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Review of Supraglottic Airway Devices (SAD)

Emine Aslanlar*
Department of Anesthesiology and Reanimation, Konya Numune Training and Research Hospital, Konya, Turkey

Review Article

***Corresponding author**
Emine Aslanlar

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Abstract: The development of the laryngeal mask airway in 1981 was the first step toward widespread use and acceptance of the supraglottik airway device (SGAD). SGAD have revolutionized the field of airway management. They are commonly used equipment for airway maintenance during elective procedures under general anaesthesia. They may be used also in other indications such as conduit for tracheal intubation or rescue airway device in prehospital medicine.There have been several innovations to improve the SGHAs in design, functionality, safety and construction material. These have ranged from changes in the shape of the mask, number of cuffs and material used, like rubber, polyvinylchloride and latex. In this review, some SGHAs are mentioned and the reported benefits and potential pitfalls are underlined.
Keywords: supraglottik airway device; laryngeal mask airway; other supraglottic airway devices.

INTRODUCTION

Face masks and endotracheal tubes have long been accepted as standard method in achieving adequate ventilation. Following the searches for more suitable options in terms of efficacy, safety and adverse effects, supraglottic airway devices (SAD) have been developed. After being introduced to clinical practice in 1988, laryngeal mask has become popular. Although it has first been used as an alternative of face mask, at present, with some new modifications, it is employed in some areas where endotracheal tube is used. An important advantage of laryngeal mask is that it makes it possible to secure airway in cases in which ventilation is difficult without tracheal intubation and mask [1].

Recently, many SAD have been developed. In these new SAD; modifications have been made for separating respiratory and gastrointestinal ways and for decreasing leak during ventilation. All of these devices have been designed for reducing gastric insufflation, regurgitation and risk of probable pulmonary aspiration [2]. Among properties expected from a SAD, enabling positive pressure ventilation and not leading to any alteration in ventilation parameters in head neck position are worth mentioning [3]. After new modifications, SAD have been classified into first and second generation ones. First generation SAD's are defined as "simple airway devices" [1]. They have not been designed in a way that aspiration risk is decreased in case of regurgitation. Laryngeal mask airway (LMA), flexible LMA, ILMA (intubating LMA), perilaryngeal cobra airway, ambu airway, laryngeal tube (LT) are first generation SAD's. Second generation SAD's have been designed in order that they can decrease risk of aspiration. Moreover, they have high oropharyngeal leak pressure that can provide controlled ventilation in high airway pressure conditions and have biting block that can prevent occlusion of airway. I-gel, Supreme LMA (SLMA), Laryngeal tube suction II (LTSII) (disposable version LTS-D), Streamlined liner of the pharynx airway (SLIPA) are second generation SAD's.

SAD are divided into 5 groups according to their different characteristics [4].

- *Cuffed perilaryngeal sealers:* LMA, LMA Flexible, LMA Unique, pLMA, ILMA
- *Cuffed pharyngeal sealers with esophageal cuffs:* Combitube
- *Cuffless preshaped sealers, esophageal sealing:* i-gel
- *Cuffless preshaped sealers, non esophageal sealing:* SLIPA
- *Cuffed pharyngeal sealers without esophageal cuffs:* Cobra PLA

Laryngeal Mask

Laryngeal mask (LMA), is one of the most commonly used SAD's. Laryngeal mask (LMA, North America, Inc., San Diego, CA, USA) was developed in 1981 by Archie Brain as an alternative to baloon valve mask (BVM) ventilation and endotracheal intubation (ETI). Classical LMA is made from medical silicon

