A prospective, randomised comparison of KingVision, Airtraq videolaryngoscopes and TotalTrack video intubating laryngeal mask for face-to-face intubation in morbidly obese patients

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Research Article

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Abstract

Backgroud: Traditional endotracheal intubation demands unlimited access to the patient and possibility to stand behind his head. However, in case of difficult conditions in emergency settings we can use an alternative method. Face-to-face intubation can be performed in patients in semi-erect position, prone position and in the situation of difficult access to the head.

Method: After obtaining an approval from the Local Ethics Committee Nr RNN/62/20/KE and written informed consent from the patients, we performed in 30 patients who were scheduled for planned operations, randomly divided into 3 subgroups of using KingVision or Airtraq videolaryngoscopes or TotalTrack video intubating laryngeal mask.

Results: The intubation time was comparable between devices: 9.25 ±2.05 s vs 8 ±2.14 s (p=0.2322) in KingVision and Airtraq videolaryngscopes respectively and significantly longer for TotalTrack VILM: 23.5 ±3.89 sec. All three devices allowed for successful intubation in all cases. Both videolaryngoscopes appeared to deliver an optimal view of the entrance to larynx and TotalTrack worse but acceptable. All devices enable the operator to intubate with face-to-face method without any complications.

Conclusions: KingVision and Airtraq videolaryngoscopes and TotalTrack VILM during face-to-face intubation allowed for front-access endotracheal intubation and ensured an good view of larynx entrance. We assume that in case of difficult access to the patient's head or untypical position, the usage of examined video laryngoscopes, can be considered.

Introduction

In a typical endotracheal intubation, the patient is in the supine position, with the anesthetist standing behind the patient's head and with adequate access to the head and neck of the patient. However, there are plenty of situations, where traditional intubation is extremely difficult or even impossible. In immobilised trauma victims, difficult access settings or suspected cervical spine injury, an inverse intubation (performed by a person standing in front of a patient) could be the only chance to support the airways. [1],[2] Likewise, in bariatric anesthesia, face-to-face intubation is increasingly being considered due to semi-sitting position, recommended in this group of patients. Postural change from supine to semi-erect position decreases the risk of an airway obstruction, caused by pharyngeal soft tissues collapsing in patients undergoing general anesthesia and muscle relaxation, suffering from obstructive sleep apnoea. [3] Nevertheless, facemask ventilation in lying positioned patient might be complicated due to fat tissue collected in cheeks and palate, tonsil hypertrophy, larynx relocation and limited mouth opening. [4] These are the reasons why postural change might be crucial to ensure an optimal ventilation and intubation conditions in bariatric patients. Airtraq video laryngoscope (Prodol, Spain), widely used in anesthesiology, increases the effectiveness in intubation in first attempt and reduces the need of additional maneuvres. [1] The device is equipped with a tube guidance channel, supporting an appropriate

placement of an endotracheal tube. This video laryngoscope can be used with a screen attached to the device or separate monitor. The additional advantage is a possibility to register the video for medical and academic reasons. It is available in several sizes and can be used in adults and children. Kingvision video laryngoscope (Ambu, Netherlands) is equipped with disposable blades with or without tube guidance channel. It is also available in adult and children version. The device has a built-in screen, however we can watch a video on a separate monitor. In our research we used devices with the screen attached to laryngoscope and blades with guidance channel.

TotalTrack video intubating laryngeal mask (MedCom Flow, Spain) is a device which enables ventilation (and oxygenation) patient during attempts of visualisation of entrance to larynx and intubation. Construction of this device is based on laryngeal mask combined with videolaryngoscope with ET channel. The possibility of oxygenation of patient during attempts of visualisation of larynx and intubation is especially important in obese patients, who desaturate very fast because of small oxygen reserves.

In prospective randomised observation study we decided to compare clinical use of KingVision, AirTraq videolaryngoscopes and TotalTrack video intubating laryngeal mask in morbidly obese patients.

Methods

After obtaining an approval from the Institutional Ethics Committee Nr RNN/62/20/KE (Medical University of Lodz, Poland) and written informed consent from the patients thirty morbidly obese patients scheduled for elective sleeve gastrectomy were randomly allocated into 3 subgroups: intubated with face-to-face (inverse) method using KingVision (KV) or AirTraq (AT) or TotalTrack VILM (TT) (Fig. 1). Demographic data are presented in Table 1. The standard anesthesia monitoring involved electrocardiogram, pulsoxymetry, non-invasive blood pressure and end-tidal carbon dioxide. All patients were positioned with upper body elevation by about 30 degrees. The induction of general anesthesia involved the intravenous administration of 1–2 $\mu g.kg^{-1}$ of fentanyl and 2-2.5 $mg.kg^{-1}$ of IBW of propofol. After facemask ventilation possibility was confirmed, rocuronium in a dose of 0.6 $mg.kg^{-1}$ of IBW were given intravenously. After obtaining an optimal muscle relaxation confirmed by nerve stimulation monitoring, face-to-face intubation was performed with one of the studied device. Performing intubation anesthetist was standing on the left side of a patient and was observing the larynx entrance on the screen attached to the device (Fig. 2.) or on separate monitor depending on selected device (Fig. 3, Fig. 4). An intubation time was measured from the mouth opening to the right placement of the tube confirmed by capnography. An intubation time, the need of additional manoeuvres like cricoid pressure, adjustement of device position, esophagus intubation, mucosal or teeth injuries were noted. The presence of sore throat or dysphagia were assessed in post-anesthesia care unit. In case of prolonged intubation (> 120 s) or 2 unsuccessful attempts, patients were supposed to be intubated in a traditional way with the videolaryngoscope.

