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Awake endotracheal intubation in patients with severely restricted mouth opening- alternative devices to fiberscope: series of cases and literature review

Case Report

Ewelina Gaszynska*[1], Andrzej Wieczorek[2], Tomasz Gaszynski[3]

1 Department of Hygiene and Health Promotion, Medical University of Lodz, Poland

2 Department of Anesthesiology and Intensive Therapy, Medical University of Lodz, Poland

3 Department of Emergency Medicine and Disaster Medicine, Medical University of Lodz, Poland

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Abstract: Awake Fiberoptic Intubation (AFI) is a standard method of airway management in the case of anticipated difficult intubation. It is usually performed with the use of flexible fiberscopes. In this report we have described two methods in which alternative devices to the fiberscope were utilized for awake intubation in patients with severely restricted mouth opening scheduled for craniomaxillofacial surgery: TruView PCD and Levitan FPS. Information about the use of these devices in such conditions has not been previously published in the literature. Some of the possible advantages of these alternative methods for AFI result from the fact that they are easy to use, especially for anesthesiologists who are relatively inexperienced with fiberscope intubation procedures. Additionally, these alternatives are cheaper than fiberscopes and can be used for many AFI procedures.

Keywords: *Awake intubation • Videolaryngoscopes • Cranio-maxillo-facial surgery*

Patients with tumors of the oral cavity, especially those operated due to recurrence of the illness prior to final reconstructive surgery, may present a challenge during airway management necessary for safe anesthesia. As a standard approach, the awake fiberoptic intubation is recommended in the case of suspected difficult intubation. However, in unfavourable conditions, the fiberoptic intubation requires extensive skill, experience, and specialized equipment for it to be performed in a means which is safe and effective. After adequate training, new devices such as videolaryngoscopes and optical stylets are easy to use when dealing with difficult airways. Anesthesiologists who do not perform fiberscope intubation during routine practice may find the newer systems much easier. These new video systems can be used for intubation not only under general anesthesia but also for the awake intubation technique. The successful use of videolaryngoscopes [1] and optical stylets [2] for awake intubation was described in several studies but patients with severely limited mouth opening (less than 15 mm) were previously excluded from study populations. We present two cases of patients with mouth opening under 15 mm which were successfully intubated with the use of these new devices for an awake intubation technique. Informed consent for anesthesia and publication was obtained from the patients involved.

1. Case 1

A 64 year old male patient who suffered from advanced squamous cell carcinoma of the buccal mucosa was

* *E-mail: ewelina.gaszynska@umed.lodz.pl*

scheduled for reconstructive surgery. The patient had been operated on before and partial reconstructive surgery was performed. Evaluation of the airway revealed the following: mouth opening was less than 15 mm with partial trismus, the patient was edentulous, and the horizontal dimension of the lips was about 30 mm, neck mobility was severely restricted because of a musculocutaneus flap. The operator requested nasotracheal intubation. At first attempt, the fiberscope was used (Ambu aScope). Local and topical anesthesia was administered: the patient received an inhalation with 1% Lidocaine using a nebulizer, then the throat and tongue was anesthetized with 1% lidocaine spray. Propofol-Fentanyl sedation was administered for intubation attempts and the patient was moderately sedated. The dose of Propofol was titrated to achieve a level of sedation at which the patient would fall asleep if undisturbed, but also react to stimuli. The patient continues to open his mouth, clear his airway and maintains a weak coughing potential and non-purposeful movement.

In the Modified Steward Score a patient in such condition would receive 4 points (Table 1). Fentanyl was administered in a single dose of 100 mcg iv. The patient was breathing spontaneously, receiving oxygen through a catheter placed in the throat.

During the first approach we decided to perform AFI using Ambu aScope (Ambu, Holland) – a single use fiberscope set with a monitor. Ambu aScope is a fiberscope which has no ocular and can only be used with the connected monitor. The nasal fiberoptic intubation failed due to malfunction of the device: the monitor of Ambu aScope broke requiring a change to the technique. Subsequent to discussion with the surgeons, it was agreed upon that there were no risks for the well-oxygenated patient, thus the decision was made to employ alternative devices to attempt intubation, rather than postponing the scheduled procedure.

The nasotracheal AirTraq optical laryngoscope for nasal intubation was used (Figure 1). AirTraq is a single use laryngoscope from the group of airway devices built with a special channel for the tube, in additional to an ocular and light source. It was designed for patients with limited mouth opening of 19 mm, as the manufacturer describes. Unfortunately, in this case, the device was bigger than the mouth opening. Thus, to preserve the outcome of the previous maxillacraniofacial surgery, force was not applied to attempt intubation with the AirTraq device.

