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EDITORIAL

Questions about the Macintosh laryngoscope and technique of laryngoscopy

Tracheal intubation for administration of anaesthesia was rarely used until it could be performed under vision. Within a few years of the first description of tracheal intubation by direct laryngoscopy [1], tracheal intubation under vision was used regularly to provide maximum airway security for the anaesthetized patient. These early tracheal intubations involved the use of straight laryngoscopes, but few authors gave details of their techniques. However, Jackson [2] stressed the importance of keeping the laryngoscope lateral to the tongue (paraglossal technique). Magill [3] also recognised the importance of inserting the laryngoscope from the right side of the tongue, and went on to refine the technique, when difficulty was experienced, by keeping the laryngoscope in the right side of the mouth throughout laryngoscopy and tracheal intubation. Others subsequently recommended [4, 5] or illustrated [6] use of the straight laryngoscope in the centre of the mouth, suggesting that it made identification of landmarks easier. This may be true in some patients, but in the more difficult case it renders the straight laryngoscope technique more difficult, more traumatic, and more likely to fail. This failure to adhere to the details of Magill's recommendations set the scene for the introduction of the Macintosh laryngoscope [7]. At present, straight laryngoscopes are rarely used for tracheal intubation of adults in Europe, and skill in the technique has been lost. Furthermore, it is difficult to rediscover these skills, since many textbooks give the erroneous impression that straight laryngoscopes should be used in the midline.

The Macintosh curved laryngoscope [7] was introduced in conjunction with a technique of indirect elevation of the epiglottis. It requires less effort to master the Macintosh than straight laryngoscopy techniques. Although the Macintosh laryngoscope is inserted lateral to the tongue, the tongue is moved to the left and the laryngoscope is advanced in the midline. Location of the epiglottis and larynx is usually easy. In addition, the optimum depth of insertion is determined automatically by the valecula. However, there is a significant incidence of failure to see the larynx with the Macintosh laryngoscope [8]. Furthermore, there are now six series [9] in which optimum straight laryngoscopy techniques have facilitated a view of the larynx in most patients in this situation. It seems that the price to be paid for the ease of use of the Macintosh technique in most patients, is more frequent failure to visualize the larynx than is the case with straight laryngoscopy techniques. Because difficult tracheal intubation is a major cause of serious complications in anaesthesia (vide infra), it is probable that exclusive use of the Macintosh laryngoscope is responsible for avoidable morbidity and mortality, with serious consequences for patients, individual anaesthetists, and healthcare costs.

It is time to reassess the role of the Macintosh technique. Important questions are:

1 What are the implications of the failure rate of the Macintosh technique?
2 What are the advantages and limitations of blind techniques of intubation, when the Macintosh technique fails?
3 Why is failure with the Macintosh laryngoscope inevitable in some patients?
4 Can we use straight laryngoscope techniques to reduce the morbidity of tracheal intubation?
5 If so, what are the implications for clinical practice and training?

What are the implications of the failure rate of the Macintosh technique?

Because the Macintosh laryngoscope is used almost exclusively for tracheal intubation of adults in Europe, complications of tracheal intubation can be regarded

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as complications of exclusive use of the Macintosh technique. Even with optimum technique, the larynx is not seen in 1–3% of patients with the Macintosh technique [8,10]. Difficult and failed tracheal intubation can result in serious complications. Death and brain damage still occur [11,12], even in private patients anaesthetized by consultants (MDU confidential document).

What are the advantages and limitations of blind techniques of intubation, when the Macintosh technique fails?

When difficulty with tracheal intubation occurs unexpectedly, the best course is often to postpone surgery and awaken the patient. However, it is sometimes essential to proceed with surgery. How should the anaesthetist secure the airway with a cuffed tracheal tube in such patients? Most anaesthetists in the UK resort to blind techniques in this situation. However, it is time to reassess the role of blind techniques. In particular, we should question the success rate of these techniques, and the number of blind attempts at intubation which can be justified in each patient, before proceeding to alternative visual (vide infra) techniques or abandoning attempts at tracheal intubation.

The most frequently used blind technique in the UK is to pass an introducer (bougie) blindly into the trachea and then to 'railroad' the tracheal tube over the bougie and into the trachea. This technique was introduced by Macintosh in 1949 [13]. Use of bougies is usually successful when most of the epiglottis can be seen, but success may be a matter of 'luck' when the epiglottis cannot be seen [14]. The failure rate in the most difficult cases may be as high as 33% [15] and repeated blind use of bougies, as of any blind technique, can cause serious trauma [16–22]. The bougie technique is very valuable if it is successful in a couple of attempts, but repeated blind poking with the bougie should have no place in modern anaesthetic practice. Obstetric anaesthetists stress the importance of limiting the number of attempts at intubation [23], and a suggested limit of three attempts [14] has been widely accepted. All patients deserve similar protection from an excessive number of blind attempts at intubation [8,22].

Several techniques of intubation under vision are of proven value when the larynx cannot be seen with the Macintosh technique. These techniques include fibreoptic intubation through the (original or intubating) laryngeal mask airway [24,25], and use of Bullard [26–28], and McCoy laryngoscopes [29–33]. These techniques vary in success rate, complexity, ease of learning and cost.

