CCI JOURNAL CRITICAL CARE INNOVATIONS

CASE REPORT

Crit. Care Innov. 2021; 4(2):38-43

A novel video laryngoscope for the use in hypoxemic COVID-19 patients: a case report.

Mohd Mustahsin [1] - A,F,H,J,K,M,N,O. ORCID www.orcid.org/0000-0003-2503-1906
Zaw Ali Khan [2] - C,G,H,L,O. ORCID www.orcid.org/0000-0002-8418-8068
Garima Singh [1] – M,N,O. ORCID www.orcid.org/0000-0001-9961-160X
Sanjay Choubey [1] – J,N,O. ORCID www.orcid.org/0000-0001-6052-0647

[1] *Department of Anaesthesiology and Critical Care, Era's Lucknow Medical College and Hospital, Lucknow, India.*
[2] *Department of Research and Development, Era's Lucknow Medical College and Hospital, Lucknow, India.*

Address for correspondence:
Mohd Mustahsin, MD - Era's Lucknow Medical College and Hospital Sarfarazganj, Hardoi Road Lucknow – 226003, India; E-mail: mustahsin.malik@gmail.com

ISSN 2545-2533
Received: 10.05.2021
Accepted: 25.05.2021
Published: 30.06.2021

Author Contributions (CRediT Taxonomy):

Conceptualization - **A**
Data Curation - **B**
Formal Analysis - **C**
Funding Acquisition - **D**
Investigation - **E**
Methodology - **F**
Project Administration - **G**
Resources - **H**
Software - **I**
Supervision - **J**
Validation - **K**
Visualization - **L**
Writing (Draft Preparation) - **M**
Writing (Review & Editing) – **N**
Approved the final version - **O**

ABSTRACT

Critically ill COVID-19 patients require endotracheal intubations due to hypoxemic respiratory failure. These patients tend to desaturate fast especially during the intubation. Video laryngoscopes are recommended for airway management in COVID-19 patients due to better glottic view, higher first attempt success rates, less risk of contamination from airway secretions due to increased distance of patient's and intubator's face. Commercially available video laryngoscopes are expensive, difficult to acquire especially during pandemic and require training to use them. In order to overcome these issues, the authors designed a video laryngoscope by modifying the commonly used Macintosh laryngoscope blade which makes it easy to use, is low cost (approximately 90% cheaper than average cost of commercially available video laryngoscopes) and does not require any additional training. Moreover an oxygen channel was integrated along with the camera for deep laryngeal oxygen insufflation which has the additional advantage of delaying the desaturation during laryngoscopy. With these added advantages this modified video laryngoscope would prove to be a valuable tool for airway management team during current COVID-19 crisis.

KEY WORDS: COVID-19, intubation, remote monitoring, deep laryngeal oxygen insufflation, tele-medicine-telebation.

INTRODUCTION

COVID- 19 disease had been declared as pandemic by the World Health Organization in March 2020 and has infected millions around the world [1]. These patients develop worsening hypoxemia and may require endotracheal intubation that presents a big challenge to the intensivists due to the resulting sudden desaturation especially during laryngoscopy. Video laryngoscopes are recommended for the airway management of COVID-19 patients [2]. Commercially available video laryngoscopes are costly and difficult to acquire during pandemic. Video laryngoscopy is not a new technique of airway management, but it still remains a less common tool especially in some medical facilities.

Hamal et al designed a cost effective video laryngoscope by modifying Macintosh laryngoscope by using a borescope camera in the groove of the blade and claimed encouraging results during the initial use [3]. To prevent the risk of desaturation during the intubation procedure, we have devised an affordable video laryngoscope which has a deep laryngeal oxygen insufflation facility. The authors hereby report the successful use of modified video laryngoscope in a hypoxemic COVID-19 patient who underwent emergency intubation in Intensive Care Unit (ICU).

CASE REPORT

Clinical findings: 61 year old male weighing 80kg, BMI 31.25, a known case of hypertension and Diabetes Mellitus on regular treatment since 12 years was admitted to our ICU as case of severe COVID-19 pneumonia.

Diagnostic Assessment: His ABG showed pH of 7.33, pCO_2 66 mmHg, pO_2 71 mmHg, HCO^{3-} 34.8 mmol/L and SO_2 93%. He was started on NIPPV with FiO_2 1.0, CPAP 10cm H_2O and PS 5 cm H_2O. His labs showed TLC- 9.9 x10^9/L, DLC (N-86%, L- 10%, M-2%, E-2%), Creatinine 0.9 mg/dl, Urea 42 mg/dl, Glucose 134 mg/dl, Calcium-8.2 mg/dl, Albumin 2.4g/dl, Lactate 1.8 mmol/L, Procalcitonin 0.118 ng/ml, CRP >90mg/L, Ferritin 916ng/mL and D-Dimer 3.81 mcg/ml. His chest X-ray showed patchy airspace opacification in bilateral lung fields with peripheral predominanace. His NCCT thorax showed multifocal areas of ground glass opacity with CT severity score of 17/25.

