The success and popularity of the laryngeal mask airway led to the development of other supraglottic airways (SGAs), as they freed the hands of anesthetists and provided additional oxygen support for patients. It was the dawn of the age of ambulatory surgery. This review describes the SGA devices, including the laryngeal mask and its various subtypes, that are currently in clinical use in the United States (Table 1).

**Part I: Standard Supraglottic Airway**

The SGA has 3 components:

1. A mask with an inflatable cuff;
2. An inflation line with a nonreturn valve and an inflation indicator balloon to block the mask; and
3. A tube whose distal aperture opens into the inflatable mask and whose proximal aperture is fused to a standard 15-mm connector that is attached to the circuit of the anesthesia machine.
<table>
<thead>
<tr>
<th>Name/Manufacturer</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>AuraStraight (Ambu Inc)</td>
<td>Shape similar to LMA Unique, no epiglottic bars on the anterior surface of the cuff.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Aura40/Aura40 Straight (Ambu Inc)</td>
<td>Same design as the Ambu AuraOnce, but reusable. Aura40 Straight can be autoclaved up to 40 times.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>AuraFlex (Ambu Inc)</td>
<td>Original AuraOnce cuff design attached to smaller-diameter, flexible, armored tube that allows repositioning of the tube without cuff displacement. Integration of pilot tube in the airway tube makes handling and insertion easy.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>AuraOnce (Ambu Inc)</td>
<td>Built-in curve replicates human anatomy. One-piece molding with integrated inflation line. No epiglottic bars on anterior surface of cuff.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>CobraPLA Perilaryngeal Airway</td>
<td>Large-ID laryngeal tube, which is soft and flexible in design with a tapered, striated tip. Improved distal curve, softer tube, softer head. High-volume, low-pressure oropharyngeal cuff.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>CobraPLUS (Engineered Medical Systems)</td>
<td>Similar to the CobraPLA. Includes temperature monitor (all sizes) and distal gas sampling (pediatric sizes only: ½, 1, and 1 ½).</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>KING LAD (King Systems/VBM Medizintechnik GmbH)</td>
<td>Similar in shape to LMA Unique with silicone cuff.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>KING LAD Flexible (King Systems/VBM Medizintechnik GmbH)</td>
<td>Silicone cuff design of King LAD with reinforced PVC tubing</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>KING LT/LT-D (King Systems/VBM Medizintechnik GmbH)</td>
<td>Multiuse, latex-free, single-lumen silicone tube with oropharyngeal and esophageal low-pressure cuffs, 2 ventilation outlets, insertion marks, blind distal tip, Color-coded connectors, no epiglottic bars.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>LMA Classic (LMA North America, Inc)</td>
<td>Supraglottic ventilatory device consisting of an inflatable silicone cuff. Wide-bore tube can be connected to an Ambu bag or anesthesia circuit. Designed to fit the pharynx of patients of various weights.</td>
<td>Adult and pediatric, accommodating ETT 3.5-7.0 mm</td>
</tr>
<tr>
<td>LMA Flexible (LMA North America, Inc)</td>
<td>Original LMA cuff design attached to smaller-diameter, flexible, armored tube that allows repositioning of the tube without cuff displacement. New single-use version is easier to insert.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>LMA Unique (LMA North America, Inc)</td>
<td>Original, disposable LMA design. Sterile, latex-free, available with or without syringe and lubricant. Soft cuff and airway tube allow conformation to patient’s natural anatomy.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Sheridan Laryngeal Mask (Teleflex Medical)</td>
<td>Similar to LMA Unique. No epiglottic bars.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>SLIPA Streamlined Liner of the Pharynx Airway (SLIPA Medical Ltd)</td>
<td>Cuffless supralaryngeal airway, mask with anatomically preformed shape, latex-free, no epiglottic bars.</td>
<td>Adult, corresponding to the dimension across thyroid cartilage cornu: 47, 49, 51, 53, 55, and 57 mm</td>
</tr>
<tr>
<td>Portex Soft Seal Laryngeal Mask (Smiths Medical)</td>
<td>Similar in shape to the LMA Unique, but differs in its one-piece design, in which the cuff is softer and there is no “step” between the tube and the cuff, an integrated inflation line, no epiglottic bars on the anterior surface of the cuff, and a wider ventilation orifice.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Ultra CPV/ Ultra Clear CPV (AES, Inc.)</td>
<td>Shape similar to LMA Unique with silicone cuff. Cuff pilot valve (CPV) marked with color bands to gauge changes in cuff pressure.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>UltraFlex CPV (AES, Inc.)</td>
<td>Shape similar to Ultra CPV.</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Vital Seal (GE Healthcare/Vital Signs)</td>
<td>Similar to LMA Unique.</td>
<td>Adult; pediatric available soon</td>
</tr>
</tbody>
</table>

