difficult intubation. *Anaesthesia* 2004; **59**: 675–94
11. Cook TM. A new practical classification of laryngeal view. *Anaesthesia* 2000; **55**: 274–9
12. Cooper RM. Is direct laryngoscopy obsolete? *Internet J Airway Manage* **4**
13. Malik AM, Frogel JK. Anterior tonsillar pillar perforation during Glidescope® video laryngoscopy. *Anesth Analg* 2007; **104**: 1610–1

Please see multiple choice questions 13–15.