Why is failure with the Macintosh laryngoscope inevitable in some patients?

Difficult tracheal intubation with direct laryngoscopy is a consequence of factors which make it impossible to achieve a line of sight (LOS) of the larynx. Many skeletal and soft tissue factors can contribute to this difficulty, and several factors are often involved in the individual patient [34–38]. The final common pathway, when direct laryngoscopy proves difficult, is failure to get the LOS round the base of the tongue.

The theoretical basis of the poorer performance of the Macintosh laryngoscope, in comparison with the straight laryngoscope, has two components. First, the curvature of the Macintosh laryngoscope intrudes into the LOS when laryngoscopy is difficult [39]. Second, in these patients, it is not possible to displace the entire volume of the tongue to the left of the laryngoscope, so that the base of the tongue is compressed distally, producing posterior displacement of the epiglottis [36]. The Macintosh technique of laryngoscopy actually causes soft tissue obstruction of the view of the larynx in such patients. The concept that the Macintosh laryngoscope can contribute to difficulty with tracheal intubation is consistent with the clinical [39] and radiological [36] picture, as well as with the better performance of straight laryngoscopes. In contrast, straight laryngoscopes do not intrude into the LOS, and the paraglossal technique increases the probability of achieving a LOS, lateral to the base of the tongue, of the larynx [9].

Can we use straight laryngoscopy techniques to reduce the morbidity of tracheal intubation?

Straight laryngoscopes predated and were displaced by the Macintosh laryngoscope, but they still have particular advantages, compared with more complex techniques. The equipment is simple, robust, and inexpensive. The technique has few steps, so that the

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process of tracheal intubation continues smoothly with a simple change in laryngoscope. It should be used in preference to repeated attempts at blind intubation.

Some commitment is required for mastery of the paraglossal straight laryngoscopy technique. Other disadvantages relate to the design of currently available straight laryngoscopes, and include difficulty in passing the tracheal tube, when the Miller laryngoscope is used with the paraglossal technique [40]. It is hoped that this problem will be overcome by a new design of laryngoscope [41]. Initial experience is encouraging [42]. The straight laryngoscope has limitations. Direct laryngoscopy inevitably produces more neck movement than flexible or rigid [43] fibreoptic laryngoscopy, and is not the technique of choice for tracheal intubation of patients with unstable or potentially unstable necks. Awake fibreoptic intubation should be used when serious difficulty in tracheal intubation is anticipated.

The case for regular use of the paraglossal straight blade technique is strong. It is capable of facilitating an improved view of the larynx in most patients in whom use of the Macintosh laryngoscope proves unexpectedly difficult. It allows tracheal intubation under vision, and should be used in preference to blind techniques. However, if laryngoscopy is not successful within two attempts, it is important to use an alternative technique (vide supra) of tracheal intubation under vision.

Straight laryngoscopes should be available wherever tracheal intubation is practiced. All anaesthetists should learn to use straight laryngoscopes, once they have mastered the Macintosh technique, and should continue to use them regularly in order to maintain competence.

What are the implications for clinical practice and for training?

All our patients are entitled to expect medical care without avoidable complications.

Examination of the airway in every patient [44], and awake fibreoptic intubation of those in whom significant difficulty is anticipated, is probably the most important means by which the incidence of serious morbidity from tracheal intubation can be reduced. However, unexpected difficulty with tracheal intubation will continue to occur, and use of the flexible fibreoptic laryngoscope can be difficult in this situation. If we are to eliminate all complications of tracheal intubation, every anaesthetist should be skilled in alternative techniques (no method is 100% successful) of tracheal intubation under vision, and appropriate equipment must be available [8,44].

The failure of many anaesthetists to master alternative techniques of tracheal intubation under vision implies that our speciality continues to regard rare, serious complications from unexpected difficult intubation as inevitable or acceptable. Can we justify this attitude? Our aim should be safe and atraumatic airway management for all our patients. Training in alternative techniques is recommended by French [45] and Canadian [8] airway experts, and in the UK by the Difficult Airway Society.

In conclusion, anaesthetists have been seduced by the ease of use of the Macintosh laryngoscope – in most patients, at the price of an increased risk of morbidity and mortality in a few patients. There is a significant incidence of failure to see the larynx with the Macintosh laryngoscope. We have relied on blind attempts at intubation when we fail to visualize the larynx with this single technique of laryngoscopy. Blind attempts at intubation have a failure rate and repeated attempts can cause significant morbidity and mortality. Successful, atraumatic tracheal intubation in all patients cannot be achieved with the Macintosh laryngoscope alone, and we should move away from blind techniques. When dealing with unexpected difficult intubation, we should aim to achieve tracheal intubation under vision, using simple, robust equipment. Use of Magill's paraglossal technique with the straight laryngoscope has much to offer – provided this slightly more difficult technique has been mastered during routine practice. We have been unwise to abandon the straight laryngoscope in favour of exclusive use of the Macintosh laryngoscope for tracheal intubation.

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