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Blind intubation via iGEL laryngeal mask performed by novice physicians: A randomized, crossover, manikin trial

Intubacja na ślepo z zastosowaniem maski krtaniowej iGEL wykonywana przez lekarzy stażystów: randomizowane, krzyżowe badanie symulacyjne

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Keywords

endotracheal intubation, cardiopulmonary resuscitation, doctor, simulation, respiratory tract

Słowa kluczowe

intubacja dotchawicza, resuscytacja krążeniowo-oddechowa, lekarz, symulacja, drogi oddechowe

Conflict of interest
Konflikt interesów

None
Brak konfliktu interesów

Summary

Introduction. Performing endotracheal intubation based on direct laryngoscopy is a procedure that requires extensive experience from medical personnel. An alternative to this method may be performing blind intubation using supraglottic ventilation devices as a specific guide for the endotracheal tube.

Aim. The aim of the study was to evaluate the efficacy of blind intubation using the iGEL laryngeal mask performed by trainee doctors in simulated cardiopulmonary resuscitation conditions.

Material and methods. In a study designed as a prospective, randomized, cross-study simulation, forty-two interns participated. The participants of the study performed blind intubation using the iGEL laryngeal mask as a guide for the endotracheal tube. Intubation was carried out during simulated CPR in an adult scenario: scenario A – without chest compressions; scenario B – continuous chest compressions. After approval from the Institutional Review Board of the Polish Society of Disaster Medicine (Approval no. 32.03.2018. IRB), written informed consent was obtained from 42 participants.

Results. The effectiveness of the first attempt to protect the airway patency with the iGEL mask was 100% during both research scenarios. In the case of blind intubation, the effectiveness was 80.9% for scenario A, and 73.8% for scenario B ($p = 0.056$). The duration of blind intubation was 29.5 s (IQR: 24-41), while scenario B took 31 s (23-45.5, $p = 0.318$).

Conclusions. In the conducted simulation experiment, the participants were able to perform endotracheal intubation blindly with the use of the iGEL as a guide for the endotracheal tube with high efficiency and in a short period of time.

Streszczenie

Wstęp. Wykonanie intubacji dotchawiczej w oparciu o laryngoskopię bezpośrednią jest procedurą wymagającą dużego doświadczenia od personelu medycznego. Alternatywą dla tej metody może być wykonywanie intubacji na ślepo z zastosowaniem nadgłośniowych urządzeń do wentylacji jako swoistej prowadnicy dla rurki intubacyjnej.

Cel pracy. Celem badania była ocena skuteczności intubacji na ślepo z zastosowaniem maski krtaniowej iGEL, wykonywanej przez lekarzy stażystów w warunkach symulowanej resuscytacji krążeniowo-oddechowej.

Materiał i metody. W badaniu zaprojektowanym jako prospektywne, randomizowane, krzyżowe badanie symulacyjne udział wzięło 42 lekarzy stażystów. Uczestnicy badania wykonywali intubację na ślepo, stosując maskę krtaniową iGEL jako prowadnicę dla rurki intubacyjnej. Intubacja odbywała się podczas symulowanej resuscytacji krążeniowo-oddechowej osoby dorosłej w dwóch scenariuszach: scenariusz A – bez uciskania klatki piersiowej, scenariusz B – ciągłe uciskanie klatki piersiowej. Protokół badania został zaakceptowany przez Radę Programową Polskiego Towarzystwa Medycyny Katastrof (zgoda: 32.03.2018.IRB). Uzyskano także pisemną zgodę od 42 uczestników.

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Wyniki. Skuteczność pierwszej próby zabezpieczenia drożności dróg oddechowych za pomocą maski iGEL wynosiła 100% podczas obu scenariuszy badawczych. W przypadku intubacji na ślepo skuteczność ta wynosiła 80,9% dla scenariusza A oraz 73,8% dla scenariusza B (p = 0,056). Czas wykonania intubacji na ślepo wynosił w scenariuszu A – 29,5 s (IQR: 24-41), zaś w przypadku scenariusza B – 31 s (23-45,5; p = 0,318).

Wnioski. W przeprowadzonym badaniu symulacyjnym uczestnicy badania byli w stanie z wysoką skutecznością i w krótkim czasie wykonywać intubację dotchawiczą na ślepo z wykorzystaniem maski krtaniowej iGEL jako prowadnicy dla rurki intubacyjnej.