Rescue Intubation | Special Features
--- | ---
Yes | Single use
Yes, ETT 3.5-7.0 mm | Easy, quick insertion
No | Disposable, flexible, longer and narrower tube
Yes, ETT 3.5-7.0 mm, recommended over Aintree AEC | Anatomically shaped, curved, and reinforced tip that facilitates placement. Single use
Yes, ETT 3.0 (non-cuffed)-8.0 mm | Single use
Yes, ETT 3.0 (non-cuffed)-8.0 mm | Single use; allows monitoring of the patient’s core temperature; in neonates and infants, distal CO₂ can be monitored
Yes, ETT 3.5-7.0 mm | Single use, silicone, MRI compatible
No | Single use, flexible silicone material
Yes, with FOB and exchange catheter | Nondisposable and reusable, possible aspiration protection
Yes, ETT 3.5-7.0 mm | Nondisposable and reusable, aperture bars, epiglottic bars
No | Flexible; longer and narrower tube
Yes, ETT 3.5-7.0 mm | Single use, aperture bars, epiglottic bars
Yes, ETT 3.0-8.0 mm | Single use, has a wider shaft—No. 4/7.0 mm ETT
Yes, with FOB and exchange catheter | Single use; hollow structure allows storage of regurgitant liquids, minimizing aspiration risk; high sealing pressure
Yes, ETT 3.5-7.5 mm | Single use
Yes | Ultra Clear has PVC tube
No | Flexible, single use
Yes, ETT 6.0-7.0 mm | Patented reinforced tip to prevent folding; no aperture bars

The mask is designed to conform to the contours of the hypopharynx or oropharynx with its lumen facing the laryngeal opening. When fully inserted, the distal tip of the SGA cuff presses against the upper esophageal sphincter, its sides face the piriform fossae, and the upper border rests against the base of the tongue.

The flexible SGA is identical to the standard devices in all respects except that its airway tube has been replaced by a narrower tube supported by a continuous coil of wire incorporated into its inner wall. Although intubation is not possible via these devices because of their elongated, narrow tubes, they can be used for rescue ventilation.

**Clinical Application**

Currently, SGAs are used in 2 important areas of airway management: 1) during procedures performed with the patient breathing spontaneously or on mechanical ventilation (intermittent positive pressure ventilation [IPPV] up to 20 cm H₂O) and 2) for rescue ventilation and intubation (Table 21-16).

Relative contraindications to SGA use during spontaneous breathing or mechanical ventilation include morbid obesity (maximum weight, 110 kg) and the known presence of gastric contents. The duration of surgery is recommended not to exceed 6 to 8 hours.

The success of SGAs as rescue ventilation and intubation devices is limited by factors such as oropharyngeal swelling, infection (epiglottitis), airway trauma, tumor, and major craniofacial distortion.

**Tips for Insertion**

It is important to have an adequate depth of anesthesia prior to insertion of the SGA to achieve conditions such as unresponsiveness, loose jaw, and easy mouth opening. If appropriate anesthesia is given, there is no need for muscle relaxation. Exceptions may include cases in which mechanical ventilation is planned and elderly patients, who may not tolerate large induction doses of propofol. If other agents are used for induction, mask ventilation with a volatile agent should follow until adequate depth is achieved. All volatile agents, including desflurane (Suprane, Baxter Healthcare), are appropriate to use with SGAs.

Most SGAs are best inserted with the patient’s head in the “sniffing position” or in slight extension. The device is pushed along the roof of the mouth and the posterior wall of the pharynx (the route of a bolus of food) until it stops. The correctly positioned SGA tip lies at, and partially blocks, the upper esophagus. It is important to avoid overinflation of the cuff of any SGA device. This happens commonly in an effort to achieve a good seal and is often the source of complications.