and can be used repeatedly after being sterilized in aoutoclave. Its commercial use was started in 1988 in England and in 1992 in USA. After the first developed classical 13 model, different variations have been developed with modifications in its material and shape. Classical LMA (LMA), intubating LMA (ILMA, Fastrach) and ProSeal LMA (PLMA), are the SAD's that can be used repeatedly. Recently Supreme LMA (SLMA), which have the characteristics of both ILMA and PLMA but is disposable, has been developed [5]. Laryngeal masks have originally been developed for elective anesthesia practice, but its use in difficult intubation for urgent, safe airway has become more common in time [6]. It has been suggested that laryngeal mask produces less harm in airway than other SAD's. As there is no balloon under vocal cords that renders airway safe, theoretically there is risk of aspiration. However, in evaluations of pre-hospital practice, there are no data regarding aspiration. In limited studies investigating the pre-hospital use of LMA, its success rate has been similar to other SAD's, with which it is usually compared [7]. The success rate of the insertion of LMA varies between 64-100% and it can be inserted easily even by inexperienced people. PLMA, the insertion of which is more difficult than other types, is hence not recommended in emergency cases. The type, which can be inserted most readily, is ILMA and is preferred more by users. SLMA, which is of more recent origin, is another SAD, which is easy to use like ILMA [8]. In some with anatomic anomalies or in supraglottic airway obstruction, LMA may not be effective. The leading concerns regarding the use of LMA are the risk of gastric insufflation, inadequate ventilation when it is not properly inserted, and its being insuffcient in cases requiring high ventilation pressure. However, in spite of these, this principle is valid: "a patient who lives with aspiration pneumonia, should be preferred to one whose airway could not be opened" [9]. In 2005 European Resuscitation Council (ERC) guide, it was recommended for the first time that LMA should be used during Cardiopulmonary Resuscitation (CPR) [10]. On the grounds that, during sterilization of LMA, some virions could not be eliminated and sterilization cost is added to cost, single use LMA's have been developed (LMA Unique, LMA Softseal, LMA Ambu etc.). Recently, in anesthesia practice, single use laryngeal masks are preferred instead of cLMA and it has been demonstrated in many studies that its success and complication rates are close to those of cLMA. Especially in pre hospitalization period or during cardipulmonary resuscitation attempts, the use of disposable airway devices is considered as an advantage due to risk of infection [11].

Proseal Laryngeal Mask

LMA-Proseal™ (PLMA, Intavent Orthofix, Maidenhead, UK), is a supraglottic airway device, which is suitable for multiple use, and is the first device that contains a drainage tube that enables its being advanced until the stomach [4]. It was started to be used in 1999 [12]. It has a hard part at the level of the teeth for protection against biting and has a small pocket in which a finger or a metal bar termed "introducer" which facilitates placement can enter. As it allows airway pressure up to 30 cmH_2O [13], its use is possible also in patients with intraabdominal pressure (14). It makes aspiration of liquid stomach content possible from drainage tube [5]. There is no study on the use of PLMA during CPR. However, due to its merits, in 2010 ERC guide, it was suggested that it may be superior to classical LMA during CPR. Its insertion requires more experience than classical LMA [15]. It should be kept in mind that sore throat and other laryngopharyngeal symptoms occur more commonly in LMA types that allow high airway pressure such as proseal LMA [16]. Airway obstruction, which may also occur in classical LMA, may be be more frequent with PLMA, due to its softer material and larger size [18]. In the study of Brimacomb *et al*., [18], it was reported that airway obstruction developed in 19 of 6321 patients with paralysis in whom PLMA was inserted. There are also cases with development of gastric bloating in spite of PLMA [19].

Intubating Laryngeal Mask

The most important advantage of a LMA is that it enables ventilation in cases which can not be intubated. Brain made a change in LMA model and developed a LMA making intubation possible, i.e. intubating laryngeal mask (ILMA) (Fastrach Intavent UK). This LMA has an anatomical structure accomodating to oral, pharyngeal and oral axes and its placement to glottis is easy. It has a metal handle facilitating its insertion and manipulation. It has a mobile bar structure, which directs endotracheal tube to glottis and lifts lumen and epiglottis while passing the tube. Compared to classical LMA, the fact that it can be inserted without much need for head and neck movements should be a cause for preference in patients with suspicion of cervical trauma. ILMA has been investigated in 500 cases under anesthesia, and it was observed that it was inserted successfully in all of the 500 cases. Blind tracheal intubation via ILMA was carried out in 96.2% of the cases and it was stated that in cases in which endotracheal intubation can not be carried out, ILMA is a good alternative [20]. In pre hospital emergency airway management, when difficult intubation is encountered, endotracheal intubation by means of ILMA may be possible. In a study by Tentillier *et al.*, [21], it was demonstrated that in 91% of the cases with difficult prehospital intubation, ILMA makes endotracheal intubation possible and it was suggested that it has a place in the algorithm of prehospital difficult intubation. In 254 patients with immobile cervical and whose airway anatomy was disrupted owing to tumor or surgical intervention, ILMA was used and it was inserted sucessfully in 3 or less attempts in all patients. In blind

intubation and fibreoptic intubation performed with ILMA, success rates have ben reported to be respectively 96.5% and 100% [22]. ILMA is among the airway devices recommended in 2010 ERC guideline. In a study in which ILMA and classical LMA was compared, it was demonstrated that inexperienced clinicians carried out ventilation more rapidly and successsfully with ILMA [23]. ILMA has no pediatric forms.