INTRODUCTION

The ability to protect airway patency in both pre-hospital and hospital settings is one of the basic skills of medical personnel. In normothermic conditions, oxygen reserves are sufficient enough for only 3-5 minutes. After this time, irreversible changes associated with progressive hypoxia occur. The central nervous system is the most susceptible organ for hypoxia, therefore it is the first organ to become damaged. In relation to above, quick protection of airway patency and implementation of oxygen therapy is a key element in the management of the patient, especially regarding to a patient with cardiac arrest. According to the guidelines for cardiopulmonary resuscitation published by the European Resuscitation Council (1) as well as the American Heart Association (2), the gold standard for protecting the airways during resuscitation is endotracheal intubation. It allows you to perform asynchronous resuscitation in addition to achieving adequate final pressure in the airway. The guidelines mentioned above recommend that endotracheal intubation be performed during uninterrupted chest compressions or only with a short break in compressions to allow the insertion of the endotracheal tube between the vocal folds, which in turn minimizes breaks in chest compressions. However, as indicated by numerous studies, a more preferred method is the interruption of chest compressions at the time of intubation, due to the fact that continuous chest compressions reduce the effectiveness of the first endotracheal intubation attempt and extend the duration of the procedure (3-5).

Another important factor that may influence the effectiveness of intubation is the experience of the individual performing endotracheal intubation. The ERC and AHA guidelines recommend that it be performed by the most experienced person on the team. This is important due to the potential complications of intubation, such as damage to the teeth, damage to soft tissues and the induction of bleeding, epiglottis detachment, dislocation of the cartilage, or tearing of the trachea. In the case of inability to perform standard intubation guided by direct laryngoscopy, medical personnel may use various alternative methods such as supraglottic ventilation devices or video laryngoscopy. The use of video laryngoscopes, as indicated by numerous studies, increases the effectiveness of intubation, especially for patients with difficult airways, however, due to the price, they are rarely encountered in pre-hospital care.

AIM

The aim of the study was to assess the effectiveness of blind intubation via iGEL laryngeal mask by physicians during simulated cardiopulmonary scenarios.

MATERIAL AND METHODS

After approval from the Institutional Review Board of the Polish Society of Disaster Medicine (Approval no. 32.03.2018.IRB), written informed consent was obtained from 42 participants. All participants had limited clinical experience in endotracheal intubation. Before recruitment into our trial, all participants had never attempted airway management using supraglottic airway devices.

During the experiment, we used iGEL size 4 (Intersurgical, Wokingham, Berkshire, United Kingdom) and a standard intubation tube (7.0ID; Sumi, Sulejowek, Poland). In order to simulate the patient in cardiac arrest, Resusci Anne Simulator (Laerdal, Stavanger, Norway) was used, which has been designed to simulate the adult patient. In order to simulate cardiopulmonary resuscitation and the need to secure the airway in conditions of uninterrupted chest compressions, the chest compression device LUCAS3 (Physio-Control, Redmond, WA, USA) was used. Protection of airway patency occurred in two scenarios: scenario A – without chest compressions; scenario B – protection of airway patency during uninterrupted chest compressions (6, 7).

Prior to the study, all participants took part in theoretical training in the field of airway obstruction using supraglottic ventilation devices. Theoretical training was completed with a tutorial given by an experienced instructor. Practical exercises were not allowed.

In the study, the participants performed blind intubation using the supraglottic airway device as a guide for the endotracheal tube. The procedure consisted of securing airway patency using the iGEL device and then performing the blind intubation procedure (fig. 1).

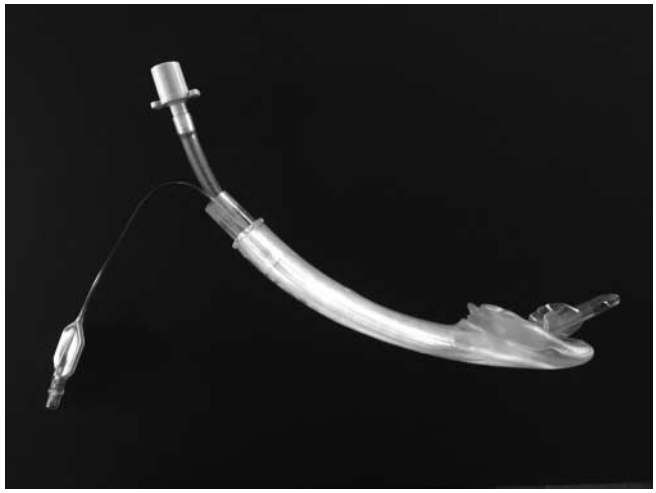

Fig. 1. iGEL laryngeal mask as a conduct for endotracheal tube

The procedure was completed with confirmation of the precision of endotracheal intubation by ventilation with a self-expanding mask and the obstructing simulator indicators responsible for the ventilation of the "patient" lungs. The test was carried out on the basis of a randomized, cross-over study. For this purpose, both the order of the participants and the research scenarios were random. As a result, the coin tossing method was used. A detailed randomization procedure for the study is shown on figure 2.

