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Original Article / Özgün Araştırma

Intubation of a Paediatric Manikin in Tongue Oedema and Face-to-Face Simulations by Novice Personnel: a Comparison of Glidescope, Airtraq and Direct Laryngoscopy

Pediatrik Maketin Deneyimsiz Personelce Dil Ödemi ve Yüz Yüze Simülasyonlar ile Entübasyonu: Glidescope, Airtraq ve Direk Laringoskopinin Karşılaştırılması

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Abstract / Öz

Objective: Glidescope and Airtraq were designed for facilitating intubation and for teaching regarding the airway anatomy. We aimed to evaluate their efficacy in normal airway, tongue oedema and face-to-face orotracheal intubation models when used by novice personnel.

Methods: After the local human research ethics committee approval, 36 medical students who were in the beginning of their third year were enrolled in this study. After watching a video regarding intubation using one of these devices, the students intubated a paediatric manikin with a Glidescope or Airtraq via the normal airway, tongue oedema and face-to-face approach.

Results: Although the insertion and intubation times were similar among the groups, the intubation success rate of the Glidescope was higher in the normal airway (100% vs 67%) and tongue oedema (89% vs. 50%) compared with the Airtraq (p=0.008 and p=0.009). The success rates with the paediatric manikin by the face-to-face approach were similar among the groups (50%) (p=0.7). The need for manoeuvres in the Glidescope was lower in the normal and tongue oedema models (p=0.02 and p=0.002). In addition, oesophageal intubation was low in the control and tongue oedema models with the Glidescope (p=0.03 and p<0.001).

Conclusion: Novice personnel could more easily intubate the trachea with the Glidescope than with the Airtraq. Intubation with the Glidescope was superior to that with the Airtraq in the normal and tongue oedema models. The face-to-face intubation success rates were both low with both the Glidescope and Airtraq groups.

Keywords: Laryngoscopes, airway management, intubation

Amaç: Glidescope ve Airtraq entübasyonu kolaylaştırmak ve havayolu anatomisini öğretmek için geliştirilmişlerdir. Biz, bu havayolu araçlarının deneyimsiz personelce kullanımlarındaki etkinliklerini normal havayolu, dil ödemi ve yüz yüze entübasyon modellerinde değerlendirmeyi amaçladık.

Yöntemler: Lokal İnsan Araştırmaları Etik Kurulu onayı alındıktan sonra tıp fakültesi 3. sınıf başlangıcında olan 36 öğrenci çalışmaya dahil edildi. Glidescope ve Airtraq ile pediyatrik maket üzerinde üç havayolu modelinde (sırasıyla); normal havayolu, dil ödemi ve yüz yüze entübasyon yapmışlardır.

Bulgular: Yerleştirme ve entübasyon süreleri gruplar arasında benzer olmasına rağmen, Glidescope'un entübasyon başarı oranı normal havayolunda (%100 ve %67) ve dil ödeminde (%89 ve 50%) ile Airtraq'den fazladır (p=0,008 ve p=0,009). Maket üzerinde yüz yüze entübasyon başarı oranı gruplar arasında benzerdi (%50) (p=0,7). Manevra gereksinimi Glidescope grubunda normal ve dil ödemi modellerinde daha azdı (p=0,02 ve 0,002). Ek olarak, Glidescope ile özofagus entübasyonu normal ve dil ödeminde azdı (p=0,03 ve p<0,001).

Sonuç: Deneyimsiz personel Glidescope ile Airtraq'e kıyasla trakeayı daha kolay entübe etmişlerdir. Glidescope ile entübasyon, normal ve dil ödemi modellerinde Airtraq'ten üstündür. Yüz yüze entübasyon başarı oranları hem Glidescope hem de Airtraq grubunda düşük bulunmuştur.

Anahtar kelimeler: Laringoskoplar, havayolu yönetimi, entübasyon

Introduction

Trauma victims often have to be intubated at the scene of their trauma. This is sometimes difficult because of limited access to the patient or because of cervical spine injury or if something is making it difficult to obtain information regarding the state of the patient's airway. When conventional techniques fail, anaesthetists require more effective airway devices that can provide rapid and safe tracheal intubation. The Glidescope and Airtraq devices were designed to facilitate difficult intubation. They are useful devices for understanding the airway anatomy and tracheal intubation procedure. Moreover, their superiority to the Macintosh laryngoscopy in tongue oedema and cervical trauma victims has been validated (1-6).

In this study, we compared the tracheal intubation success of these two video laryngoscopes in tongue oedema and an inverse (face-to-face) intubation models on a paediatric manikin when used by novice personnel.

