ORIGINAL ARTICLE

Evaluation of the Truview™ EVO2 laryngoscope for nasotracheal intubation

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ABSTRACT

Background: The Truview™ EVO2 laryngoscope, with its unique optical lens system and blade tip angulation, has proved its usefulness in providing adequate laryngeal exposure and intubation via the oral route. However, the same has not been evaluated for nasotracheal intubation. **Aim:** We evaluated the suitability of the Truview™ EVO2 laryngoscope for nasotracheal intubation. **Methods:** Fifty ASA grade I and II elective surgical patients were studied. Patients aged below 15 years or having difficult airway were excluded. Under standard anesthesia protocol, nasotracheal intubation was performed using a Truview™ EVO2 laryngoscope and, in cases of inability to complete intubation in three attempts, the Macintosh laryngoscope was used. Time taken for intubation, use of Magill's forceps and need for optimization maneuvers were noted. The primary outcome was percentage of successful intubation, while hemodynamic changes and duration of intubation were taken as secondary outcomes. **Results:** Majority (94%) could be intubated successfully with the Truview™ EVO2 laryngoscope. Average time taken for intubation was 50.1 s. The hemodynamic changes were not clinically significant. Regression analysis revealed lack of association between duration of intubation and hemodynamic changes. There were no serious complications. **Conclusion:** The Truview™ EVO2 laryngoscope is a useful tool in performing nasotracheal intubation, ensuring a high level of success rate among patients with normal airway anatomy.

Key words: *Laryngoscope, orthognathic surgery, nasotracheal intubation, Truview™ EVO2*

INTRODUCTION

The Truview™ EVO2 laryngoscope is a relatively new addition to the equipment available for airway management, particularly when difficulty is anticipated in visualizing the glottis in the presence of reduced mouth opening or when the neck movement is restricted.[1,2] In several studies involving manikins and humans, it has been found to improve the visualization of vocal cords (Cormack and Lehane Grading) during oral endotracheal intubation even if the conventional Macintosh blade had failed.[3-6]

To the best of our knowledge, evaluation of the Truview™ EVO2 laryngoscope for nasotracheal intubation has not been reported previously in the literature. Based on the observations regarding its usefulness in oral intubation, we hypothesized that this laryngoscope will be useful in aiding nasotracheal intubation as well.

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METHODS

The study was conducted in 50 adult patients belonging to ASA physical status I and II, admitted to a tertiary care center to undergo maxillary and/or mandibular osteotomy. Institutional ethical committee clearance was obtained. Patients satisfying the following criteria were included in the study: patients with ASA grade I and II, normal airway and age above 15 years. Exclusion criteria included ASA grade III and above, children below 15 years, morbid obesity and anticipated difficult airway.

Every patient was subjected to detailed preanesthetic evaluation, explained about the anesthetic procedure and informed consent taken either from the patient or the guardian in case of a minor. Along with ruling out gross structural anomalies, airway assessment was performed

using modified Mallampati classification,[7] mouth opening, thyromental distance, neck circumference and neck mobility, and the patients with anticipated difficult airway were excluded.

All patients were fasted overnight. Premedication consisted of tab. diazepam 5 mg and tab. ranitidine 150 mg on the previous night and 2 h before surgery. A standardized anesthetic induction and intubation sequence was used. Monitoring included ECG, pulse oxymetry, noninvasive blood pressure, end-tidal CO_2 and peripheral nerve stimulator. After determining the most favorable nostril, a drop of nasal decongestant, xylometazoline 0.1%, was instilled. Fentanyl 2 μg/kg IV was followed by preoxygenation and induction agent propofol, 2 mg/Kg IV, 5 min later. After confirming the ability to ventilate, vecuronium 0.1 mg/kg and clonidine 75 μg were administered intravenously. Ventilation was continued with 1% isoflurane in oxygen for 3 min. The patient's head was stabilized in the neutral position on a ring. Nasotracheal intubation was performed using the Truview™ EVO2 laryngoscope (Truphatek International Limited, Netanya, Israel), with optical port for viewing. A well-lubricated disposable armored endotracheal tube (Safety-Flex™ with Murphy Eye, Mallinckrodt Medical, Athlone, Ireland) was passed through the most favorable nostril. The Truview™ EVO2 laryngoscope was then passed through the center of the mouth, with 8 L/min of oxygen flow through the side port. Once the larynx was visualized, the endotracheal tube was advanced until it was visible through the Truview™ EVO2 laryngoscope and then it was manipulated so that it entered the glottis. In case of difficulty, instead of the specially designed stylet provided with the Truview™ EVO2 laryngoscope, a Magill's forceps was used to guide the endotracheal tube. If intubation was not possible in three attempts, a Macintosh laryngoscope was employed to complete the procedure. The same was recorded as failure to intubate with Truview™ EVO2 laryngoscope. In case of poor view of the larynx through the Truview™, optimization maneuvers, namely changing head position (extension at atlanto–occipital joint), antero–posterior and/or upward pressure on larynx (external laryngeal manipulation) were engaged. Time from removal of facemask to resumption of ventilation was considered as time taken for intubation. All the intubations were performed by the first and second authors, who had at least 15 years of experience in anesthesia as consultants and 1 year of experience with the Truview™ EVO2 laryngoscope for orotracheal intubations, and took part in the preceding pilot study for nasotracheal intubation.

