Time to abandon the ‘vintage’ laryngeal mask airway and adopt second-generation supraglottic airway devices as first choice

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The number of supraglottic airway devices (SADs) available to anaesthetists (and those managing the airway outside anaesthesia) has increased dramatically in the last decade. In addition to a large number of devices that mimic the classic laryngeal mask airway (cLMA), there have been newer devices that have been designed to improve performance, increase functions, increase safety, or all of these. Supraglottic airway devices now have important roles beyond airway maintenance during routine low-risk surgery. These advanced roles include the following: airway maintenance in obese and higher risk patients; airway rescue after failed intubation or after failed intubation and failed ventilation; as a conduit for intubation routinely or during difficulties; and airway management outside the operating theatre by experts and novices, most especially during cardiac arrest.

With so many potential roles for SADs in modern airway management, it is worth considering whether one device can be the best device for all such functions and perhaps considering whether some devices might no longer be needed. This discussion raises the question as to whether the cLMA (and equivalent SADs) have any role in modern airway practice or whether it is time to move on.

The Fourth National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society (NAP4)
1 2 identified three important issues around SADs: (i) pulmonary aspiration is the most common cause of major airway complications in anaesthesia, and aspiration associated with SADs is an important contributor to this; (ii) the vast majority (>80%) of SADs used in UK anaesthetic practice are first-generation devices [the cLMA or equivalent laryngeal masks (LMs)]; and (iii) important complications are associated with use of (first-generation) SADs in obese patients. It is highly likely that there is increasing use of SADs in our ever more obese anaesthetic population. The questions of greatest importance regarding SADs for routine anaesthetic practice are therefore around safety rather than efficacy.

It has recently been stated that the LMA has ‘stood the test of time’. It is true that the cLMA—and many similar LMs—remain in everyday use with a low rate of complications. The question, however, arises as to whether the cLMA should remain the predominant SAD in anaesthetic practice. The cLMA was devised more than 30 yr ago, and the prefix ‘classic’ might now indicate that it is a ‘vintage’ device rather than a ‘state-of-the-art’ one. The evidence suggests that many of the newer SADs have performance characteristics that do improve efficacy compared with the ‘vintage LMA’ and have the potential to increase safety.4 5 6 The cLMA is an example of a first-generation SAD (a simple airway tube); second-generation devices are defined as ‘those with specific design features intended to reduce the risk of aspiration’,7 and it is time to consider whether second-generation devices should now be our first choice. There are three main problems with SADs: difficult insertion; leakage during positive pressure ventilation; and the risk of aspiration of gastric contents. Many second-generation SADs now outperform the first-generation LMAs and LMs in all these domains.

being as easy or easier to insert, with higher oropharyngeal seal pressures, and with design features that are intended to, and probably do, reduce the risk of aspiration.

If safety is the major concern when deciding which SAD to select, what sort of evidence should we seek to support our choices? It is worth considering carefully the value of randomized controlled trials (RCTs) in answering this (and other safety-related questions). Previous cohort studies have estimated a risk of aspiration with the cLMA, in starved patients without increased risk of aspiration, to be approximately one in 10,000. Using simple power calculations, it is easy to calculate that an RCT designed with 80% power to detect a 50% decrease in the rate of aspiration would require more than a million patients in each limb of the study. As such, a study is self-evidently impractical, and because it would probably be judged unethical to perform such a study on patients in high risk of aspiration, we must conclude that RCTs are not the solution here. It is perhaps here that high-quality bench-top and cadaver studies have been most useful in examining the functional safety features of many of the second-generation SADs. These have demonstrated considerable variation in the ability of such devices to obturate the oesophagus and to vent regurgitant material.

In general, RCTs of SADs—and meta-analyses of such—have four limitations. First, they focus most on the early phase of use and efficacy (e.g. ease of insertion, first-time insertion, and airway seal) rather than examining use throughout anaesthesia. However, Asai reports ‘serious airway complications’ with SADs in 5% of patients. Second, the vast majority are powered to identify differences in airway seal—producing the smallest studies possible—again focusing on efficacy over safety. Third, the only complications collected are minor ones (e.g. sore throat, soft tissues trauma). Fourth, they only study low-risk patients, but in everyday practice SAD use has expanded beyond this. These small studies in low-risk patients are poor at identifying more critical aspects of safety (e.g. rates of mid-procedure failure, nerve injuries, and aspiration) because these events are too rare. Many studies do not even report such complications.

