Supraglottic airway devices: More devices and research required?

The scope for use of the supraglottic airway device (SAD) has been widened since it was first introduced by Dr. Archie Brain, with better design features and refinements to enhance the efficacy and patient safety.[1] In addition to facilitating airway management during anesthesia, it forms an integral part of rescue oxygenation and ventilation in an emergency, especially when faced with a difficult tracheal intubation or mask ventilation, as recommended by most difficult airway guidelines.[2-4]

Extraglottic sealing with SADs is necessary for effective ventilation and protection against aspiration. Depending on the type of sealing, the devices are often classified into peri-laryngeal sealers, pharyngeal sealers, and cuff-less preshaped sealers.[5] Intubation through the device is a desirable, yet nonessential feature. The newer SADs are designed to enhance patient safety with special features to reduce the risk of aspiration. These are, therefore, classified as second-generation devices, which facilitate gastric drainage and provide higher sealing pressures to protect against aspiration.[6] Some authors refer to a device having a self-sealing cuff as a third-generation device, while some use the term to describe the ability to intubate through the device and for others, it is a combination of a bite block, higher sealing pressure, and presence of gastric drainage.[6-9] While these features are desirable, the most essential are safety features to protect against aspiration, which the second-generation devices aim at providing. Tracheal intubation can be performed successfully through most first- and second-generation SADs, when guided by a bronchoscope. Therefore, though a revision of the classification may be desirable, classification as a third-generation device seems unnecessary.[9] Labeling every improvement in the design of SAD as a next-generation device will only create confusion and may not be appropriate. The Fourth National Audit Project (NAP4) of the Royal College of Anesthetists and Difficult Airway Society recommended changing over to second-generation devices for improved patient outcomes.[10] Difficult airway guidelines from various airway societies have also advocated to prefer the use of second-generation SADs.[3,4]

With improvement in monitoring techniques and the improved safety profile of SADs, the indications for use of SADs have been ever expanding. With the availability of SADs having higher seal pressures, their use in laparoscopic surgeries, obstetrics, obese patients, in prone position, during cardiopulmonary resuscitation, and as a bridge to extubation (Bailey's maneuver) has been increasing.[11-13] A wide array of SADs are available, with each one claiming superiority over the other for specific indications. The intra-cuff pressure, which is the pressure inside the cuff of SAD, should be maintained at less than 60 cmH_2O, which is the perfusion pressure of the pharyngeal mucosa, to prevent pharyngeal mucosal ischemia.[14] This pressure can be measured using a cuff pressure manometer, though it is not performed in routine clinical practice. In addition to providing higher seal pressure, some newer devices have additional useful features such as an integrated pilot cuff with an indicator to help maintain the acceptable range of intra-cuff pressure.

The current issue of the journal includes two randomized control trials comparing various SADs which prevent gastric aspiration and a case series of patients with severe post-burn contracture (PBC) scheduled for neck contracture release under general anesthesia. Sharma *et al.*,[15] in a randomized controlled study, compared the clinical performance of three SADs, LMA® ProSeal™, Ambu® AuraGain™, and LMA® Supreme™, in 270 anesthetized patients receiving controlled mechanical ventilation. The primary aim of the study was to compare the oropharyngeal seal pressure (OSP) of these devices. The highest OSP was achieved with the LMA ProSeal followed by the LMA Supreme and the Ambu AuraGain. However, this difference in OSP, though statistically significant, is not clinically relevant, as high peak pressures are usually not achieved in anesthetized paralyzed patients with normal lungs, to be concerned about the of loss of airway seal with properly positioned devices. Though a well-conducted study, it only confirms the findings of several other similar studies.