With the flexible SGAs (LMA Flexible, Ambu AuraFlex, King LAD Flexible, Ultra Flex CPV), a meticulous placement technique—constantly flattening the SGA against the palate—is required during insertion (Figure 1). It has been suggested that insertion tools be used to transiently stiffen the flexible SGAs and to facilitate placement, but
studies have shown that these devices are not necessary if the correct technique is applied.18

**COMPLICATIONS**

Although the SGA is considered a minimally invasive device, complications and problems have been associated with its use (Table 38,19,20). The worst complication is aspiration; however, laryngospasm, negative pressure pulmonary edema, and various forms of airway injury also have been reported. Overall, the occurrence of complications appears to be inversely proportional to the experience and skill level of the operator.

Factors that may prevent these complications include selecting patients appropriately, choosing an SGA of the correct size, and using a recommended insertion technique to obtain the optimal supraglottic position. Light anesthesia and an improperly placed device may lead to coughing, retching, and regurgitation. Overinflation of the cuff should be avoided, and attention should be paid to the surgical stimulus, as well as the depth of anesthesia, for the best results during surgery.

**CASE REPORTS**

### Prone Position

A 32-year-old woman (American Society of Anesthesiologists [ASA] physical status classification I; 5 ft 3 in, 137 lb, body mass index [BMI] of 22) was scheduled for a pilonidal sinus surgery with an estimated duration of one hour. General anesthesia was provided because the patient refused spinal anesthesia. The patient was induced in the supine position with midazolam, fentanyl, and propofol. After placement of the laryngeal mask, the patient was turned in the prone position, head placed to the side. Spontaneous ventilation was maintained under desflurane, oxygen, and air. The surgeon administered a local anesthetic. At the end of the procedure, the patient emerged without complications (Figure 2).

### Rescue Intubation

A 68-year-old man (ASA IV, Mallampati III, moderate obesity [5 ft 8 in, 180 lb, BMI of 27.4]) was brought in for an emergency repair of a leaking abdominal aortic aneurysm. Rapid-sequence induction was performed with etomidate, fentanyl, and succinylcholine. After placement of the laryngeal mask, the patient was turned in the prone position, head placed to the side. Spontaneous ventilation was maintained under desflurane, oxygen, and air. The surgeon administered a local anesthetic. At the end of the procedure, the patient emerged without complications (Figure 2).

**Rescue Intubation**

A 68-year-old man (ASA IV, Mallampati III, moderate obesity [5 ft 8 in, 180 lb, BMI of 27.4]) was brought in for an emergency repair of a leaking abdominal aortic aneurysm. Rapid-sequence induction was performed with etomidate, fentanyl, and succinylcholine. After intubation attempts with the Macintosh blade, Miller blade, and fiber-optic bronchoscope (FOB) had failed, an SGA was placed and a fiber-optic intubation through the laryngeal mask was successfully performed. The endotracheal tube (ETT) and laryngeal mask remained in place throughout the procedure and were later exchanged for a larger ETT in the intensive care unit (Figure 3).

**Part II: Supraglottic Airway With Gastric Access**

The SGA with gastric access (Table 4) has 3 components:

1. a mask with inflatable cuff (with exception of Intersurgical i-gel);
2. an inflation line with a nonreturn valve and an inflation indicator balloon to block the mask; and

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**Table 2. Various Uses of Standard SGAs**

<table>
<thead>
<tr>
<th>Clinical Applications of SGAs</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge to extubation</td>
<td>Decreased coughing for smokers, COPD, and procedures requiring smooth emergence–exchange of the ETT for SGA (“Bailey maneuver”)</td>
</tr>
<tr>
<td>Dental surgery</td>
<td>Mostly flexible SGAs to allow access to all teeth</td>
</tr>
<tr>
<td>Electroconvulsive therapy</td>
<td>If face mask ventilation is difficult</td>
</tr>
<tr>
<td>Endoscopy</td>
<td>EGD, TEE, ERC &gt;smaller size recommended</td>
</tr>
<tr>
<td>ENT surgery</td>
<td>Mostly flexible SGAs; however, for tonsillectomy adenotonsillar, tracheal intubation is still commonly used</td>
</tr>
<tr>
<td>General surgery</td>
<td>Anorectal surgery, pilonidal surgery, breast surgery, low pelvic/abdominal surgery (no upper or major abdominal surgery, no laparoscopy), thyroid surgery; mostly flexible SGA</td>
</tr>
<tr>
<td>Medical imaging, radiotherapy, and interventional radiology</td>
<td>MRI/CT &gt;position can be seen; aluminum spring in pilot balloon of some devices causes artifact on MRI</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>Brain biopsies (in supratentorial region), as part of “asleep–wake–asleep” craniotomy, burr holes for functional neurosurgery</td>
</tr>
<tr>
<td>Obstetric procedures</td>
<td>Rescue airway</td>
</tr>
<tr>
<td>Ophthalmic surgery</td>
<td>Flexible or standard SGA</td>
</tr>
<tr>
<td>Orthopedic procedures</td>
<td>Spine procedures in the lateral position, hip surgery (combined with regional anesthesia), shoulder arthroscopy</td>
</tr>
<tr>
<td>Plastic surgery</td>
<td>Often flexible SGA</td>
</tr>
<tr>
<td>Postextubation</td>
<td>If extubation fails and is followed by airway obstruction</td>
</tr>
<tr>
<td>Tracheotomy</td>
<td>Used for ventilation, fiber-optic inspection</td>
</tr>
<tr>
<td>Urologic procedures</td>
<td>Cystoscopy, stent placement, etc</td>
</tr>
</tbody>
</table>