Ideally, RCTs should study the whole period of use, should be powered against outcomes of clinical importance, should be studied in a clinically relevant setting, and importantly, should in most circumstances compare the new device with a high-performing device (probably a second-generation device) rather than the cLMA. It would be good to see RCTs of SAD performance moving away from the current situation.

Even when considering which SAD to select for routine use, there is a strong argument that current studies tell us much about efficacy but little about safety, and in most instances the efficacy is similar. For advanced uses and rescue uses (i.e. all those listed above), the evidence on which to select a SAD is even more difficult to divine. In these settings, safety becomes ever more relevant, but the clinical evidence becomes less robust. If existing RCTs are useful only for answering questions of relative efficacy and minor safety-related issues, what evidence can then be used to examine major safety issues? In practice, for direct and indirect evidence of safety we must rely on other sources of information, such as bench-top tests, large case series, narrative reviews, registries, and national audits. This evidence can then be synthesized with a knowledge of local experience and requirements.

It is likely that different circumstances demand different priorities in SAD performance and safety characteristics. During routine anaesthesia in a low-risk elective patient, the priorities include high rates of insertion in expert hands, an ability to ventilate the patient, and low rates of complications, including a sore throat. When using a SAD for airway rescue by a non-anaesthetist attending a cardiac arrest, the priorities are different and are likely to include speed of insertion, success without expert training, and ability to ventilate the lungs, with features that lessen the risk of aspiration being of importance but not primary. For airway rescue of an obese patient after failed rapid sequence induction, the main requirements are reliable first-attempt insertion success, a high airway seal, and features that lessen the risk of aspiration. If the intention is then to intubate through the SAD, factors that improve fibreoptic-guided intubation (e.g. the device reliably lying over the glottis and having an adequately wide airway tube) become important.

It is relatively easy to construct a scoring system that lists the desirable features of a SAD for a given circumstance and to ascribe a maximal score according to the importance of each feature. Table 1 and Supplementary Tables 2–4 show indicative examples of these for a range of clinical settings. The ranking of desirable features and the allocated scores are based on the authors’ knowledge of the literature, judgement, and clinical experience. Such tables enable a summative assessment of the performance of devices in specific clinical settings and offer an

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**Table 1** Choice of airway for routine use during elective anaesthesia. Aspects of device performance are given a maximal score according to importance in the clinical circumstance. Each device is then scored for each aspect of performance. The sum of these scores gives an indication of the most and least suitable device. BVM, bag-mask ventilation; cLMA, classic laryngeal mask airway (LMA); ILMA, intubating LMA; LTS II, laryngeal tube suction mark II; PLMA, ProSeal LMA; SLMA, Supreme LMA. *Second-generation device

<table>
<thead>
<tr>
<th>Overall insertion success</th>
<th>Speed of insertion</th>
<th>Quality of ventilation</th>
<th>Airway seal</th>
<th>Aspiration protection</th>
<th>Avoiding airway trauma</th>
<th>Avoiding sore throat</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal score</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>BVM</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>cLMA</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>ILMA</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>15</td>
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<td>PLMA*</td>
<td>3</td>
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<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>i-gel*</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
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<td>SLMA*</td>
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<td>LTS II*</td>
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<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>15</td>
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</tbody>
</table>
opportunity to examine which device might best fit requirements. We entirely accept that construction of the tables involves some judgement, and it is entirely possible that other readers may allocate maximal scores and relative scores somewhat differently. However, in the exemplar tables, two things are notable: (i) that different circumstances lead to different SADs ranking highest; and (ii) that the cLMA rarely ranks highly in such analyses.

With second-generation SADs matching or out-performing first-generation devices in terms of efficacy, and being highly likely to be safer and more suited to advanced uses, there is a strong argument that it is time we abandoned the first-generation devices completely and moved to a situation where second-generation devices are the norm. Adoption of high-performing SADs for routine use not only improves the risk-to-benefit ratio for all patients but also ensures that when advanced use is required, the anaesthetist is expert in its use. Such is the high standing of the cLMA in many areas of anaesthetic practice that this may sound like heresy. In our department, second-generation devices are already used routinely by the vast majority of consultants, and we have already considered removing cLMAs from routine use. Perhaps the time has come.

Supplementary material

Supplementary material is available at British Journal of Anaesthesia online.

Declaration of interest

T.M.C. has been paid, >5 yr ago, for lecturing for Intavent-Orthofix/LMA company, which at that time distributed laryngeal mask airways. The authors’ department has received free or at cost airway devices for evaluation and research. Neither author has financial conflicts.

References