Laryngoscopic view as per the Cormack and Lehane grading,[8] time taken for intubation, number of attempts (number of times the Truview™ EVO2 laryngoscope was inserted and removed either after completing intubation or due to inability to intubate within maximum stipulated time of 150 s), use of Magill's forceps, and head, neck and external laryngeal manipulation were noted. The complications were documented. Heart rate, blood pressure and appearance of arrhythmia were recorded before induction, soon after induction, just before intubation, and 1, 2, 3, 4, 5 and 10 min after intubation. Values recorded before induction were taken as baseline.

Statistical analysis

The sample size was calculated based on the success rate during a pilot study of 10 cases, using the formula:

$$n = 4pq/L^2$$

where, p = success rate, q = 1-p, L = allowable error.

Considering an initial success rate of 90% as per the pilot study and allowable error 10% of p (10% of 90%, i.e., 9%), the minimum sample required (n) was 44.4. We took a sample size of 50. Linear regression analysis and Pearson coefficient were used to determine the association, using software Statistical Package for the Social Sciences (SPSS15) (IBM Corporation, Route 100, Somers, NY, USA).

RESULTS

The demographic details of the patients are summarized in Table 1. Both male and female patients were adequately represented. Airway assessment, laryngoscopic view (Cormack Lehane) and number of attempts are shown in Tables 2-4, respectively. Table 5 shows the need for optimization maneuvers and success rate. Time taken for intubation is shown in Table 6.

The most common complication was mild nasal bleeding (26%), which was self-limiting [Table 7].

DISCUSSION

Orthognathic procedures often require nasotracheal intubation, primarily to avoid interference in the surgical field.[9] These patients are known to have associated facial skeletal malformations of congenital or developmental etiology. Syndromes involving airway may also be present. However, majority of these patients do not have difficulty in mask ventilation, but trouble could be encountered during laryngoscopy and intubation.[10] Therefore, we decided to evaluate the Truview™ EVO2 laryngoscope for nasotracheal intubation among patients undergoing orthognathic procedures.

Table 1: Demographic details

Sex (Male:Female)	21 (42)	29 (58)	
ASA grade (I:II)	47 (94)	3 (6)	
Age in years	Range 15–75	Average 23	SD 10.06
Weight in kg	Range 36–90	Average 50	SD 10.33

Figures in parenthesis are in percentage

Table 2: Airway assessment

Mouth opening	
Adequate	22 (44)
Normal	28 (56)
Mallampati	
Class I	44 (88)
Class II	6 (12)
Micrognathia	
Nil	42 (84)
Mild	3 (6)
Moderate	5 (10)
Other anomalies	
Cleft lip and/or palate	5 (10)
Hemi-facial microsomia	1 (2)

Figures in parenthesis are in percentage

Table 3: Laryngoscopic view (Cormack lehane)

Grade 1	Grade 2	Grade 3	Grade 4
43 (86)	5 (10)	1 (2)	1 (2)

Figures in parenthesis are in percentage

Table 4: Number of attempts

1	2	3	>3
38 (76)	8 (22)	1 (2)	3 (6)

Figures in parenthesis are in percentage

Table 5: Optimization maneuvers and success rate

	Yes	No
Use of Magill's forceps	32 (64)	18 (36)
Head and neck manipulation	10 (20)	40 (80)
External laryngeal manipulation	14 (28)	36 (72)
Success rate	47 (94)	3 (6)

Figures in parenthesis are in percentage

Table 6: Time taken for intubation (in seconds)

Minimum	Maximum	Average	SD
9	142	50.1	30.52

Table 7: Complications

Bleeding	13	26
Tachycardia	10	20
Bradycardia	4	8
Hypertension	7	14

Figures indicates percentage

Although 28% had micrognathia and other anomalies, they were not severe enough to exclude from the study.