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Methods

After local human research ethics committee approval (KOU KAEK 2014/145) and after written informed consent was obtained from 36 third-year medical students who had an education regarding laryngeal anatomy but had no idea concerning the tracheal intubation procedure, the participants were divided into two groups (the Glidescope and Airtraq groups). They were educated about one of the devices and its optimization manoeuvres (handling force manoeuvre and reinsertion manoeuvres) and were shown a video of a tracheal intubation with the device before they were asked to perform a real intubation on a paediatric manikin (Nasco Plastics, Fort Atkinson WI, USA). They were told that they could attempt intubation thrice only; however, they could perform manoeuvres if they wanted and could reinsert the devices. This study was also registered at Clinical Trails (www.clinicaltrials.gov) NCT: 02478203. In situation 1 (control), they intubated the paediatric manikin with a normal airway by the traditional approach. In situation 2 (tongue oedema), they intubated the manikin with a tongue oedema simulation by the traditional approach. In situation 3 (face-to-face), they intubated the manikin with the face-to-face approach (Figures 1, 2).

Another person, who was not blinded to the devices, recorded the number of insertion and intubation attempts and the insertion and intubation times. The insertion time was defined as the time elapsing between the device entering the oral cavity up to the viewing of the glottis. The intubation time was defined as the time elapsing from the device entering from the oral cavity up to the viewing of the endotracheal tube entering the vocal cords. A 4.5-mm diameter uncuffed polyvinyl chloride endotracheal tube was used for intubation. Failed intubation was defined as one in which the trachea could not be intubated within 2 min (120 s) or after three intubation attempts.

Statistical analysis

We based our sample size according to previous data with the ice-pick position as 18 per group to detect a 40-s difference in the tracheal intubation time between the groups (7). The values are given as the number or median [25–75 percentile] because they did not fit a normal distribution. We used chi-square and Fisher's Exact tests to compare the categorical data, such as the insertion and intubation success rates, occurrence of oesophageal intubation and Cormack–Lehane grades. We used the Mann–Whitney U test to calculate the insertion and intubation times of these devices. A p value of <0.05 was considered statistically significant.

Results

In this study, 36 third-year medical students attempted tracheal intubation on a paediatric manikin. The insertion and intubation times were similar in the normal, tongue oedema and face-to-face intubation models among the groups (Table 1).

Figure 1. Face-to-face intubation with Airtraq

Figure 2. Face-to-face intubation with GlideScope

Table 1. The insertion and intubation times of the devices. The values are given as the medians [25–75 percentiles]

	Glidescope (n=18)	Airtraq (n=18)	p
Control group insertion time (s)	17 [9.8–27.8]	17 [11.5–26]	0.9
Control group intubation time (s)	36 [17.5–66.5]	28 [19.5–53.5]	0.7
Tongue oedema group insertion time (s)	20.5 [12–27.3]	27.5 [14.8–39.3]	0.1
Tongue oedema group intubation time (s)	42.5 [25.8–58]	39.5 [28.5–63.8]	1
Face-to-face group insertion time (s)	14.5 [8.8–21.3]	20 [11–30.5]	0.2
Face-to-face group intubation time (s)	61 [45–70]	64 [44.8–88.8]	0.7

The Mann–Whitney U test was used for the comparisons. s, seconds

Table 2. The intubation success rate of the devices. The values are given as the numbers or %

	Glidescope (n=18)	Airtraq (n=18)	p
Intubation success rate of the control group Successful/Failed	18/0 (100%)	12/6 (67%)	0.008*
Intubation success rate of the tongue oedema group Successful/Failed	16/2 (89%)	9/9 (50%)	0.009*
Intubation success rates of the face-to-face group Successful/Failed	9/9 (50%)	8/10 (50%)	0.7

The chi-square test was used for the comparisons. *p<0.05

Table 3. The number of intubation attempts of the devices. The values are given as numbers

	Glidescope (n=18)	Airtraq (n=18)	p
Control group number of intubation attempts	10/7/1	5/7/6	0.03*
Tongue oedema group number of intubation attempts	12/4/2	4/10/4	0.02*
Face-to-face group number of intubation attempts	4/2/12	3/10/5	0.06

The chi-square test was used for the comparisons. *p<0.05

Table 4. The need for optimization manoeuvres. The values are given as numbers

	Glidescope (n=18)	Airtraq (n=18)	p
Control group need for optimization manoeuvres			
Present/Absent	10/8	17/1	0.02*
Tongue oedema group need for optimization manoeuvres			
Present/Absent	9/9	16/1	0.002*
Face-to-face group need for optimization manoeuvres			
Present/Absent	17/1	15/1	0.9

The chi-square test was used for the comparisons. *p<0.05

Table 5. The oesophageal intubation rates of devices. The values are given as numbers

	Glidescope (n=18)	Airtraq (n=18)	p
Control group oesophageal intubation			
Present/Absent	2/16	9/9	0.03*
Tongue oedema group oesophageal intubation			
Present/Absent	1/17	11/7	<0.001†
Face-to-face group oesophageal intubation			
Present/Absent	12/6	13/5	0.7

The chi-square test was used for the comparisons. *p<0.05, †p<0.001

The face-to-face approach had an increased intubation time in all the groups (Table 1).