Another randomized study by Agrawal *et al.*[16] compared the Baska mask™ with LMA ProSeal in 80 adult patients undergoing elective surgery under general anesthesia with controlled ventilation. Baska mask has a selfsealing membranous recoiling cuff that inflates and deflates proportionally with each positive pressure breath. It is classified by some as a third-generation SAD, as the OSP is claimed to be higher (>35 cmH_2O). Their primary outcome was OSP, which was measured within 5 min and at 30 min after device insertion. The study concluded that the Baska mask provides higher oropharyngeal leak pressure (37.6 ± 2.43 cmH_2O), better anatomical alignment with glottis, and faster time to achieve effective airway, compared to LMA ProSeal, without increasing airway morbidity. The findings of the

study are similar to those of previous studies and may suggest that the Baska mask may be beneficial in patients with poor lung compliance or other conditions requiring higher airway pressures for effective ventilation, though this was not studied in patients with poor lung compliance. However, tracheal intubation is usually safer in such patients, obviating the need for a device with a very high OSP. In addition, the clinical relevance of these findings is questionable, as most second-generation SADs provide satisfactory oropharyngeal seal and effective ventilation even with a lower OSP. Better anatomical alignment with the glottis is additionally desirable for successful blind intubation through an SAD; however, blind intubation is no longer recommended.[3,4]

Apart from inadequate fasting status and long duration of surgery, other contraindications for the use of SADs are popularly known by the mnemonic *RODS*: Restricted mouth opening, Obstruction in upper airway, Disrupted upper airway (e.g., trauma, intraoral burns following caustic ingestion), and Stiff lung (poor lung compliance).[17] Kumar *et al*.[18] describe the use of six different types of preshaped second-generation SADs as the first choice of airway device in 24 patients with moderate to severe PBC release of the neck. In 19 of these cases, the SADs were placed in an awake patient after topicalization of the airway and in the remaining five patients, they were placed under general anesthesia while maintaining spontaneous respiration. The SADs could be placed in the first attempt in all the cases. The time taken to hand over the patients to surgeons was 12–20 min. The SADs maintained their proper placement and function in spite of changing airway dimensions during the contracture release. The patients tolerated the SADs well until the time they were removed when fully awake. In this case series, preshaped SADs were found to be an effective and safe first-choice airway device, when used as an alternative to awake tracheal intubation with a flexible scope. Though awake tracheal intubation has been traditionally used, increased experience with managing the airway in these cases with an SAD has increased confidence in their use. This case series has further demonstrated the feasibility of using a preshaped SAD as an effective alternative technique to secure the airway for this short surgical procedure by experienced operators in select patients. The authors have proposed a scoring system for neck contractures based on the neck range of motion, which may help investigators select suitable patients and facilitate uniform reporting of findings in future studies. Future studies are required to establish the safety of this approach. Until such time, the routine use of SADs for PBC release of the neck should not be advocated based on these findings.

The two randomized studies have further demonstrated the enhanced safety profile and efficacy of the second-generation SADs, confirming the findings of several other similar studies. The question is whether we need more research comparing these devices or, for that matter, more research on SADs at all. Comparing the OLP of existing devises has been over-investigated in small trials with similar findings or subtle differences, which, though significant, are not of much clinical importance, questioning the need for further trials in this area. Experience with SADs in various settings, as in the case series, on their use for PBC increases our confidence in using these devices for expanded indications, where tracheal intubation may have been considered conventionally. However, establishing the safety of this approach is required in large studies in future.

While additional features related to ease of insertion and efficacy are desirable, the most essential are safety features to protect against aspiration. During the coronavirus disease 2019 (COVID-19) pandemic, the use of SADs was a concern due to potential aerosol generation and the increased risk of infection to the health-care workers. Guidelines from airway societies recommended its use with due precautions to minimize the risk of infection, though no robust evidence to support the same is available.[19,20] Future studies should address these concerns with the use of SADs in patients with COVID-19 and other respiratory infections using well-designed trials. Future innovations will bring in SADs with better ease of insertion, efficacy, and enhanced patient safety. Research must continue to assess and compare new devices and expanded indications for the use of SADs, while large trials are needed to assess their safety.

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