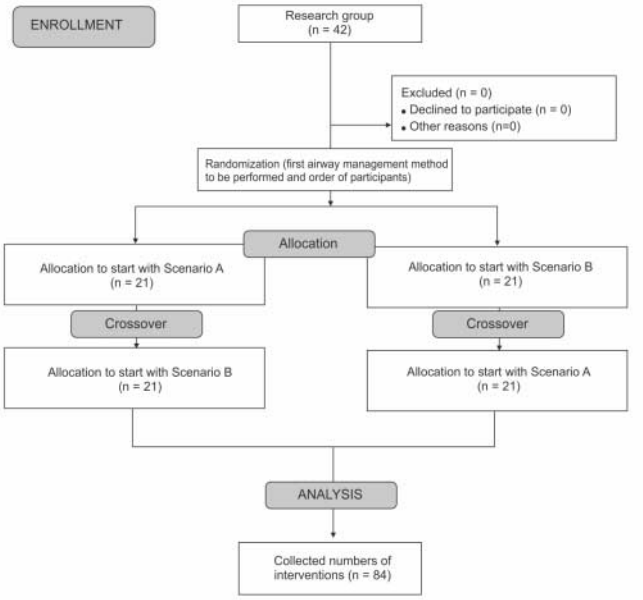

Fig. 2. Randomization flow chart

During the experiment, both the blind intubation effectiveness and the duration of the procedure were evaluated. Two time parameters were analyzed: Time T1 – time to protect the patency of the airway using a supraglottic ventilation device, defined as the time from taking the device into the hand until the device is introduced to the airway and the respiratory tract is secured. The second-time parameter was time T2 – duration of the whole procedure, defined as the time from taking the device to the blind intubation and attempting to confirm the effectiveness of intubation with a ventilation test using a self-expanding bag.

Descriptive data is given as median and interquartile range (IQR). The McNemar's test was used for statistical analysis of success rates of intubation under cardiopulmonary resuscitation scenarios with and without chest compressions. For analysis of the duration of the blind intubation as well as the airway management using iGEL, the Student's paired t test was utilized. Calculations were done with the statistical package STATISTICA 13.0EN (StatSoft, Tulusa, OK, USA). $P \leq 0.05$ were considered statistically significant.

RESULTS

All 42 participants (18 females; 42.8%) completed the study. The median experience in medicine was 0.5 years (IQR: 0.0-1.0). Demographic data and participants' experience with airway management is provided in table 1.

Tab. 1. Demographics and experience of participants

Variable	Number	Percent (or IQR)
Participants	42	100%
Sex Male Female	 24 18	 51.2% 42.8%
Age	24.5	(24-26)
Work experience (yr.)	0.5	(0.0-1.0)
Experience with ETI iGEL	 42 0	 100% 0%

The median duration of airway patency protection using the iGEL device (Time T1) for scenarios A and B were 9 s (IQR: 8-12.5) and 9 s (IQR: 8-14), respectively. The difference during the protection of the airway patency with the use of the iGEL device was not statistically significant ($p = 0.744$; fig. 3).

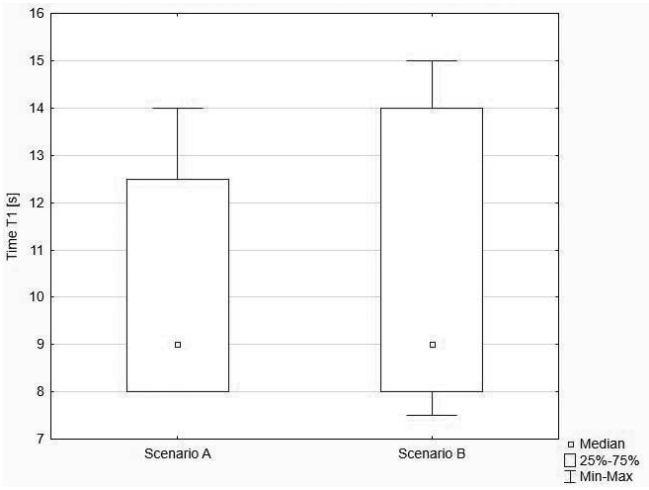

Fig. 3. Median time of airway management using iGEL mask

In the case of T2 (blind intubation time) time evaluation, the procedure execution time was 29.5 s (IQR: 24-41), and 31 s (23-45.5) s in the case of scenario B. Differences in the duration of the T2 procedure are shown in figure 4 ($p = 0.318$).