Esophageal-Tracheal Combitube

Esophageal-Tracheal Combitube (ETC, The Kendall Company, Mansfield, Massachusetts) is an airway device with double lumen which is suitable for multiple use and is inserted into oropharynx in a blind manner. ETC is placed in esophagus or trachea, making ventilation possible. The end of one lumen is open (tracheal lumen), while the other lumen has a closed end (oesephagal lumen). On the part of the esophageal lumen corresponding to pharyngeal region, there are openings making air passage possible. Esophageal-tracheal combitube is placed into esophagus in 95% of the cases and the rates of insertion and successful ventilation are respectively between 79-82.4%. Its having double lumen and the necessity of determining which lumen provides ventilation are considered as its disadvantages. It was developed as an alternative airway device, which can be used during cardiopulmonary resuscitation, and was designed in order that those without endotracheal intubation (ETE) experience can open airway temporarily. Its complications include unrecognized tracheal placement, pneumomediastinum, subcutaneous emphysema, piriform sinus perforation and complications associated with the ventilation of incorrect passage [24]. Esophageal- tracheal combitube is not much in favor among anesthesists and those involved with prehospital airway management, which is attributed to the complexity of its use and the probability of leading to injuries [25]. Although combitube is included in 2010 ERC guide, there is also a comment in the guide mentioning that its use decreased and is replaced by Laryngeal Tube (LT) [15].

SLIPA (The Streamlined Liner of the Pharynx Airway)

It is a supralaryngeal airway device without cuff, which has a hollow chamber in its middle for the collection of regurgitated fluids and hence decreases the risk of aspiration. It has sizes only for adults. SLIPA has a boot shaped part and hollow chamber. Big toe of the boot covers the root of tongue while heel part enables the device to be positioned somewhere between osephagus and nasopahrynx. Its hollow chamber can store regurgitated gastric content up to 50 ml. It has 6 adults sizes according to the size of thyroid cartilage. It is used as a primary airway device in short lasting operations under general anesthesia [26]. Therefore, its efficacy and complication rate is comparable to that of classical LMA [27]. SLIPA is not recommended in positions other than supine position and cases in which the risk of aspiration is high. Duration of insertion, success rates of insertion at first attempt, duration of recovery and hemodynamic rsponses are similar to those of pLMA. Although it has a reserve for collecting regurgitated fluids, its protection against pulmonary aspirations has not been proven in clinical practice [28].

Cobra Perilaringeal Airway

Cobra Perilaryngeal Airway is a disposable supraglottic airway device with cuff. It has a tip like the head of the snake and large volume pharyngel cuff and tube allowing air passage. It has eight diferent sizes available ranging from neonatal to adult [29]. At the point where tube and head meet, it has a structure lifting epiglottis in order to prevent the obstruction of airway by epiglottis [26]. In many studies, it was demonstrated that it makes spontaneous and positive pressure ventilation possible [27]. It is inserted in a blind manner and produces positive pressure ventilation due to tightly closed airway (It enables the use of higher pressures than does LMA). New Cobra-plus has additional characteristics of heat and distal CO_2 sampling. Cobra PLA is comparable to classical LMA in terms of insertion, incidence and severity of sore throat and severity, but its allowing high airway pressure, and more successful performance in patients with limited mouth opening and head extension are its advantages compared to classical LMA [28].

I-Gel

I-gel, is one of the second generation single use new supraglottic airway devices [30]. I-gel was developed by Dr. Muhammed Aslam Nasir in Karachi in 1990's who was inspired by LMA of Archie Brain. I-gel was developed as a result of the searches for a device, which will provide more reliable airway than LMA and will be between LMA and endotracheal tube with regard to airway safety. As material, SEBS (styrene ethylene butylene styrene) was used. This material is soft, expandable and strong. The reason why it was termed as 'i-gel' by Intersurgical firm is that this material has gel like characteristics. In Britain and Ireland Winter Scientifice Meeting held in London in January 2007, it was first officiallly introduced and marketed. Following the success of i-gel, v-gel form was developed for use in rabbits and cats. It is an airway device without cuff that is gelatinous, transparent and has a thermoplastic elastomer structure. It was designed so that it does not exert any pressure on laryngeal and pharyngeal anatomic structures. Characteristics of i-gel, which makes it different from other SAD's stem from the chemical structure of theromoplastic elastomer. Elastic part of thermoplastic elastomer is made of Styrene-Ethylene-Butylene-Styrene (SEBS) rubber and plastic part of polyolefinic structure. Plastic part allows an easier and less costly production compared to traditional technologies used

for the production of thermoplastic material and is also suitable for complete recycling. Elastomeric part has a rubber like structure, which makes it easier to return to its original shape and to be soft. Having no double bonds and a saturated chemical structure renders SEBS resistant to athmospheric agents and UV agents.

