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Comparison of blind intubation through the I-gel and ILMA Fastrach by nurses during cardiopulmonary resuscitation: A manikin study

Theodora Melissopoulou, MD [a], Konstantinos Stroumpoulis, PhD [a,b], Michail A. Sampanis, MSc [a,b], Nikolaos Vrachnis, PhD [c], Georgios Papadopoulos, PhD [d], Athanasios Chalkias, PhD [a,b], Theodoros Xanthos, PhD [a,b,*]

[a] MSc "Cardiopulmonary Resuscitation", University of Athens, Medical School, Athens, Greece
[b] Hellenic Society of Cardiopulmonary Resuscitation, Athens, Greece
[c] 2nd Department of Obstetrics and Gynecology, University of Athens, Medical School, Aretaieio Hospital, Athens, Greece
[d] Department of Anaesthesiology, Medical School, University of Ioannina, Greece

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CPR
cardiopulmonary resuscitation
AHA
American Heart Association
ILMA
intubating laryngeal mask airway
ID
internal diameter
NO CC
no chest compressions
CC
chest compressions
ACLS
Advanced Cardiovascular Life Support

ABSTRACT

Objectives: To investigate whether nursing staff can successfully use the I-gel and the intubating laryngeal mask Fastrach (ILMA) during cardiopulmonary resuscitation.
Background: Although tracheal intubation is considered to be the optimal method for securing the airway during cardiopulmonary resuscitation, laryngoscopy requires a high level of skill.
Methods: Forty five nurses inserted the I-gel and the ILMA in a manikin, with continuous and without chest compressions.
Results: Mean intubation times for the ILMA and I-gel without chest compressions were 20.60 ± 3.27 and 18.40 ± 3.26 s, respectively ($p < 0.0005$). ILMA proved more successful than the I-gel regardless of compressions. Continuation of compressions caused a prolongation in intubation times for both the I-gel ($p < 0.0005$) and the ILMA ($p < 0.0005$).
Conclusion: In this mannequin study, nursing staff can successfully intubate using the I-gel and the ILMA as conduits with comparable success rates, regardless of whether chest compressions are interrupted or not.

Introduction

Insertion of a supraglottic device in order to provide ventilation during CPR is considered to be an acceptable alternative, especially when rescuers attending a cardiac arrest have little or no experience in carrying out a procedure requiring a high level of skill such as laryngoscopy.[1] Tracheal intubation, however, is still perceived as the optimal method for maintaining a secure airway according to the ERC Guidelines 2010.[1] In addition, airway devices which can be used as conduits for tracheal intubation may offer an additional advantage.

The ILMA Fastrach is a recognized alternative to classic laryngoscopic intubation.[2] Its use in the difficult airway management

* Corresponding author. National and Kapodistrian University of Athens, Medical School, MSc "Cardiopulmonary Resuscitation", Hospital "Henry Dunant", 107 Mesogion Av., 115 26, Athens, Greece. Tel.: +30 210 6972144; fax: +30 210 6972396.
E-mail addresses: theodorosxanthos@yahoo.com, info@eekaa.com (T. Xanthos).

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has been demonstrated by several studies in the past.[3–6] In fact, results from two studies have indicated that the ILMA may be a superior device for placing an endotracheal tube in an emergency situation by personnel unskilled in conventional intubation.[7,8] Moreover, recent data suggest that it can be used by nursing staff for establishing a patent airway in the setting of out of hospital cardiac arrest.[9]

On the other hand, the I-gel has recently drawn the attention of the researchers due to the insertion ease, the minimal training requirements and the favorable overall results when used by novices.[10,11] Although the results of a previous study by Michalek et al seem to favor the use of the ILMA for blind tracheal intubation,[12] a recent study by Halwagi et al suggests that the I-gel can be used as well for that purpose with comparable first attempt success rate to the ILMA.[13] However, the use of the I-gel in the setting of airway management during cardiac arrest still remains to be defined.[14,15]

Survival of cardiac arrest victims is directly associated with the quality of CPR.[16] Among factors which determine this quality, minimizing interruptions of CC seems to be of great significance.[17,18] Taking into consideration that intubation attempts by paramedics require the cessation of CC for more than the recommended interval of 10 s,[19] placement of a supraglottic device seems to be the best choice for providing ventilation in cardiac arrest, especially while the airway is not managed by an expert anesthesiologist.[20] Timing is a critical issue in CPR and delaying interventions such as defibrillation and CC have a negative impact on survival rates.[21]

Nurses are often involved in the initial management of in-hospital cardiac arrest, either as witnesses or as first responders. Therefore, their role in CPR is of great significance.[22] Considering that the ability to provide ventilation is among essentials skills for rescuers, as well as that the use of supraglottic airways for emergency airway management by nurses is common in some countries,[9,23] the aim of our study was to investigate whether nursing staff would be able to successfully intubate using the ILMA and the I-gel during CPR.