The next attempt employed the use of the TruView PCD system with a camera and monitor (Figure 1). The TruView PCD laryngoscope is a laryngoscope with a view fiberoptic tube in the blade. The operator can look through the eyepiece at the tip of the view tube. The PCD system is equipped with a camera that can be attached to the eyepiece and the monitor, so it may also act like a videolaryngoscope. The blade of the TruView laryngoscope is a modified Miller blade – it has a bigger angle at the tip (45 degrees). In the blade there is a channel for oxygen administration. In the presented case, continuous oxygen delivery was connected to the Truview blade. Blade size number 3 was introduced carefully into mouth of the patient with no resistance. The view obtained on the monitor was very good – CL scale 1. The Gum Elastic Bougie with a slightly bended tip (about 30 degrees) was introduced through nasal cavity to the pharynx. No special manipulation was necessary to introduce it to the trachea because of the previously bent tip, which enabled introduction of the GEB upwards to the entrance of the larynx. The GEB was followed by the endotracheal tube.

Table 1. The Modified Steward Score

CONSCIOUSNESS (0–4)
4-fully awake, eyes open, conversive
3-lightly asleep, eyes open intermittently
2-eyes open on command
1-response to ear pinching
0-no response
AIRWAY (0–3)
3-opens mouth, coughs on command
2-opens mouth, clears airway, weak cough
1-airway obstruction relieved by head extension
0-airway obstruction needing jaw retraction/oropharyngeal airway
ACTIVITY (0-2)
2-raising arm on command
1-non-purposeful movement
0-no movement

Figure 1. (From up) Truview PCD with oxygen catheter, nasotracheal intubation optical laryngoscope AirTraq, optical stylet Levitan FPS

2. Case 2

A 53 year old male, presented for elective surgery because of lichen planus (Wilson`s lichen). His mouth opening was less than 15 mm. Local and topical anesthesia was administered: the patient received an inhalation with 1% Lidocaine using a nebulizer, and then the throat and tongue were anesthetized with 1% lidocaine spray. Propofol-fentanyl sedation was used for the intubation attempts. The patient was breathing spontaneously receiving oxygen through a catheter placed in the throat. The level of sedation was estimated at 4 points on the Modified Steward Scale. On the initial intubation attempt, the Truview PCD was used due to experience with the previously mentioned case. However, this method was unsuccessful as the measured mouth opening was only 10 mm, a measure unfavourable for insertion of the Truview PCD blade.

As a result, the decision was made to use the Levitan FPS (Clarus Medical Systems, USA) – Figure 1. Levitan FPS is a rigid optical stylet. It has an ocular similar to the fiberscopes and a connector to a light source. There are two methods of use of rigid optical stylets. In both methods the intubation tube must be put on the stylet prior to intubation attempts. The operator is holding the device in the right hand, and the left hand holds a laryngoscope to elevate the base of the tongue. When the operator is able to see the epiglottis with direct laryngoscopy, the stylet is inserted (like a typical intubation stylet) – while the eyepiece is used to control the insertion of the tip. After passing the vocal cords the intubation tube may be introduced into the trachea. The second method, especially advised for patients with limited mouth opening, is to insert the optical stylet laterally, behind molars (a retromolar approach). After passing the molars, the operator should be looking straight through the eyepiece searching for the entrance to the larynx. This method was used in the presented case. The device was introduced carefully into the mouth of the patient; however, there was no visualization of the entrance to the trachea. The device was removed and the tip of stylet was adjusted. The malleable tip of the Levitan stylet can be shaped to achieve the required angle, which allowed us to adjust it to match the particular anatomy. Thus, the second attempt was successful. A laryngoscope was not used to create access; rather an oropharyngeal tube was used to elevate the tongue. The patient was operated under general anesthesia and there were no complications in the perioperative period.

3. Discussion

To the best of our knowledge, this is the first reported case of successful awake nasotracheal intubation with the use of the TruView PCD (after failed fiberscope intubation–because of malfunction of the device and failed use of the nasotracheal AirTraq) for the patient with severely restricted mouth opening. In the case of a predicted difficult intubation the fiberscope is the device of first choice. Awake intubation is recommended as a safe and effective method, and the use of videolaryngoscopes for awake intubation is described as an alternative method to awake fiberoptic intubation [1].

There is a wide range of videolaryngoscopes and other airway devices currently available. Videolaryngoscopes can be divided into subgroups: Macintosh-like blades (for example C-Mac, McGrath MAC), and modified blades (for example McGrath Series 5, Glidescope). The TruView PCD, which we have used, is a laryngoscope with a modified blade. The view of the glottis is obtained by the optical view tube incorporated into the blade, and a video system can be additionally connected. There are also devices with a special channel for the endotracheal tube, for example AirTraq, Pentax AWS and King Vision. Nasotracheal intubation AirTraq, which we used, is modified: it has no channel for the tube.

When using rigid optical stylets the operator can look through the ocular (BonFils, Levitan FPS) like in a fiberscope. Sensa Scope is a rigid optical stylet with a moving tip like in fiberscopes.