In our series, 94% of the patients were successfully intubated nasally with a Truview™ EVO2 laryngoscope. Of these, 76% were completed in the first attempt. In the majority, Cormack and Lehane grading was I (86%). Only two patients had Cormack and Lehane grading III or IV. Causes of failure to intubate were inability to negotiate endotracheal tube into the glottis in spite of good vision in one and poor vision of the larynx in two patients (Cormack and Lehane grade III). Although intubation was completed with a Macintosh blade, the laryngoscopic view was of higher grade (grade IV vs grade III with Truview™ EVO2 laryngoscope). Our success rate improved in the latter half of the study as all three cases of failure occurred in the first. One of the factors responsible may be the learning curve, as suggested by Singh and others (2009).[2]

Nasotracheal intubation requires a longer duration as compared with orotracheal intubation. Fifty percent of the intubations were over in less than 43 s. Time taken by us is similar to the 51 s reported by Li *et al.* (2007) for orotracheal intubation.[4] They defined time to intubation as time from instrument entering the patient's mouth until end-tidal carbon dioxide was detected, whereas we defined it from removal of face mask to resuming ventilation after intubation. Considering these facts, we achieved nasotracheal intubation in less time. Nevertheless, there was no incidence of hypoxia or arrhythmia requiring treatment during the procedure.

Intubation was successful in the majority (68%) of the patients without complications. The most common complication noted was nasopharyngeal bleeding (26%). This bleeding was minor, self-limiting and was not related to the Truview™ EVO2 laryngoscope. The cause of bleeding was trauma resulting from insertion of the nasotracheal tube. Although any amount of blood or secretion can be bothersome during endoscopy, it was never serious enough to affect the outcome.

There was no incidence of soft tissue injury other than mild nasopharyngeal bleeding. Incidence of bleeding was much less in our series compared with that of Seo and team.[11] This low incidence of epistaxis in our series may be attributable to the use of an armored tube. Overall, there were no significant complications that required treatment or interfered with the procedure.

Hemodynamic findings [Figure 1] in our study are in agreement with that of Lixy and co-workers, who, while performing Glidescope-assisted nasotracheal intubation, noted that there was a significant drop in the parameters

in the postinduction period, which returned to baseline after intubation.[12] Moreover, regression analysis clearly indicated lack of correlation between duration of intubation and hemodynamic changes [Figures 2 and 3]. These findings demonstrate that while the Truview™ EVO2 laryngoscope takes a longer time for completion of intubation, hemodynamic response is not proportional to the time taken [Figures 2 and 3]. This may be attributable to the less force applied on the structures of the floor of the mouth and larynx for visualization of larynx and intubation, as there is no need to align the three axes while

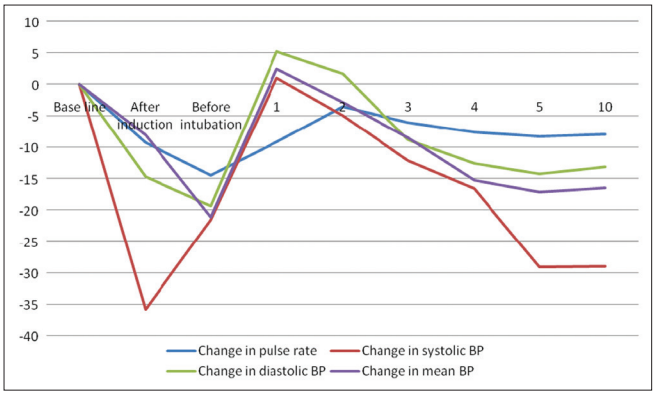

Figure 1: Hemodynamic changes

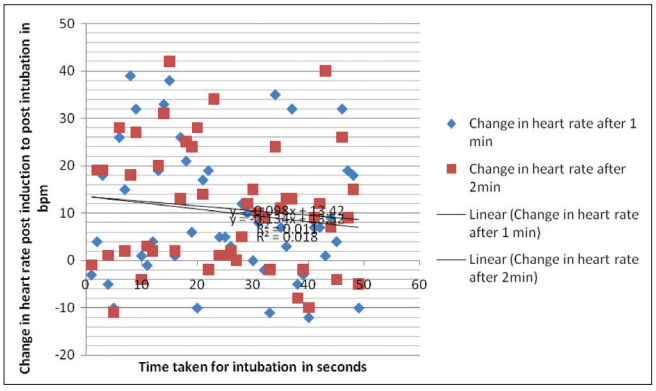

Figure 2: Relationship between time taken for intubation and change in heart rate