Methods

Study design

The study was conducted in Athens, Greece between May 2012 and May 2013, recruiting all consecutive nurses who had applied on their own will for ACLS training at a scientific society, namely the Hellenic Society of CPR, which was authorized to provide such accreditation. The study was additionally approved by the Postgraduate (MSc) Study Program "Cardiopulmonary Resuscitation" of the Medical School of the National and Kapodistrian University of Athens. Participants were all individuals aged >18 years. Exclusion criterion was any previous training in airway management, while participation to the study was voluntary with participants giving informed consent.

Forty-five nurses with no previous experience in the use of the ILMA and I-gel, were enrolled in our study.[24,25] They all received a standardized demonstration in the use of both supraglottic devices by AHA "Airway Management" instructors. All volunteers were allowed to practice placing the ILMA and I-gel in the manikin (Resusci Anne, Laerdal, Stavanger, Norway) until they gained confidence in their technique. After completing their practice, they were asked to perform blind intubation using the ILMA and the I-gel as conduits. The order of interventions for each participant was determined with the method of sealed envelopes. Thus, two different groups occurred, one group intubating using ILMA first without CC and afterward with uninterrupted CC and one group intubating using I-gel first without CC and afterward with uninterrupted CC. Later on, groups crossed over in order to attempt intubation with both devices. Randomization was achieved using 45 random computer generated integers of one (ILMA), or two (I-gel), as previously described (Fig. 1).[26]

The size of supraglottic devices and tracheal tubes was chosen according to previous insertion attempts by the investigators with the manikin, in order to determine their suitability. We used ILMA 4.0, I-gel 4.0 and tracheal tubes 7.0 mm I.D. Both ILMA and I-gel were well lubricated and the cuff of the ILMA was fully deflated prior to use, according to manufacturer's instructions. A 10 ml syringe was used for inflation of the tracheal tube's cuff and a 50 ml syringe to inflate the cuff of the ILMA. In order to assess effective ventilation a self-inflating valve-bag was used. Equal lung inflation on both sides of the chest was indicative of proper ILMA, I-gel and tracheal tube positioning, as previously described.[27]

Each participant had to stand above the manikin's head holding the supraglottic device. Syringes, endotracheal tubes and the self-inflating bag were placed beside the manikin's head within the reach of each volunteer.[28] Each nurse after placing the I-gel and ILMA and confirming adequate ventilation by providing two rescue breaths with the self-inflating bag, attempted blind intubation. Three intubation attempts with each device were allowed to be carried out without CC and three attempts while a certified ACLS Instructor performed CC. Chest compressions were carried out in compliance with the ERC guidelines.[1]

The primary aim of our study was successful intubation through both devices with and without CC. Secondary aim was the assessment of the effect of CC on the intubation success. Intubation time was recorded by an observer using the same stopwatch. The time taken from placement of the supraglottic device at teeth until the inflation of the tracheal tube's cuff was considered as the duration of intubation, and in the case of ILMA it included the inflation of its cuff. Afterward, the success of intubation was checked using the self-inflating bag. Attempts resulting in esophageal intubation or of duration greater than 30 s were considered failed.[21]

Statistical analysis

Continuous data are expressed as the number of participants (n), means, standard deviations (SD) and medians while categorical data are expressed as frequencies and percentages. The Kolmogorov–Smirnov test was used to assess the normality of the distributions. Two-way repeated measures ANOVA was used in order to study intubation time in relation to both, device and CC. When there was no statistically significant interaction between these two factors, we studied time for each one independently. Paired samples t-test was used in case these factors were found to have statistically significant interaction. Success rates comparisons were made using McNemar's test. All statistical analyses were conducted using the SPSS, version 16.00 (SPSS Inc, Chicago, IL) and all tests were two-sided. The level of statistical significance was set as p-value <0.05, while statistical differences between $0.05 < p < 0.1$ were also recorded. It was estimated that a sample size of 45 evaluable participants was required in order to have a 90% probability of demonstrating a between two devices difference of >2 s (SD 5) in intubation times with continuous CC, with a significance of <5%.

Results

Of the 45 volunteers who participated in our study, 23 were anesthesia nurses and 22 were nurses working in the intensive care unit. Their mean age was 39 ± 7.4 years and their work experience was 13 ± 7.1 years. Thirty three nurses were women and twelve were men.