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1. Martin C. 
3. American Society of Anesthesiologists. 
5. American Society of Anesthesiologists. 
10. American Society of Anesthesiologists. 
17. American Society of Anesthesiologists. 
3. A dual-tube system to separate the respiratory and alimentary tracts with a built-in bite block. The distal aperture of the airway tube opens into the inflatable mask, and its proximal aperture is fused to a standard 15-mm connector to be attached to the circuit of the anesthesia machine. The alimentary tube can be used to insert a gastric tube, gum elastic bougie (GEB), temperature probe, manometer, fiber-optic scope, oximetry probe, esophageal stethoscope, or a gastric balloon tube.

**Clinical Application**

SGAs with gastric access are used for the same applications as the classical SGA (Table 5): a) for procedures with spontaneous or mechanical ventilation (IPPV up to 30 cm H₂O, moderate hyperventilation possible), and b) for rescue ventilation and (potential) intubation.

In contrast to normal SGAs, SGAs with gastric access can be used for morbidly obese patients and patients at moderate risk for regurgitating gastric contents (ie, those with diabetes, gastroesophageal reflux disease [GERD]). The duration of surgery is recommended not to exceed 6 to 8 hours. In addition to patients in the supine, lateral, or prone position, these SGAs can also be used in patients in the moderate Trendelenburg position.

The success of SGAs as rescue ventilation and intubation devices is limited by factors such as oropharyngeal swelling, infection (epiglottitis), airway trauma, tumor, and major craniofacial distortion.

**Tips for Insertion**

The basic rules for SGA insertion should be followed during insertion of a laryngeal mask with a gastric access.

The LMA ProSeal (PLMA) contains a pocket for insertion of the index finger, which often helps the practitioner use the correct technique. The pocket enables the use of an introducer tool, which is a reusable clip-on/clip-off device that consists of a thin, curved, malleable metal blade with a guiding handle.

Even with the insertion tool, 3 common malpositions are likely to occur:

1. The PLMA is not inserted deeply enough, and the position of the distal cuff is midlaryngopharyngeal. Correction usually requires pushing the PLMA farther.
2. The PLMA is inserted too anteriorly, and the distal cuff is placed in the glottis inlet. Correction usually requires reinsertion from a lateral approach or with the GEB.
3. The distal cuff is folded over backward. Correction usually requires reinsertion from a lateral approach, or with a stiffened drain tube, stylet, or GEB.

Because this complication can lead to aspiration, it is standard care to insert a gastric tube after PLMA placement to confirm the right position. Finally, a technique that uses the GEB and a laryngoscope works very well when conventional placement fails.

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**Table 3. Complications of SGA Use**

<table>
<thead>
<tr>
<th>Complications</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sore throat, dry mouth, pharyngeal edema, minor pharyngeal abrasion, trauma to epiglottis and larynx</td>
<td>Wrong insertion technique, wrong size, overinflation of cuff (use of nitrous oxide)</td>
</tr>
<tr>
<td>Vascular compression and nerve damage (ie, tongue cyanosis, hypoglossal and lingual nerve palsy, dysarthria, dysphonia)</td>
<td>SGA not inserted far enough, malpositioning of SGA cuff or shaft and cuff overinflation</td>
</tr>
<tr>
<td>Aspiration</td>
<td>Inappropriate patient selection, depth of anesthesia</td>
</tr>
</tbody>
</table>

---

**Figure 1.** Patient having sinus surgery with the LMA Flexible. The surgeon is administering local anesthetic and vasoconstrictor to the nasal passages.