Chemical characteristics of thermoplastic structure:

- Perfect resilience against many chemical agents (bases, acids, alcohol, detergants, water based solutions)
- Being very elastic in wide spectrum of heat and returning to its original shape
- High thermal and electrical insulation values
- High resistance to fatique
- High resistance to athmospheric and ultraviolet agents
- Perfect resistance to abrasion
- Low compression in placement in high temperatures
- High transparency
- Suitable for contact with foods.

Its cuff like thickened structure was developed to accomodate laryngeal region. It has an additional lumen which enables the aspiration of gastric content and a protector against biting at the level of teeth. Therefore, it becomes possible to empty accumulated gas in stomach during ventilation. Compated to other SAD's, its insertion dose not require much expertise. As it fits larynx well, oropharyngeal leak pressures are also high. High oropharyngeal leak pressure indicates how well i-gel encloses laryngeal structures and demonstrates that it has a good performance in controlled ventilation. It has 7 different sizes allowing its use in pediatric patient population as well [30].

In cadaver studies, it was demonstrated by endoscopy, dissection and radiography investigations that i-gel can positioned in accommodation to entrance of larynx. Its softness and contours have been produced based on mirror image of laryngeal region anatomy [31]. The part sitting on larynx is made up of a soft material similar to gel and accordingly produces lees trauma during insertion. Gel like structure of i-gel is its superiority compared to other SAD's. This soft structure helps to decrease neurovascular complications associated with prevention of blood flow in laryngeal and perilaryngeal region. When I-gel is inserted correctly, it sits on laryngeal structure while its tip sits on upper esophageal opening and biting block is at the level of incisor teeth [30].

When looked at through fiberoptic, i-gel provides the most optimal view of glottis due to its epiglottis support, and short and thick body. Its short body is ideal for placement of endotracheal tube [32]. When I-gel is inserted, it is held from biting block and in "sniffing" position, while the head is in extension and neck in flexion, it is pushed below from the jaw and advanced towards palatum durum. It is moved backwards and downwards until resistance is felt. An experienced person is expected to insert in a period shorter than five seconds [30]. I-gel was found to be effective and reliable in adults whose body mass index (BMI) is under 35, and non-obese children and in positive pressure ventilation [33]. In another study in which i-gel was used 280 patients, regurgitation occurred in 3 patients and resulted in non fatal aspiration in one of them [34]. Theoretically its use seems to be suitable in emergency airway management and CPR. Favorable comments were published on its use in cardiac arrest [35]. Soar reported that i-gel was inserted in a period shorter than 10 seconds and ventilation was successfully carried out without leak and that aspiration did not occur during its use for ten minutes [36].

In a study with 70 patients in which the performance of i-gel was evaluated in prehospital cardiopulmonary resuscitation, it was reported that i-gel provided adequate ventilation in 96% of all CPR procedures [37].

CONCLUSION

Since Archie Brain LMA Classic™ in clinical practice in early 90's, we witnessed an unceasing evolution and widespread diffusion of SAD's; therefore, at present probably more than 40 different devices are commercially available all over the world [38].

The concept of SAD has changed in time, starting from a rescue device for the patients who can not be ventilated, becoming a routine anesthesia management device with many theoretical advantages over tracheal tube [39, 40], for which it represents a logical and currently clinically accepted alternative in different surgical procedures, including non-operating room anesthesia.

REFERENCES

1. Asai T, Morris S. The laryngeal mask airway: its features, effects and role. Canadian Journal of Anaesthesia. 1994 Oct 1;41(10):930-60.
2. Cook TM, Lee G, Nolan JP. The ProSeal™ laryngeal mask airway: a review of the literature. Canadian Journal of Anesthesia. 2005 Aug 1;52(7):739.
3. Park SH, Han SH, Do SH, Kim JW, Kim JH. The influence of head and neck position on the oropharyngeal leak pressure and cuff position of three supraglottic airway devices. Anesth Analg 2009; 108(1): 112-7.
4. Ramaiah R, Das D, Bhananker SM, Joffe AM. Extraglottic airway devices: A review.