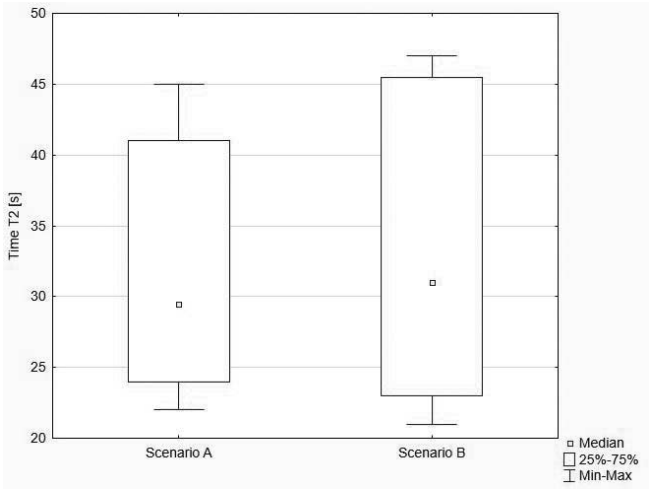

Fig. 4. Median time of blind intubation

The effectiveness of the first attempt to protect the airway patency with the iGEL mask was 100% during both research scenarios. In the case of blind intubation, the effectiveness was 80.9% for scenario A, and 73.8% for scenario B ($p = 0.056$).

DISCUSSION

The conducted simulation test indicated that even people who do not have sufficient skills in the field of endotracheal intubation are able to perform the blind intubation after being provided with short instructions on using a supraglottic device as a guide for the endotracheal tube.

Medical personnel carrying out advanced resuscitation procedures should perform high quality chest compressions and minimize breaks in compressing the chest (8, 9). The element indicating the degree of minimization of gaps in chest compressions is more and more often described in the scientific literature "Chest compression fraction" (CCF) parameter calculated as the ratio of time in which the chest is compressed to the total time of resuscitation (10, 11). In order to minimize interruptions in chest compressions, CPR guidelines (12) indicate the possibility of using supraglottic airway devices to protect the airway patency, in which there is no need to interrupt chest compressions to perform rescue breaths. An example, and even the gold standard, is endotracheal intubation. However, the effectiveness of endotracheal intubation performed in emergency medicine is inadequate. Research carried out by Brown et al. (13) indicate the efficacy of the first intubation trial in an adult emergency department at 83%. Furthermore, Pallin et al. (14) indicate the efficacy of the first attempt to intubate a pediatric patient at 83%, during which the risk of a first-attempt failure was the highest for infants (2.31 95% CI 1.8 to 3.0). Numerous intubation attempts may exacerbate soft tissue bleeding and swelling, which may lead to a situation determined by Difficult Airway Society as "cannot intubate, cannot ventilate" (15-17). This correlation is confirmed by studies by Ehrlich et al. (18) which shows that multiple endotracheal intubation attempts are associated with significant complications and may offer limited advantage over bag valve mask and possibly may affect outcome. An additional difficulty, apart from the impact of the experience on the effectiveness of endotracheal intubation (19), may be the performance of chest compressions during endotracheal intubation. This fact is confirmed by numerous scientific studies (20).

Endotracheal intubation with the use of supraglottic ventilation devices is becoming an increasingly common practice (21-24). Due to the specificity of individual supraglottic device (25), in this case the iGEL device, it is possible to place the tracheal tube in the trachea without having to visualize the entrance to the glottis. Another method of endotracheal intubation using supraglottic ventilation devices may be the method presented by Szarpak et al. (26) involving the introduction of the Eschmann Introducer supraglottic device through the ventilation canal. Regardless of the method of endotracheal intubation, the possibility of its implementation during cardiopulmonary resuscitation has an unquestionable benefit – its result in effectiveness on the performed resuscitation.

The study has limitations. A certain limitation is the fact that the study was conducted in the setting of the medical simulation laboratory, not in a real setting of cardiopulmonary resuscitation. However, conducting randomized, cross-over studies during real resuscitation is unethical and could affect the quality of cardiopulmonary resuscitation (27). In addition, the use of medical simulation has an additional value – the standardization of the conditions of the procedures performed. Another limitation is the performance of respiratory protection by trainee doctors without having much experience in endotracheal intubation. However, it is this staff that works, among others, in clinics that may need to conduct resuscitation and protect the airway patency in anticipation of the arrival of the emergency medical team. In this event, knowledge of alternative methods of endotracheal intubation is extremely important in this professional group.

CONCLUSIONS

In the conducted simulation examination, the participants were able to perform endotracheal intubation blindly with the use of the iGEL device as a guide for the endotracheal tube with high efficiency and in a short period of time.

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