The LTS™ (Laryngeal Tube Suction): a new device for emergency airway management

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Difficulties with tracheal intubation and facemask ventilation occur more frequently under out-of-hospital conditions. Alternatives to ensure a patent airway should be standard equipment for all ALS ambulance systems. Development of Laryngeal Tube (LT) and Laryngeal Tube Suction (LTS), which were introduced as supraglottic alternatives in our MICU in Mannheim, are described. An overview of the first reports on the devices - both in-hospital and out-of-hospital - is given. The algorithm for prehospital emergency airway management implemented in our system is described. Important requirements for successful adoption of this emergency airway management concept besides availability of suitable alternatives are sufficient training in airway models and in patients as well as knowledge about the limitations of the devices.

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Introduction
Difficult intubation is reported in up to 11% of patients requiring tracheal intubation in the prehospital setting, and intubation is not possible in approximately 1% (1). In addition, facemask ventilation can also proof to be difficult: even in the OR, mask ventilation does not allow sufficient oxygenation in up to 5% of patients and fails in 0.1% (2). A widespread algorithm for airway management was published by the American Society of Anesthesiologists (ASA) in 1993 and has recently been modified (3). The ASA states that “options for emergency non-surgical airway ventilation include (but are not limited to): transtracheal jet ventilation, laryngeal mask ventilation, or esophageal-tracheal combitube ventilation.” In our system, the emergency pathway of this algorithm serves as a basis for a prehospital airway management concept, but a newer alternative to facemask ventilation and tracheal intubation has been chosen: the Laryngeal Tube LT and its modified version, the LTS or Laryngeal Tube Suction serve as non-surgical alternative.

Laryngeal Tube
The Laryngeal Tube (LT) was first presented at the German Congress of Anaesthesiology in 1999 (4). The LT is a single lumen silicone tube closed at the distal end, with a large oropharyngeal and a smaller esophageal low pressure cuff sealing the airway. Two ventilatory outlets between the cuffs allow ventilation (Fig. 1). Six sizes are available, suitable for neonates to large adults (size 0 to 5). The device is reusable after sterilization in an autoclave.

Fig. 1
Laryngeal Tube LT – a single lumen silicone tube with oropharyngeal and esophageal cuffs and anterior ventilatory outlets

Early on, the use for emergency airway management was proposed by several authors (5-7). In airway models, comparison with other airway alternatives proved the feasibility of the device (8, 9). In a resuscitation model, ventilation with the Laryngeal Tube was superior to mask ventilation and comparable to the tracheal tube (10). Acceptance of the device by paramedics was higher in comparison to the Laryngeal Mask Airway (LMA) and handling was considered to be easier (9, 11). Airway leak pressure was found to be significantly higher than with the LMA which is enclosed in the ILCOR 2000 guidelines for cardiopulmonary resuscitation (12, 13). In addition, the incidence of gastric insufflation was lower (12). From different ambulance systems, successful use of the Laryngeal Tube for emergency airway management during
resuscitation and in trauma patients by physicians and paramedics has been reported in a total of 15 cases (14-19). In-hospital, the successful use in a patient with an unstable neck and progressive quadriplegia was demonstrated (20). So far, there are no prospective prehospital trials evaluating the Laryngeal Tube, but a state-wide survey in Baden-Wuerttemberg, Germany, showed that in 2001 the LT was available in 9.5% of those physician-staffed ambulance systems providing alternatives for airway management (21). A major limitation for the use of the Laryngeal Tube in emergencies is the lack of access to the alimentary tract due to complete seal of the oesophageal inlet (6, 22). An additional lumen to allow suctioning of gastric contents and to avoid excessive oesophageal pressure in case of vomiting was considered an important improvement for emergency airway management (7).

LTS - Laryngeal Tube Suction

The demand for a Laryngeal Tube model better suitable for use in emergency patients was taken into account by the manufacturer: in the summer of 2002, the LTS (Laryngeal Tube Suction, Fig. 2 and 3) was introduced to the European market (23, 24). With an additional lumen for suctioning and free gastric drainage but not for ventilation, the LTS is a double lumen tube with a similar appearance to the Combitube, but there are several important differences: the LTS is shorter and softer, it is reusable, latex-free, both cuffs are inflated with a single pilot tube, and there is only one lumen for ventilation. A gastric tube up to a diameter of 14 French can be inserted via the second lumen. The LTS is available in sizes 3 (school children) to 5 (large adults).

Handling of the LTS is comparable to the standard Laryngeal Tube: insertion is performed without additional tools, black lines on the tube indicate adequate depth of insertion when aligned with the teeth, and both cuffs are inflated simultaneously with a large colour-coded syringe provided by the manufacturer.

Correct position and adequate airway seal should be verified by auscultation over both lungs and the stomach, bilateral chest excursions and end-expiratory capnometry. When air leakage is noticed, additional air should be inflated into the cuffs. Chin lift may improve ventilation in some patients. When ventilation is possible, a gastric tube can be inserted through the second lumen.

Clinical experience

For ventilation under elective clinical conditions, use of the LTS could be demonstrated with a high success rate comparable to the standard device (23, 25). In a comparison with the LMA-ProSeal™, the LTS™ was considered to be equivalent and can be used to establish a safe and effective airway in mechanically breathing anaesthetized adult patients (26). The LTS™ was successfully used for ventilation during laparoscopic surgery demonstrating the reliability for securing the airway even under adverse conditions (27).

Experimental data

In a resuscitation model, the LTS was compared to the LMA-ProSeal and the Combitube: with a ventilation:compression ratio of 2:15 and chest compressions standardized with a pneumatic thumper, tidal volumes were comparable for all three devices and superior to facemask ventilation (Fig. 4). In addition, no signs of gastric insuflation were found while this occurred in some ventilations with the facemask (28). Comparison with the standard Laryngeal Tube also showed comparable results and lack of gastric insuflation (24).

Set for airway management

In our physician-staffed ambulance system manned by anaesthesiologists with a special emergency training, a set
for airway management is provided: the Laryngeal Tube in sizes 0 to 2 and the LTS in sizes 3 to 5 serve as non-surgical alternatives to facemask ventilation and tracheal intubation. Training in the operating room is possible with these reusable devices, but experience of the individual physicians varies. Sets for needle cricothyroidotomy in paediatric and adult sizes are available as surgical emergency airways. The equipment is packed in a special bag in the MICU.

A simple algorithm for emergency airway management was implemented (Fig. 5) and has been adopted by the second emergency physician base in Mannheim as well (29). Several successful utilizations of the LTS™ have been recorded so far, including intubation difficulties in patients with intracranial haemorrhage, intoxication, and mandibular fracture.

Important requirements for successful adoption of this emergency airway management concept besides availability of suitable alternatives are sufficient training in airway models and in patients as well as knowledge about the limitations of the devices. The fact that not all ambulance systems are equipped with suitable devices for emergency airway management (21) must be considered unacceptable in light of the data on prehospital intubation difficulties available today.

References


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