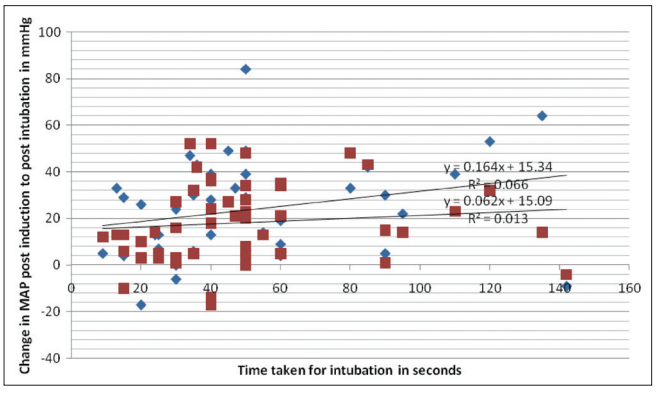

Figure 3: Relationship between time taken for intubation and change in MAP

using video laryngoscopes in general and Truview™ EVO2 laryngoscope in particular, as suggested by Lieberman and colleagues (2003).[13] Meanwhile, depth of anesthesia achieved, especially when supplemented with clonidine, might also have contributed to some degree toward hemodynamic stability.

Mallik and co-workers reported a significant incidence of use of optimization maneuvers while employing the Truview™ EVO2 laryngoscope.[1] In our series, only 20% required repositioning of the head and 28% required external laryngeal manipulation. In nine cases (18%), both were required. This is much less than that used for orotracheal intubation with the Truview™ EVO2 laryngoscope.[1]

Directing the tip of the endotracheal tube into the larynx requires use of Magill's forceps during nasotracheal intubation. We tried to manipulate the ETT to align it with the glottic opening and negotiate into the trachea without the help of a Magill's forceps. Intubation was successful without Magill's forceps in 36% of the cases. As there is less space available with the Truview™ EVO2 laryngoscope, manipulation of the tube with forceps becomes difficult. However, in a significant proportion of the cases, Magill's forceps was required for intubation.

The following issues are of concern while using the Truview™ EVO2 laryngoscope for nasotracheal intubation. One, the time taken to complete intubation is longer. With more expertise, this may be reduced. Two, there was some difficulty in visualization of the endotracheal tube due to limited field of vision through the scope, especially while using ETT made up of PVC due to the transparency of the material, as was noted during the pilot study leading to use of armored ETT later. In this aspect, Portex RAE tubes (Portex® Polar™ Preformed Tracheal Tube, Smith MedicalInternational Ltd., Hythe, Kent, UK) made up of opaque bluish white soft plastic, or armored ETT may be a better choice. Three, there is a need to look outside the Truview™ EVO2 laryngoscope while using Magill's forceps, which may cause delay and some difficulty in completing the procedure.

There are many types of video laryngoscopes available, but none is as inexpensive as the Truview™ EVO2 laryngoscope.[14,15] Some of them have been evaluated for nasotracheal intubation.[15,16] Hirabayashi and Seo (2008) employed the Airtraq laryngoscope for nasotracheal intubation and compared it with Macintosh in manikins. They found that duration of intubation was slightly longer in the Airtraq group (15±11 s vs. 13±6 s). Interestingly, the Magill's forceps was not used for intubations with Airtraq

(0±52%). In this manikin study, they concluded that the Airtraq laryngoscope, which provides non line-of-sight view, produces a good condition for nasotracheal intubation.[16]

In our study, we have not used a video screen attachment for visualization for the following reasons: firstly, this attachment makes the whole equipment bulky and cumbersome to handle; secondly, the screen may limit the field of vision outside the laryngoscope; thirdly and most importantly, additional cost involved in procuring the equipment.

Limitation of the study

We found that nasotracheal intubation with the Truview™ EVO2 laryngoscope was easy and simple. However, the current study is only an evaluation trial and requires a comparison with the Macintosh laryngoscope. Moreover, to be clinically relevant, results have to be tested in target populations, i.e. in those with restricted mouth opening and/or limited neck mobility.

CONCLUSION

We found good intubating conditions provided by Truview™ EVO2 for nasotracheal intubation. Thus, our study demonstrates the suitability of the Truview™ EVO2 laryngoscope for nasotracheal intubation.

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