Each device has its advantages and disadvantages. Videolaryngoscopes are advantageous in that they function very similar to that of standard laryngoscopes. As a result, anesthesiologists can quickly master the skill to effectively employ this device. A possible disadvantage to its use is fogging, which may be resolved in a variety of ways. For example, in the case of C-Mac, applying anti-fog solution or for AirTraq the device should be turned on 30 seconds prior to use, to warm up the lens. In the case of the TruView PCD, constant oxygen flow to the lens area prevents fogging and removes secretions from the view (Figure 1). Optical stylets have disadvantages similar to fiberscopes: limited view, possible fogging and further limitation of view by secretions. The advantage to using optical stylets is that they are similar in use to standard intubation introducers, easy to use and requiring minimal training.

The general indication for all devices mentioned above is in situations of both predicted and unexpected

difficult intubation. Such devices are becoming more frequently employed in cases of standard patients because they provide optimal prevention of possible intubation injuries in comparison to standard laryngoscopes. In the case of predicted intubation difficulties (like in the case of patient with oral cavity cancer) the fiberscope is preferred, however the modern airway devices can be a good alternative. Anesthesiologists who are using the new devices during every day practice can create new opportunities to manage difficult patients in an effective way.

In the presented case TruView PCD was used successfully as a videolaryngoscope for awake intubation. When using TruView Evo2 laryngoscope the operator can look through the eyepiece at the tip of the view tube, but in the PCD version the camera can be connected with a monitor similar to the videolaryngoscope. The use of the Truview Evo2 laryngoscope for nasotracheal intubation was described both in manikins and patients [3,4], however, limitations of those studies existed in the manikin model [3], and evaluation of nasal intubation was performed only on patients with a normal airway [4]. Nasotracheal AirTraq is a very useful device for nasotracheal intubation in patients with a difficult airway [5,6], so it was justified to try intubating our patient with this device. Unfortunately in the presented case, the diameter of the device was bigger than the mouth opening. The Truview PCD blade is smaller: 15 mm comparing to 19 mm of AirTraq. In the second case described, the Truview PCD blade was also too big to insert. In this situation devices like the optical stylets are very useful. The use of a Bonfils (Storz, Germany) optical stylet in patients with ear, nose and throat cancer was described [7]. The main difference between Levitan FPS and Bonfils is that Levitan FPS stylet has a malleable tip (BonFils does not), which is very useful in case of severe anatomical variations. The optical stylets can be used with or without a laryngoscope to create access, while elevating the tongue. For patients with trismus the retromolar approach technique is also possible. Additionally, optical stylets prove advantageous in comparison to the typical intubation stylets, as the operator can observe tip placement while the stylet is inserted. This increases safety of the procedure.

The videolaryngoscopes and optical stylets are easier to use than fiberscopes and they are a good alternative to fiberoptic intubation for anesthesiologists with limited experience in awake fiberscope intubation. Videolaryngoscopes are operated in a way similar to laryngoscopes, which are well known to anesthesiologists. The optical stylets, like Levitan FPS, work similarly to the intubation stylets which are also very often used in standard anesthesia practice. From our experience, the Propofol-Fentanyl sedation for awake intubation is a very good choice because it attenuates the airway reflexes [8]. In the case of awake videolaryngoscope intubation, the blade of the laryngoscope can disturb the patient more than the fiberscope.

Repair/replacement costs were the major contributor to the total incremental costs of utilizing reusable fiberscopes in an anesthesia department. Liu at al. evaluated costs of anesthesia fiberscopes used for tracheal intubation during a 12 month period in one university hospital in the U.S.A. [9]. The total cost per fiberscope used equaled $94.95, which totals $13.75 device acquisition, $13.12 for technician labor, $4.76 for consumables towards fiberscope cleaning and processing, and $63.32 for fiberscope repairs and replacements. These results may vary between hospitals due to differences in purchase and repair arrangements with vendors, clinical practice and fiberscope use, and the frequency of damage. From our experience we observe that the costs associated with using alternative devices are significantly smaller. These alternative devices do not require special cleaning procedures and are much less vulnerable to being damaged (for example, a patient cannot bite the device as is possible with the fiberscopes). In our opinion they are a cheaper and a better alternative to fiberscopes in terms of cost-effectiveness. For example, the cost of the Levitan FPS system is approximately $300 but the costs of using it are only limited to standard cleaning procedures similar to the laryngoscopes blades. The remains true for the TruView PCD which costs approximately $5000 and during usage only the costs of standard laryngoscope sterilization must be covered. The costs of single use devices like AirTraq are even smaller. The cost of AirTraq is less than $20. Another relevant argument against “multiuse” fiberoptic bronchoscopes is the possible transmission of prions.

4. Conclusions

In our opinion the Truview PCD system has several advantages in case of patients with mouth opening under 15 mm: 1. It allows for successful intubation in patients with limited mouth opening. 2. It has a camera-monitor system, which enables its use as a videolaryngoscope. 3. It has a channel for continuous oxygen administration, which is very useful in the case of awake intubation in spontaneously breathing patient, while also removing saliva from view. The Levitan FPS optical stylet can be used in patients with <15 mm mouth opening and proves to be advantageous when comparing to other optical stylets due to its malleable tip.

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Conflict of interest statement

Authors state no conflict of interest.

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