International journal of critical illness and injury science. 2014 Jan;4(1):77.
5. Guyette FX, Greenwood MJ, Neubecker D, Roth R, Wang HE. Alternate airways in the prehospital setting (resource document to NAEMSP position statement). Prehospital Emergency Care. 2007 Jan 1;11(1):56-61.
6. Pollack CV. The laryngeal mask airway: A comprehensive review for the Emergency Physician1. Journal of Emergency Medicine. 2001 Jan 1;20(1):53-66.
7. Heuer JF, Barwing J, Eich C, Quintel M, Crozier TA, Roessler M. Initial ventilation through laryngeal tube instead of face mask in out-of-hospital cardiopulmonary arrest is effective and safe. European Journal of Emergency Medicine. 2010 Feb 1;17(1):10-5.
8. Barbieri S, Michieletto E, Di Giulio M, Feltracco P, Gorlato P, Salvaterra F, Scalone A, Spagna a. P rehospital a irway m anagement with the l aryngeal m ask a irway in p olytraumatized p atients. Prehospital Emergency Care. 2001 Jan 1;5(3):300-3.
9. Kuvaki B. Supraglottik Hava Yolu Araçlarının Hastane Öncesi Ve Kardiyopulmoner Resusitasyonda Kullanımı. Anestezi Dergisi 2011; 19(2): 79-89.
10. Nolan JP, Deakin CD, Soar J, Böttiger BW, Smith G. European resuscitation council guidelines for resuscitation 2005: Section 4. Adult advanced life support. Resuscitation. 2005 Dec 1;67:S39-86.
11. Verghese C, Berlet J, Kapila A, Pollard R. Clinical assessment of the single use laryngeal mask airway--the LMA-unique. British Journal of Anaesthesia. 1998 May 1;80(5):677-9.
12. Agro F, Antonelli S, Mattei A. The proseal LMA: preliminary data. British journal of anaesthesia. 2001 Apr;86(4):601.
13. Luba K, Cutter TW. Supraglottic airway devices in the ambulatory setting. Anesthesiology clinics. 2010 Jun 1;28(2):295-314.
14. Evans NR, Skowno JJ, Bennett PJ, James MF, Dyer RA. A prospective observational study of the use of the ProsealTM laryngeal mask airway for postpartum tubal ligation. International journal of obstetric anesthesia. 2005 Apr 1;14(2):90-5.
15. Deakin CD, Nolan JP, Soar J, Sunde K, Koster RW, Smith GB, Perkins GD. European resuscitation council guidelines for resuscitation 2010 section 4. Adult advanced life support. Resuscitation. 2010 Oct 1;81(10):1305-52.
16. Hemmerling TM, Beaulieu P, Jacobi KE, Babin D, Schmidt J. Neuromuscular blockade does not change the incidence or severity of pharyngolaryngeal discomfort after LMA anesthesia. Canadian Journal of Anesthesia. 2004 Aug 1;51(7):728.
17. Braun U, Zerbst M, Füllekrug B, Gentzel I, Hempel V, Leier M, Peters T, Hobbensiefken G, Klein U, Heuser D, Weyland A. A comparison of the Proseal laryngeal mask to the standard laryngeal mask on anesthesized, non-relaxed patients. Anasthesiologie, Intensivmedizin, Notfallmedizin, Schmerztherapie: AINS. 2002 Dec;37(12):727-33.
18. Brimacombe J, Keller C. The ProSeal laryngeal mask airway. Anesthesiol Clin North America 2002; 20(4): 871-91.
19. Stix MS, Rodriguez-Sallaberry FE, Cameron EM, Teague PD, O'connor CJ. Esophageal aspiration of air through the drain tube of the ProSeal™ laryngeal mask. Anesthesia & Analgesia. 2001 Nov 1;93(5):1354-7.
20. Baskett PJ, Parr M, Nolan JP. The intubating laryngeal maskResults of a multicentre trial with experience of 500 cases. Anaesthesia. 1998 Dec;53(12):1174-9.
21. Tentillier E, Heydenreich C, Cros AM, Schmitt V, Dindart JM, Thicoïpé M. Use of the intubating laryngeal mask airway in emergency pre-hospital difficult intubation. Resuscitation. 2008 Apr 1;77(1):30-4.
22. Ferson DZ, Rosenblatt WH, Johansen MJ, Osborn I, Ovassapian A. Use of the intubating LMA-Fastrach™ in 254 patients with difficult-to-manage airways. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2001 Nov 1;95(5):1175-81.
23. Choyce A, Avidan MS, Patel C, Harvey A, Timberlake C, McNeilis N, Glucksman E. Comparison of laryngeal mask and intubating laryngeal mask insertion by the naïve intubator. British journal of anaesthesia. 2000 Jan 1;84(1):103-5.
24. Cook TM, Hommers C. New airways for resuscitation? Resuscitation 2006; 69(3): 371-87.
25. Rumball CJ, MacDonald D. The PTL, Combitube, laryngeal mask, and oral airway: a randomized prehospital comparative study of ventilatory device effectiness and cost-effectiveness in 470 cases of cardiorespiratory arrest. Prehosp Emerg Care 1997; 1(1): 1-10.
26. Gaitini L, Carmi N, Yanovski B, Tome R, Resnikov I, Gankin I, Somri M, Alfery D. Comparison of the CobraPLA (Cobra Perilaryngeal Airway) and the Laryngeal Mask Airway Unique in children under pressure controlled ventilation. Paediatr Anaesth 2008; 18(4): 313-9.
27. Hooshangi H, Wong DT. Brief review: the cobra perilaryngeal airway (CobraPLA®) and the streamlined liner of pharyngeal airway (SLIPA™) supraglottic airways. Canadian Journal of Anesthesia. 2008 Mar 1;55(3):177.
28. Bein B, Carstensen S, Gleim M, Claus L, Tonner PH, Steinfath M, Scholz J, Dörges V. A comparison of the proseal laryngeal mask airway™, the laryngeal tube S® and the oesophageal–tracheal combitube™ during routine