**Figure 2.** Patient in prone position with Ambu AuraStraight.
**Management of Regurgitation**

- Do not attempt to remove the LMA because a significant amount of regurgitant fluid may be trapped behind the cuff of the SGA. Because the cuff shields and protects the larynx from the trapped fluid, removing the SGA may worsen the situation.
- Briefly disconnect the circuit to allow drainage of the fluid while tilting the patient’s head down and to the side.
- Suction the LMA and administer 100% oxygen.
- Ventilate the patient manually, using low gas flows and small tidal volumes to minimize the risk for forcing any fluid from the trachea into the small bronchi.
- Use a large fiber-optic bronchoscope to evaluate the tracheobronchial tree, and suction any remaining fluid.
- If aspiration below the vocal cords is confirmed, consider intubating the patient with an endotracheal tube and institute an appropriate treatment protocol.

**CASE REPORTS**

**Morbid Obesity**

A 58-year-old woman (ASA III, 5 ft 1 in, 280 lb, BMI of 52.9) was scheduled for a cerebral angiogram. In addition to her current headache, her medical history included hypertension and coronary artery disease with previous bypass surgery. She was an inpatient and had fasted for 8 hours. Although

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**Table 4. Supraglottic Ventilatory Devices With Gastric Access**

<table>
<thead>
<tr>
<th>Name/Manufacturer</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>i-gel (Intersurgical Ltd.)</td>
<td>Disposable SGA with noninflatable cuff designed to match the perilaryngeal anatomy. Incorporates an integral bite block and gastric channel.</td>
<td>Adult sizes, nasogastric tube sizes 12Fr-14Fr</td>
</tr>
<tr>
<td>KING LTS (King Systems/VBM Medizintechnik GmbH)</td>
<td>Double-lumen laryngeal tube that incorporates a second (esophageal) lumen posterior to the ventilation lumen.</td>
<td>Adult sizes 3-5; pediatric sizes 0-2.5 currently available only outside the United States and Canada</td>
</tr>
<tr>
<td>KING LTS-D (King Systems/VBM Medizintechnik GmbH)</td>
<td>Same as KING LTS, but disposable.</td>
<td>Adult sizes</td>
</tr>
<tr>
<td>LMA ProSeal (LMA North America, Inc)</td>
<td>Designed with a modified cuff and dual tubes to separate the respiratory/alimentary tracts. Has a built-in bite block.</td>
<td>Adult and pediatric sizes</td>
</tr>
<tr>
<td>LMA Supreme (LMA North America, Inc)</td>
<td>Same features as the LMA ProSeal. Design allows easy insertion. Reinforced tip and molded distal cuff prevents folding.</td>
<td>Adult sizes</td>
</tr>
</tbody>
</table>

she had received midazolam and fentanyl prior to the procedure, it was impossible for her to remain still during the angiogram. The patient was pre-oxygenated and anesthesia induced with 150 mg of propofol. After loss of consciousness, she was mask-ventilated and a PLMA No. 4 was inserted with the standard technique. Vecuronium 6 mg was given after sufficient ventilation was confirmed. The patient was mechanically ventilated (tidal volume [VT] 700 mL, respiratory rate [RR] 12/min, IPPV 26 cm H2O). The procedure lasted 60 minutes and the patient emerged from anesthesia with no complications (Figure 4).

**Voice Professional**

A 50-year-old woman (5 ft 4 in, 154 lb, BMI of 26.4) presented for surgery of bilateral wrist fractures after falling down the stairs. She had no other medical problems. The estimated duration of surgery was 5 hours. The patient wanted general anesthesia and adamantly requested no endotracheal intubation (she was a voice professional). Anesthesia was induced with midazolam, fentanyl, and propofol, and the patient was maintained with a PLMA on desflurane, oxygen, and air with mechanical ventilation (VT 700 mL, RR 10/min, IPPV 24 cm H2O). The procedure lasted 6 hours. Intracuff pressure was monitored and maintained at 60 cm H2O throughout the case. The patient’s vocal cords were inspected with an FOB and their condition and movement were recorded prior to emergence. The patient recovered without problems (Figure 5).

### Management of Regurgitation

- If fluid is seen emerging from the drain tube, the SGA should be left in position.
- If a gastric tube is in position, it should be suctioned and withdrawn to remove any residual fluid from the esophagus and drain tube.
- If a gastric tube is not positioned, one should be inserted; the stomach and esophagus should be suctioned in sequence. The gastric tube should be left in situ and suctioned regularly to reduce the risk for another regurgitation event.
- A fiber-optic scope should be passed down the airway tube to check if aspiration has occurred.

