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CLINICAL PAPER

Disposable laryngeal tube suction—A randomized comparison of two insertion techniques performed by novice users in anaesthetised patients☆

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Summary
Objective: Laryngeal tubes are supraglottic airway devices that can be used in alternative to a tracheal tube to provide ventilation during cardiopulmonary resuscitation. The product line has recently been expanded by the disposable laryngeal tube suction (LTS-D). We tested the hypothesis that, with a modified insertion technique (MIT), the rate of correct placement attempts within 45 s could be significantly increased compared to the standard insertion technique (SIT) recommended by the manufacturer.
Methods: Fifty-four adult patients undergoing trauma surgery under general anaesthesia had an LTS-D inserted by first-time users, randomly assigned to the SIT or a MIT. A brief manikin-based demonstration of the device and the assigned technique was given before insertion. In the MIT the tip of the LTS-D was rotated by 180° prior to insertion. Forced chin lift to create sufficient retropharyngeal space was performed with the other hand. Introduced to one-third of its length, the LTS-D was again rotated by 180° and pushed down the pharynx. The rate of successful tube placements within 45 s was the main outcome variable.
Results: Insertion took 73 ± 41 s (SIT) and 40 ± 8 s (MIT, $P < 0.01$). Insertion within 45 s was possible in $n = 7/27$ patients (26%, SIT) and in $n = 20/27$ patients (74%, MIT, $P < 0.01$). In one patient of the MIT group, placement failed. Non-anaesthesia personnel, such as nurses and emergency medical technicians ($n = 27$), performed comparably to board-certified anaesthesiologists or those in training ($n = 27$).
Conclusion: Applying a MIT significantly reduced the time for successful insertion of an LTS-D by first-time users. Insertion within 45 s was significantly more frequent with this technique. Further studies need to be conducted to determine if the LTS-D can be recommended as a first-line airway during cardiopulmonary resuscitation.

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Introduction

Patients with unexpected difficult airway requiring ventilatory support still remain a challenge for anaesthesiologists, emergency physicians, and emergency medical technicians (EMT). If direct laryngoscopy fails, supraglottic airway devices, i.e. various types of laryngeal tubes, can be used to establish an artificial airway. The disposable laryngeal tube suction (LTS-D) is new, its value is unproven but its design makes it a potentially useful device for emergency use and for cardiopulmonary resuscitation. Other work on similar, but different laryngeal tubes[1,2] led us to consider whether novices might benefit from an alternative insertion techniques.

We tested the hypothesis that, with a modified introduction technique, novice users would be able to successfully place the new LTS-D within 45 s significantly more frequently than using the standard insertion technique recommended by the manufacturer.

Materials and methods

After approval of the study protocol by the institutional review board, 54 adult patients undergoing elective trauma and orthopaedic surgery under general anaesthesia were included in the study. Informed, written consent was obtained on the day before surgery. Sample size estimates suggested that 27 subjects per group would be needed to achieve 80% power to detect an absolute 40% reduction of LTS-D placement attempts lasting longer than 45 s ($\alpha = 5\%$) between standard and modified insertion techniques.

All patients underwent thorough airway examination on the day before surgery. Those patients presenting with two or more predictors for difficult mask ventilation,[3] difficult tracheal intubation, or both were excluded from the study, as were those with a history of difficult tracheal intubation (Table 1).

Table 1 Study exclusion criteria

Age <18 years
Full stomach
Unstable cervical spine
Emergency procedure
History of difficult intubation
Intraoral, pharyngeal, laryngeal or cervical masses
History of intraoral, pharyngeal, laryngeal or cervical surgery
Presence of two or more of the following predictors for difficult mask ventilation and/or difficult tracheal intubation:
Mallampati grades 3 or 4
Thyromental distance <6.5 cm
Neck extension <30°
Inter-incisor distance <3.5 cm
Patients without teeth
Patients with beard
History of snoring or obstructive sleep apnoea
Age > 55 years
Body mass index > 26 kg/m^2

Anaesthesia was induced intravenously, and sufficient mask ventilation verified. No muscle relaxants were used. Thereafter, patients were assigned at random by sealed envelope technique to undergo LTS-D (VBM Medizintechnik GmbH, Sulz a.N., Germany) placement either using the standard insertion technique as recommended by the manufacturer, or a modified technique described below. Users were either physicians (anaesthesia fellows and residents; $n = 27$), or non-physician health-care providers without specific knowledge in anaesthesiology and advanced airway management (non-specialized nurses, EMT's, and medical students; $n = 27$).

All users attended a 30 min lecture on the principles of airway management given within 4 weeks prior to the study, including a brief device description of the LTS-D. The particular techniques of introducing the LTS-D were not explained. It was only mentioned that ''the device is blindly inserted through the patient's mouth''. Therefore, none of the users had any previous practical experience with the LTS-D, in patients or in manikins. A brief manikin-based demonstration of the device and the particular technique to be used was given immediately before insertion by an anaesthesia nurse experienced in the clinical use of the LTS-D. The size of the tube (#4 or #5) was chosen according to the manufacturer's recommendations by the anaesthesiologist in charge.

Before LTS-D placement, all patients were in the sniffing position and mask-ventilated for 2 min with 100% of oxygen. The insertion time was noted from removal of the face mask to attachment of the LTS-D to the breathing circuit and detection of endtidal volume $\geq$ 400 mL, endtidal $CO_2 \geq 20$ mmHg, and visible chest movements. Two attempts were allowed before a failure of insertion was recorded. A failed insertion attempt was defined as the removal of the device from the mouth. If the LTS-D could not achieve a clear airway either within two insertions, in less than 180 s, or when oxygen saturation measured by pulse oximetry dropped below 92%, intermittent mask ventilation with 100% of oxygen was performed. The airway was managed at the anaesthesiologist's discretion thereafter.

Disposable laryngeal tube suction (LTS-D)

The LTS-D is a development of the classic laryngeal tube that allows separation of the respiratory and alimentary tracts. It is a latex-free, double-lumen silicon tube. One lumen is used for ventilation and the other for gastric tube placement. The device, like the original laryngeal tube, is inserted blindly with its distal tip positioned in the upper oesophagus. The LTS-D has two low-pressure cuffs, proximal and distal, that are inflated simultaneously via one pilot tube. In between the cuffs, two oval orifices allow air to pass into the ventilatory lumen and enter the trachea. The distal cuff is designed to seal the upper oesophagus and prevent gastric inflation during ventilation. A drain tube runs posteriorly and is designed to enable access to the gastrointestinal tract and to allow egress of gastric contents if regurgitation occurs, however, the efficacy of this design has not been formally tested (Figure 1).