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ORIGINAL ARTICLE

Emergency percutaneous tracheotomy in failed intubation

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KEYWORDS

Percutaneous dilational tracheotomy;
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Abstract *Objective:* Cricothyrotomy is the emergency surgical means of gaining access to the airways. However it holds a lot of problems to the patient and is only a temporary measure until a definitive airway is reached. Griggs' forceps technique for elective bedside percutaneous dilational tracheotomy (PDT) is safe, fast, and carries fewer complications in expert hands. This study aimed at comparing between emergency cricothyrotomy and emergency PDT in patients with failed intubation.

Design: A comparative double blind study.

Setting: Emergency room of Alexandria main university hospitals.

Patients: 169 failed to intubate, failed to ventilate patients.

Methods: They were serially randomized into group I (85 patients): percutaneous cricothyrotomy and group II (84 patients): PDT using Griggs' forceps technique.

Results: Success rate was 95.3% in group I and 97.6% in group II. Procedure duration (in minutes) was 1.85 ± 0.36 in group I versus 1.46 ± 0.31 in group II. Lung atelectasis occurred to 8.2% of patients in group I only. Vocal cord injury occurred to 4.7% of patients in group I versus 1.2% in group II.

Conclusion: Emergency PDT is feasible and safe in expert hands.

Introduction

The situation of "can't intubate, can't ventilate" in emergency room is not a common finding. However when it does occur it is life threatening and necessitates immediate intervention. According to the failed airway management algorithm in most guidelines worldwide, cricothyrotomy is the most rapid and accepted means of gaining access to the airways in such emergency conditions [1,2].

Cricothyrotomy holds a lot of problems; it might be difficult to identify the cricothyroid membrane properly, and if accessed, it may not be easy to maintain the airway. The plastic cannula is often soft and kinks easily, the more rigid cannula

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may impact on the posterior tracheal wall, and both can become easily displaced [3]. Ventilators deliver low volumes because of the small internal diameter of the cannula, and jet ventilation can cause barotrauma [4]. Another problem is the risk of injuring the cricoid cartilage, which is the only complete ring in the upper airways. Injury to which can cause scarring with subsequent subglottic stenosis [5]. Apart from this, cricothyrotomy is only a temporary solution until a definitive airway can be provided [6].

Since its introduction to work in our critical care department of the Alexandria faculty of medicine in 1999, percutaneous dilational tracheotomy (PDT) had gained a lot of familiarity. It had nearly replaced the surgical technique on elective basis. More than 1200 cases had been successfully operated and a lot of trials had been accomplished comparing surgical and percutaneous techniques, as well as different percutaneous techniques with different assisting tools, like lighted stylet, ultrasonography, and bronchoscopy. Our experience was that Griggs' forceps for PDT is faster and carries fewer complications in expert hands.

All these findings encouraged us to highlight the possible promising role of PDT in providing a definitive airway if applied on emergency basis. This study aimed at comparing between emergency cricothyrotomy and emergency percutaneous dilational tracheotomy using Griggs' forceps technique in patients with failed intubation as regards success rate, duration of the procedure, and rate of complications.

Patients and methods

Patients were those who failed intubation and/or ventilation and necessitated invasive emergency airway access according to the failed airway management algorithm. They were admitted to the Alexandria university hospitals, Alexandria, Egypt, at the period from 1st of January till the 31st of December, 2011.

Patients under 10 years of age, pregnant women, and patients with known laryngeal pathology (trauma, stenosis, or cancer) were excluded from the study. Informed consent was taken from first degree relative of every patient included in the study. This interventional study was approved from the Ethics Committee of the Alexandria faculty of medicine.

Patients admitted to the emergency room (ER) with an indication for endotracheal intubation were assessed for characteristics predictive of difficult laryngoscopy and intubation using the LEMON mnemonic scoring [7–10]. Accordingly patients were classified into:

- No difficult intubation predicted, so intubation was done following the awaken technique. If successful intubation by endotracheal tube and ventilation, patients were transferred to the ICU and were not included in the study. If unsuccessful intubation by endotracheal tube and ventilation (2 attempts, each 2 min, facilitated by cricoid pressure), patients were shifted to the difficult airway management algorithm.
- Difficult intubation predicted (anticipated scenario), so intubation was done following the difficult airway management algorithm.

The study team was announced for proceeding with the difficult airway management algorithm to the targeted patients. Bag Valve Mask (BVM) ventilation using 100% oxygen was applied with cricoid pressure and manual-in-line stabilization of the cervical spine (MILS) together with re-insertion of the oro/naso-pharyngeal airway. Oxygen saturation was determined through using finger pulse oximetry to monitor SpO_2 continuously.

- If successful BVM ventilation ($SpO_2 \geqslant 90\%$), another awaken attempt for endotracheal intubation was conducted using another laryngoscope blade with a flexible stylet while ensuring patient's optimum position. Another awaken attempt was conducted, if available and not contraindicated, using intubating laryngeal mask (ILMA-Fast-Track™). If successful intubation by endotracheal tube and ventilation, patients were transferred to the ICU and were not included in the study. If unsuccessful intubation by endotracheal tube and ventilation, patients were shifted to the failed airway management algorithm.
- If unsuccessful BVM ventilation ($SpO_2 \leqslant 90\%$), (difficult to intubate, difficult to ventilate scenario), patients were directly shifted to the failed airway management algorithm.

All patients with failed airway management were serially randomized into:

- Group I: Percutaneous cricothyrotomy group: using the Seldinger 4-step cricothyrotomy technique [1,3] with insertion of a suitable sized tube to connect to the ventilator circuit to begin ventilation. If failed, percutaneous dilational tracheotomy was performed as a definitive airway (cross group drop-out was not allowed after randomization).
- Group II: Percutaneous dilational tracheotomy group: using the Griggs' forceps dilator technique [11] with insertion of a suitable sized tube to connect to the ventilator circuit to begin ventilation. If failed, surgical tracheotomy was performed as a definitive airway.

All patients in both groups were mechanically ventilated using BI-PAP mode with suitable settings according to patients' requirements. Immediate plain A-P chest X-ray was performed to all patients after airway establishment and ventilation in both groups for assessment of the position of the artificial airway and exclusion of possible complications. Fiberoptic bronchoscopic examination of the upper airways was conducted to all patients within a time window of 1 h post-intubation for assessment of early complications caused principally by artificial airway establishment.

Selective laboratory investigations were recorded to all patients in both groups shortly after airway establishment including hemoglobin concentration, platelet count, PT, INR, and arterial oxygen saturation (SaO_2) (from arterial blood gases analyses).

Airway management data were recorded for each patient and included: success rate of establishing an artificial airway that improved and maintained $SpO_2 \geqslant 90\%$, time elapsed between needle insertion till the end of procedure in both groups, and incidence of procedure-related complications. Peri-procedural bleeding was defined as a serious one when it exceeded 50 ml of blood loss.