#### Rescue Intubation

<table>
<thead>
<tr>
<th>Rescue Intubation</th>
<th>Special Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, ETT 6.0-8.0 mm</td>
<td>Single use; noninflatable cuff minimizes the risk for tissue compression; epiglottis blocker, buccal cavity stabilizer reduces risk for malposition</td>
</tr>
<tr>
<td>Yes</td>
<td>Allows easy passage of gastric tube to evacuate stomach; distal tip reduced in size to facilitate insertion; reusable</td>
</tr>
<tr>
<td>Yes</td>
<td>Same as KING LTS, but disposable; allows passage of 18F gastric tube; also available in an EMS kit</td>
</tr>
<tr>
<td>Yes, ETT 3.5-6.0 mm</td>
<td>Second cuff allows higher seal for positive pressure ventilation</td>
</tr>
<tr>
<td>Yes</td>
<td>Same as LMA ProSeal, but disposable; easier gastric tube insertion</td>
</tr>
</tbody>
</table>

**Figure 4. LMA ProSeal for radiology procedure.**

**Figure 5. LMA ProSeal in patient undergoing prolonged surgery (6 hours).**
Table 5. Various Uses for the Supraglottic Airway With Gastric Access

<table>
<thead>
<tr>
<th>Clinical Application of The Classic Laryngeal Mask</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ear, nose, throat surgery</td>
<td>Mostly ear surgery, with head carefully turned</td>
</tr>
<tr>
<td>Electroconvulsive therapy</td>
<td>If face mask ventilation is difficult or patient has potential regurgitation</td>
</tr>
<tr>
<td>General surgery</td>
<td>Anorectal surgery; gynecologic surgery; breast surgery; abdominal surgery, including laparoscopic surgery</td>
</tr>
<tr>
<td>Medical imaging, radiotherapy, and interventional radiology</td>
<td>MRI/CT: kyphoplasty</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>Brain biopsies (in supratentorial region), as part of asleep-awake-asleep craniotomy, burr holes for functional neurosurgery; patients who are not appropriate for a normal SGA</td>
</tr>
<tr>
<td>Obstetric surgery</td>
<td>Rescue airway; cesarean delivery</td>
</tr>
<tr>
<td>Ophthalmic surgery</td>
<td>For patients who are not appropriate candidates for a normal SGA</td>
</tr>
<tr>
<td>Orthopedic surgery</td>
<td>Spine procedures in the lateral position, hip surgery (combined with regional), shoulder arthroscopy; patients who are not appropriate candidates for a normal SGA</td>
</tr>
<tr>
<td>Plastic surgery</td>
<td>Patients who are not appropriate candidates for a normal SGA; liposuction; not recommended for rhytidectomy</td>
</tr>
<tr>
<td>Urologic surgery</td>
<td>Cystoscopy, stent placement, etc; patients who are not appropriate candidates for a normal SGA</td>
</tr>
</tbody>
</table>

Part III: Supraglottic Airway for Intubation

Classic features of the SGA for intubation are a modified mask that facilitates ventilation and intubation, in addition to a wider shaft that allows placement of ETTs up to 8.0 mm (Table 6).

**Clinical Application**

The SGA for intubation is used primarily as an airway intubator in adults with a difficult airway, but it can also be used as an alternative to routine laryngoscopy (Figure 6).

**Difficult airway**: These devices can facilitate airway management in patients who may be difficult to ventilate and intubate, such as morbidly obese patients and patients with sleep apnea or limited neck movement (Figure 7). They are also helpful in the event of an unanticipated difficult airway.

**Normal airway**: A properly performed insertion causes a smaller hemodynamic response than rigid laryngoscopy. Therefore, SGA intubation can be a less stimulating alternative for patients with cardiovascular comorbidities.

**Tips for Insertion**

The basic rules for SGA insertion should be followed during insertion of an SGA for intubation. For a successful intubation with the Fastrach and CTrach, the “Chandy maneuver” is recommended (see Laryngeal Mask Airway Devices: Three Maneuvers for Any Clinical Situation, page 66).

An adequate depth of anesthesia must be confirmed and muscle relaxants (or topical agent to the trachea) should be administered before insertion of these devices. After insertion in the neutral position, followed by ventilation, the Chandy maneuver should be performed. This consists of 2 steps that are performed sequentially. The first step, which is important for establishing optimal ventilation, is to rotate the intubating laryngeal mask airway slightly in the sagittal plane with the metal handle until the least resistance to bag ventilation is achieved. In the second step, performed just before blind intubation, the metal handle is used to lift (but not tilt) the intubating laryngeal mask airway slightly away from the posterior pharyngeal wall. This facilitates smooth passage of the ETT into the trachea.