The insertion success rates were similar for the three intubation models among the groups. In the control group, the intubation success rate was higher with the Glidescope than with the Airtraq (100% vs 67%; p=0.008). The Compared with the Airtraq, the Glidescope had superior performance in the tongue oedema simulation model according to the intubation success rate (89% vs 50%; p=0.009). Intubation by the face-to-face approach was difficult with both of these devices (50%), and there were no significant differences between the groups with the face-to-face approach (Table 2).

The number of intubation attempts was lower with the Glidescope for both the control and tongue oedema groups, but

the number of intubation attempts was similar in the face-to-face approach between the groups (Table 3).

All the students mentioned that the Airtraq was difficult to use; it was also difficult to understand the airway anatomy when the Airtraq was used for teaching. Furthermore, the need for the optimization manoeuvres was lower with the Glidescope in the control and tongue oedema groups (p=0.02 and p=0.002, respectively) (Table 4).

The oesophageal intubation rate was lower with the Glidescope in the control and tongue oedema groups (p=0.03 and p=0.000, respectively) (Table 5).

Discussion

This study showed that intubation with the Glidescope device resulted in higher, though not faster, rates of intubation. The Glidescope performed superior to the Airtraq device in normal and tongue oedema intubations when used by novice personnel, but this was not the case when the face-to-face approach was used. The learning curve for the Glidescope was shorter than for the Airtraq. The intubation time for both devices increased in the transition from the normal to the tongue oedema to the face-to-face approach. However, this did not result in any significant difference between the groups in the same situation. In agreement with our study, it was previously shown that when the intubation scenario was more difficult, the intubation time with video-laryngoscopes increased (8).

Kaki et al. (9) reported that the Airtraq, C-MAC and Glidescope were similar to each other but better than the Macintosh with respect to the ease of intubation and the number of intubation attempts on a normal airway manikin in novice hands.

A study that assessed the ease of intubation between the Glidescope and Airwayscope by novice physicians simulating a normal and difficult airway on an adult manikin demonstrated that the Airwayscope required less time and was easier to use than the Glidescope. The Airwayscope is shaped like the Airtraq. Our results did not support these statements (10).

Other published studies demonstrated that both Airtraq and Glidescope laryngoscopy could easily be learned compared to Macintosh laryngoscopy by novice personnel and they are good devices for teaching the airway anatomy. As in our study, another study reported that medical students preferred the Glidescope as their first choice (11-14). All two video-laryngoscopes had a short learning curve and provided higher first intubation success rates in non-experienced hands, even in normal and difficult airways (15, 16). However, all of them were performed in an adult population or adult manikin. The young medical students struggled the most while inserting the tube into the trachea. All participants in the Airtraq group found it difficult to learn and imagine the airway anatomy in our study. Novice users have previously been reported to find the Glidescope easier to operate than the Macintosh (17). Other published studies have shown that the training time for the Airtraq was longer than for other video-laryngoscopes in emergency settings (18, 19). Our results support these findings.

Our study has several limitations. First, the manikin airway cannot replace the real patients. Therefore, these results do not necessarily reflect a real-life scenario. Second, we could not blind our study data collection. Third, medical students performed the intubations, and the results could be different for experienced personnel. Additionally, all participants who attempted intubation with the Airtraq said that it was difficult to imagine where they were anatomically, thus making it difficult to use. The paediatric Airtraq is a single-use intubation device that contains a series of lenses, prisms and mirrors that transfers the image from the illuminated viewfinder. The operator must incline to view correctly. However, the Glidescope has a cabled liquid crystal display monitor system, such that you can see the glottic images in front of you. This may have contributed to making the Airtraq more difficult to use than the Glidescope in our study. Consistent with the previous reports, we have shown that the oesophageal intubation rate was lower for the Glidescope (20).

Conclusion

Novice personnel can more easily learn to use the Glidescope than the Airtraq. The Airtraq had no advantage in the normal, tongue oedema and face-to-face approaches over the Glidescope use in novice hands.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Kocaeli University School of Medicine (KOU KAEK 2014/145).

Informed Consent: Written informed consent was obtained from all patients who participated in this study.

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