Table 1
Demographic data of studied group of patients. Values are mean ± SD.

Group	KingVision	AirTraq	TotalTrack
Gender F/M	7/3	7/3	4/6
Age [yrs]	37.25 ± 3.05	37 ± 9.41	46.75 ± 12.24
Height [cm]	171.5 ± 7.5	167.5 ± 6.26	174 ± 5.45
Weight [kg]	125.5 ± 15.61	130.25 ± 24.08	149 ± 8.78
BMI kg/m^2	42.5 ± 1.8	46.88 ± 5.37	49.29 ± 3.58
Mallampati score 1/2/3/4	0/7/3/0	0/7/3/0	0/6/3/1

The intubationg anesthesiologists were experienced with use of studied devices in everyday practice. They also received additional training on face-to-face intubation technique on manikin model.

Statistical analysis was performed using Microsoft Office Package (Microsoft, Warsaw) Office Excell. To compare measured parameters the t-student test was used comparing pairs with unequal deviation. The p value was set on 0.05 and value $p < 0.005$ was considered as statistically significant.

Results

There were no differences in demographic parameters between groups. In all cases an optimal larynx entrance visualisation was achieved and all patients were successfully intubated in a time not exceeding 30 s (Table 2). Time to intubation was comparable between KV and AT and significantly shorter than in case of TT (Table 2). Need for additional maneouvers was comparable between devices. There were no complications in either of group regarding teeth damage, bleeding from muscosa, desaturation. There was no sore throat observed in postanesthesia care unit in any patient.

Table 2
Results. Values are mean ±SD.

Group	KingVision	AirTraq	TotalTrack
Intubation time	9.25 ±2.05	8 ±2.14	23.5± 3.89
Attempts 1/2	9/1	10/0	10/0
Need for manoeuvres y/n	4/6	3/7	2/8
Esophageal intubation	0	0	0
Mucosal damage	0	0	2

The view obtained by devices was estimated on Cormack Lehane scale 1 in all cases for all devices, however, the quality of obtained picture of entrance of larynx was better for KV and AT comparing to TT. In one case of intubation using KV there was a need to make second attempt, because of necessity to change the battery. The baseline vital parameters during the whole procedure remained stable. There were no complications observed. Written consent for photos publication were obtained from the patients.

Discussion

Face-to-face intubation, also known as the "Tomahawk" or "Pickaxe" method. It can be used for patients entrapped in the vehicle [2] or in patients with spondyloarthrosis. Morbidly obese patients may benefit from face-to-face intubation because the head elevated position allows for better oxygnenation during induction of anesthesia [3]. However, this method needs experience and can be used after proper training, for example in manikin model [5].

Our study demonstrated the utility of 2 videolaryngoscopes and video intubating laryngeal mask in face-to-face endotracheal intubation. According to literature, our measured times of intubation do not exceed the results of other studies.[1],[5] There are publications describing a possibility of using Macintosh laryngoscope in face-to-face intubation.[2],[6] But in our opinion the video laryngoscope is better suited for this technique, achieving higher effectiveness, shorter intubations time and conveniences for anesthetist.[7] Some authors report, that inverse intubation can be performed by one person successfully and does not demand an assistant.[8],[9] The anesthetist (standing on the left side of the patient) can hold a video laryngoscope with his right hand and insert the tube with the left one.[10],[11] It is optional to introduce the device with the left hand (like in traditional approach) and after obtaining satisfying larynx inlet visualisation, relocate a video laryngoscope to the right hand and insert intubation tube with the left one. Independently from the method, a video laryngoscope is a better choice than traditional Macintosh device undoubtedly.

There are many of publications comparing an effectiveness of video laryngoscopes. However, a number of researches involving face-to-face approach is limited. Arslan et al. indicated superiority of Airtraq over Glidescope during inverse intubation, achieving intubation times 14 s vs 25 s. respectively.[1] The authors did not find a report consisting a comparison of Airtraq and Kingvision devices regarding inverse intubation conditions, however there is a publication demonstrating the predominance of Airtraq during traditional intubation.[12]

The TotalTrack video intubating laryngeal mask is a device which enables ventilation (and oxygenation) patient during attempts of visualisation of entrance to larynx and intubation. This is especially important in case of morbidly obese patients, who have limited oxygen reserves and can desaturate very fast [13]. TotalTrack VILM is a curved laryngeal mask and allows for ventilation. Additionally it has channel for tube and camera with monitor to observe entrance to larynx. The successful use of TotalTrack VILM is described in obese and superobese patients [14,15]. This device for intubation works similarly to AirTraq – has channel for tube. The difference in using of channelled and non-channelled video airway devices is important regarding training, usage and effectiveness. When comparing channelled and non channelled devices for intubation in face-to-face technique Choi and all found out that Pentax AWS which is channelled VL allows for faster intubation in such conditions than C-Mac and Glidescope which is not channelled VLs [16].