It is recommended that the intubating laryngeal mask airway be removed after intubation with the stabilizing rod, another ETT, or a Magill forceps.

The Air-Q is inserted with the same technique as standard SGAs and inflated. Blind insertion is not recommended, but flexible and rigid fiber-optic scopes can be used. It can be easily removed after intubation with the white stylet, or the device can remain in place to facilitate a smooth extubation.

**Complications**

These devices have fewer reported complications than standard SGAs, possibly because they are removed. Tissue trauma and esophageal intubation may occur if one is not careful.
CASE REPORTS

Stereotactic Brain Biopsy

A 42-year-old woman (ASA II, 5 ft 5 in, 150 lb, BMI of 25) was scheduled for a stereotactic brain biopsy and possible resection. After frame placement and magnetic resonance imaging, the patient was brought to the OR. She was preoxygenated with a pediatric mask, then induced with 2 mg of midazolam, 50 mcg of fentanyl, and 150 mL of propofol. After the patient lost consciousness and the jaw was loose, a size 3.5 Air-Q Reusable Laryngeal Mask was placed. Adequate ventilation was confirmed. The patient was intubated fiber-optically through the Air-Q with a 7.0-mm ETT. The Air-Q Reusable Laryngeal Mask was removed with the white removal stylet. The procedure lasted 2 hours, and the patient emerged without any complications (Figure 8).

Table 6. Supraglottic Airway Devices for Intubation

<table>
<thead>
<tr>
<th>Name/Manufacturer</th>
<th>Description</th>
<th>Size</th>
<th>Rescue Intubation</th>
<th>Special Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-Q Laryngeal Mask (Cookgas LLC; distributed by Mercury Medical)</td>
<td>Hypercurved intubating laryngeal airway that resists kinking, and removable airway connector. Anterior portion of mask is recessed; a larger mask cavity allows intubation using standard ET Ts. Air-Q removal after intubation is accomplished by using Air-Q reusable removal stylet.</td>
<td>Adult and pediatric; can accommodate ET Ts 5.5–8.5 mm</td>
<td>Yes</td>
<td>Designed to minimize folding of the cuff tip on insertion; serves as an excellent fiber-optic conduit. Both reusable and disposable versions available</td>
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<tr>
<td>LMA Classic Excel (LMA North America, Inc)</td>
<td>Contains the features and shape of the LMA Classic with an epiglottic elevating bar. Removable connector permits fiber-optic intubation. ET Ts up to 7.5 mm may be placed without difficulty.</td>
<td>Adult; can accommodate PVC ET Ts 6.0–7.55 mm</td>
<td>Yes, ETT</td>
<td>Reusable device; can be used for planned fiber-optic intubation and may be left in place to allow removal of ET T prior to patient emergence</td>
</tr>
<tr>
<td>LMA CTrach (LMA North America, Inc)</td>
<td>The LMA CTrach is an LMA Fastrach with built-in fiber optics that allows ventilation, visualization, and intubation of the trachea. It includes an airway (made of silicone) that is similar to the Fastrach with an attachable lightweight viewer.</td>
<td>Adult and pediatric</td>
<td>Yes, ETT</td>
<td>Reusable only; comes with 3 airways, a viewer, charger, 5 ET Ts, and stabilizer rods</td>
</tr>
<tr>
<td>LMA Fastrach (LMA North America, Inc)</td>
<td>Consists of a mask attached to a rigid stainless steel tube curved to align the barrel aperture with the glottis vestibule. The set includes an LMA with a stainless steel shaft covered with silicone (reusable version) and a single movable epiglottic elevating bar, ET T stabilizer, and silicone wire-reinforced ET T. The single-use Fastrach is made from PVC and includes a disposable wire-reinforced ET T.</td>
<td>Adult; can accommodate special and PVC ET Ts 6.0–8.0 mm</td>
<td>Yes, ET T 6.0–8.0 mm</td>
<td>Both reusable and disposable versions available; can be utilized as a blind or visually guided technique; benefits include ability to intubate with larger ET T and remove the device easily after intubation</td>
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Figure 6. LMA Classic Excel.
Gastric Bypass