surgical procedures. European journal of anaesthesiology. 2005 May;22(5):341-6.
29. Galvin EM, van Doorn M, Blazquez J, Ubben JF, Zijlstra FJ, Klein J, Verbrugge SJ. A randomized prospective study comparing the Cobra Perilaryngeal Airway and Laryngeal Mask Airway-Classic during controlled ventilation for gynecological laparoscopy. Anesthesia & Analgesia. 2007 Jan 1;104(1):102-5.
30. Theiler LG, Kleine-Brueggeney M, Luepold B, Stucki F, Seiler S, Urwyler N, Greif R. Performance of the pediatric-sized i-gel compared with the Ambu AuraOnce laryngeal mask in anesthetized and ventilated children. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2011 Jul 1;115(1):102-10.
31. Levitan RM, Kinkle WC. Initial anatomic investigations of the I-gel airway: a novel supraglottic airway without inflatable cuff. Anaesthesia. 2005 Oct 1;60(10):1022-6.
32. Emmerich M, Tiesmeier J. The I-gel supraglottic airway: a useful tool in case of difficult fiberoptic intubation. Minerva anestesiologica. 2012 Oct;78(10):1169.
33. Beylacq L, Bordes M, Semjen F, CROS AM. The I-gel®, a single-use supraglottic airway device with a non-inflatable cuff and an esophageal vent: an observational study in children. Acta Anaesthesiologica Scandinavica. 2009 Mar 1;53(3):376-9.
34. Gibbison B, Cook TM, Seller C. Case series: protection from aspiration and failure of protection from aspiration with the i-gel airway. British Journal of Anaesthesia. 2008 Mar 1;100(3):415-7.
35. Gatward JJ, Cook TM, Seller C, Handel J, Simpson T, Vanek V, Kelly F. Evaluation of the size 4 i-gel™ airway in one hundred non-paralysed patients. Anaesthesia. 2008 Oct 1;63(10):1124-30.
36. Soar J. The I-gel supraglottic airway and resuscitation—some initial thoughts. Resuscitation. 2007 Jul 1;74(1):197.
37. Häske D, Schempf B, Gaier G, Niederberger C. Performance of the i-gel™ during pre-hospital cardiopulmonary resuscitation. Resuscitation. 2013 Sep 1;84(9):1229-32.
38. Hernandez MR, Klock Jr PA, Ovassapian A. Evolution of the extraglottic airway: a review of its history, applications, and practical tips for success. Anesthesia & Analgesia. 2012 Feb 1;114(2):349-68.
39. Maktabi MA, Smith RB, Todd MM. Is routine endotracheal intubation as safe as we think or wish?. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2003 Aug 1;99(2):247-8.
40. Griffiths JD, Nguyen M, Lau H, Grant S, Williams DL. A prospective randomised comparison of the LMA ProSeal (TM) versus endotracheal tube on the severity of postoperative pain following gynaecological laparoscopy. Anaesthesia and intensive care. 2013 Jan 1;41(1):46.