In our study all patients were intubated successfully and there were no complications during anesthesia and post-anesthesia period observed. The anesthetists have not noticed differences in usage and effectiveness between examined devices.

Conclusion

KingVision and Airtraq video laryngoscopes and TotalTrack VILM during face-to-face intubation allowed for front-access endotracheal intubation and ensured an good view of larynx entrance. We assume that in case of difficult access to the patient’s head or untypical position, the usage of examined video laryngoscopes, can be considered.

Declarations

- Ethics approval and consent to participate: Institutional Ethics Committee Nr RNN/62/20/KE (Medical University of Lodz, Poland) , patients gave written consent to participate in the study
- Consent for publication: patients gave consent for publication of picutres
- Availability of data and materials: by request to authors
- Competing interests: nothing to declare
- Funding: authors` own work
- Authors' contributions: JNT performed study, wrote manuscript, made analysis; TG designed the study, performed study, PR revisted manuscript, edited manuscript;

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Figures

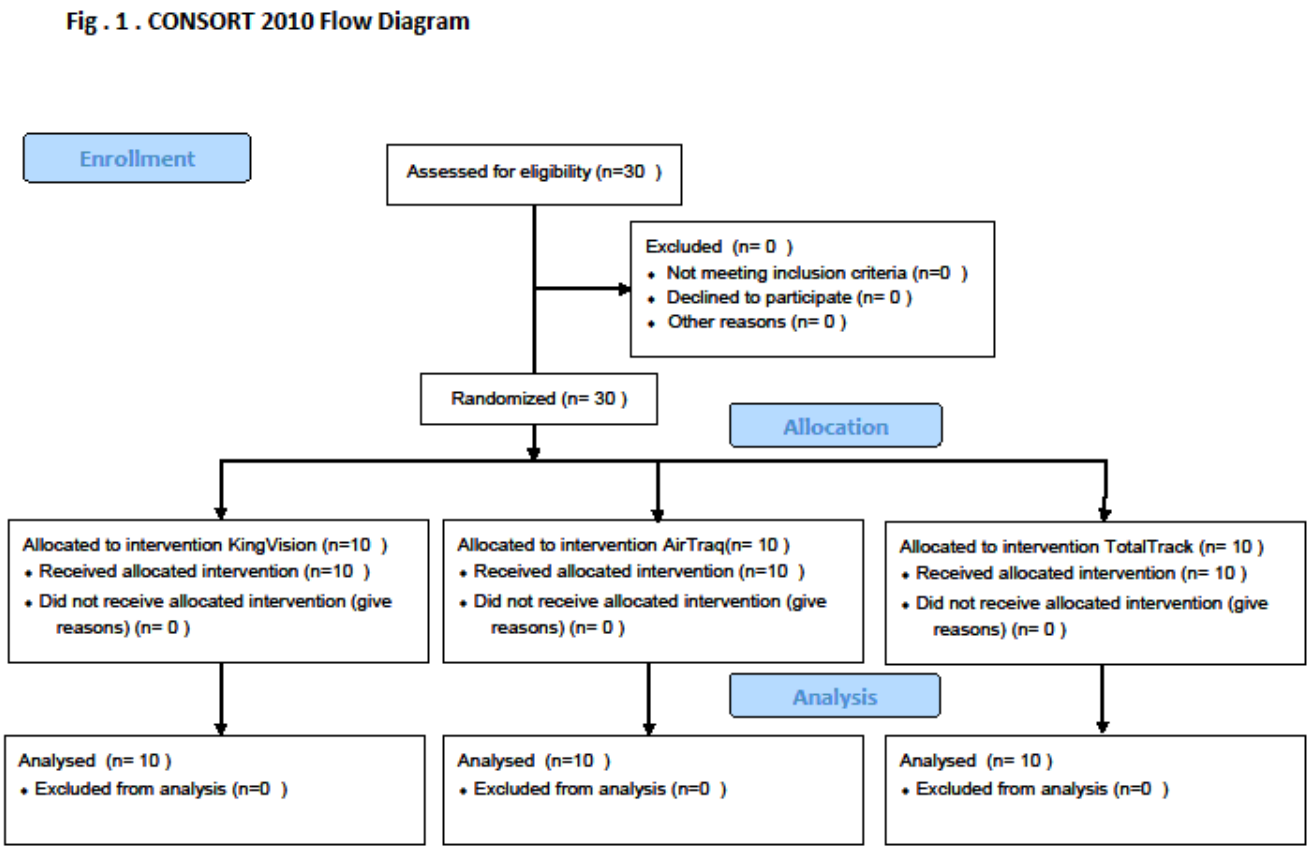

Figure 1

Consort Flow diagram

Figure 2

Intubation using KingVision videolaryngoscope.

Figure 3

Intubation using AirTraq videolaryngoscope.

Figure 4

Intubation using TotalTrack video intubating laryngeal mask.