A 63-year-old obese man (ASA II, 6 ft 1 in, 320 lb, BMI of 42.2) was scheduled for a gastric bypass. His medical history was notable for obstructive sleep apnea, hypertension, and a previous failed FOB intubation. The patient received incremental doses of midazolam and fentanyl to totals of 2 mg and 100 mcg, respectively. A 4% lidocaine spray was administered to the oropharynx, followed by 2% viscous lidocaine coated on a Guedel oral airway. The patient allowed assisted mask ventilation with 2% sevoflurane. He was breathing spontaneously as a size No. 5 Fastrach was placed and ventilation was confirmed. The patient received a 3-mL spray of 4% lidocaine through the Fastrach and coughed briefly. He resumed spontaneous ventilation, and an 8.0-mm Blue line ETT was blindly inserted without his coughing. The Fastrach was removed after confirmation of placement; a small dose of propofol and a muscle relaxant were administered. The procedure lasted 3.5 hours, and the patient emerged without complications (Figure 9).

Conclusion

The SGA has been a part of anesthesia practice for 20 years, and it has evolved with the challenges of modern patient care. These and related devices (Table 7, Figure 10) have proved their usefulness; however, further

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**Table 7. Other Devices**

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<tr>
<td>ChouAirway (Achi Corporation)</td>
<td>Adjustable oropharyngeal airway of 2-piece construction. The rigid outer tube serves as a conduit for and protects the flexible inner tube, which creates a patent air passage from the mouth opening to the glottis.</td>
<td>Adult (10-13 cm) and large adult (13.5-16 cm)</td>
</tr>
<tr>
<td>EasyTube (Teleflex Medical)</td>
<td>Similar to Combitube, nonlatex.</td>
<td>Two adult sizes: 41Fr, large; 28Fr, small</td>
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<tr>
<td>Esophageal/Tracheal Combitube (Covidien)</td>
<td>A disposable double-lumen tube that combines the features of a conventional ETT with those of an esophageal obturator airway. Has a large proximal latex oropharyngeal balloon and a distal esophageal low-pressure cuff with 8 ventilatory holes between.</td>
<td>Two adult sizes: 41Fr (height, 5 ft); 37Fr (height, 4-6 ft)</td>
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</table>

**Figure 7.** This 71-year-old woman presented for electroconvulsive therapy. She was edentulous and very difficult to mask ventilate. The King LT was used in 5 sessions to facilitate ventilation during her treatments.

**Figure 8.** Air-Q reusable laryngeal mask was used and followed by fiber-optic intubation through the device.

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clinical research is needed to ensure patient safety. A large debt of gratitude is owed to Archie Brain, MD, for the laryngeal mask airway—a remarkable innovation—and his careful subsequent development of it.

References


<table>
<thead>
<tr>
<th>Rescue Intubation</th>
<th>Special Features</th>
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<tr>
<td>No</td>
<td>The inner tube is longer than other common oral airways, and thus capable of reaching beyond the base of the tongue. Single use</td>
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<tr>
<td>Yes, using FOB</td>
<td>Same as Combitube, smaller distal tube</td>
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<tr>
<td>Yes, requires many steps. Laryngoscope may facilitate placement.</td>
<td>Ventilation is possible with either tracheal or esophageal intubation. Distal cuff seals off the esophagus to prevent aspiration of gastric contents. Allows passage of an orogastric tube when placed in the esophagus. Single use</td>
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</table>

Figure 9. Endotracheal intubation via the LMA Fastrach.

Figure 10. Combitube used in pre-hospital airway management. This patient was involved in a motor vehicle accident and could not be easily removed from the car. He had lost consciousness and was becoming apneic. Rescuers at the scene placed a Combitube and the patient was ventilated until he could be removed safely.

Photo courtesy of Peer Knacke, MD.


Abbreviations Key

ASA American Society of Anesthesiologists

BMI body mass index

COPD chronic obstructive pulmonary disease

CT computed tomography

EGD esophagogastroduodenoscopy

EMS emergency medical services

ENT ear, nose, throat

ERCP endoscopic retrograde cholangiopancreatography

ETT endotracheal tube

FOB fiber-optic bronchoscope

Fr French

GEB gum elastic bougie

GERD gastroesophageal reflux disease

ID internal diameter

IPPV intermittent positive pressure ventilation

LMA laryngeal mask airway

MRI magnetic resonance imaging

PLMA ProSeal LMA

PVC polyvinyl chloride

RR respiratory rate

SGA supraglottic airway

TEE transesophageal echocardiography

Vt tidal volume