Therapeutic Intervention: His treatment started with remdesivir, doxycycline, ivermectin, low molecular weight heparin. On 2nd day of ICU admission, his SpO2 dropped to 83% and he became increasingly tachypnoic, hence a decision was taken to intubate him. Airway examination revealed a mouth opening of 3.5 cm, Mallampati Class 3 and thyromental distance <6cm.

Multimedia 1. Modified video laryngoscope.

 doi: 10.32114/CCI.2021.4.2.38.43

The authors have designed a modified video laryngoscope by integrating the borescope camera and an oxygen delivery channel in the groove of the laryngoscope blade. The waterproof borescope HD camera (5 mm diameter) has 6 LED lights at the tip and a 2m length cable to connect to an Android mobile or tablet using CameraFi application freely available on Google Play Store.

The oxygen insufflation is facilitated by an oxygen channel through the laryngoscope. The inlet port of the channel at the proximal end of the laryngoscope handle can be connected via a kink resistant tube to a flowmeter which can deliver up to 15 litres oxygen per minute. The outlet of the oxygen channel is adjacent to the camera tip, 4 cm proximal to the tip of the laryngoscope blade (Figure 1).

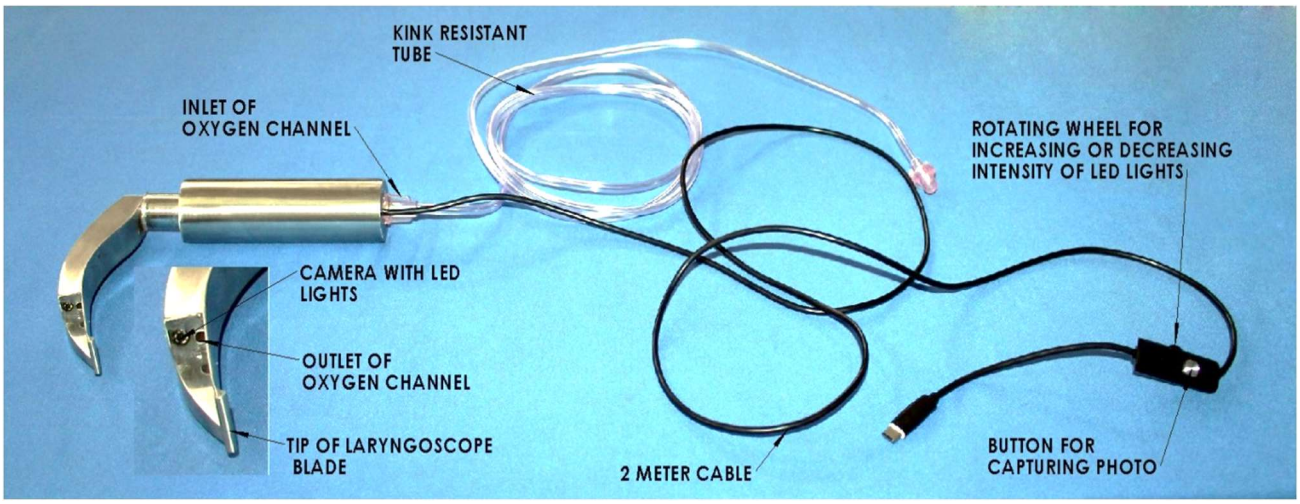

Figure 1. Modified Video laryngoscope with Size 3 blade.

Following preoxygenation for 5 minutes with 100% oxygen and at CPAP of 10cms of H2O, the patient's SpO_2 did not increase beyond 90%. The patient was premedicated with 100mcg of fentanyl and induced with 120mg of propofol. Muscle relaxation was achieved with 100mg of succinylcholine, bag and mask ventilation was continued and SpO_2 recorded just before intubation was 90%. The inlet of oxygen channel was connected to flowmeter via 2m kink resistant tube and flow was kept at 10L/min. The borescope camera was connected to tablet via type C connector and viewed using CameraFi Application. The screen of the tablet was shared over Wi-Fi with control room computer using Zoom application where the critical care team was monitoring and guiding the junior resident who was intubating the trachea.

The video laryngoscope was inserted from the right side of oral cavity, the tongue was moved to the left and the tip of the laryngoscope was advanced into the valecula similar to the Macintosh blade laryngoscopy. The trachea was intubated in the first attempt using 8.5mm internal diameter cuffed tracheal tube and connected to ventilator for lung protective ventilation. The modified Cormack-Lehane grade of airway view was 1 and the oxygen saturation was maintained at 90%. The laryngoscope blade and handle were washed with soap and water before being wiped with a 70% alcohol swab. The oxygen channel was filled with 2% glutaraldehyde, kept for 20 minutes, drained off and flushed with normal saline for the next use.

DISCUSSION

The important findings in this case report are:

1. The patient underwent smooth intubation in first attempt with good glottic view
2. Due to deep laryngeal oxygen insufflation, there was no episode of desaturation which is frequently encountered during routine intubation of hypoxemic COVID-19 patients
3. The patient was intubated under the watchful eyes of critical care expert using remote monitoring and guidance
4. Instant confirmation and documentation of correct placement of endotracheal tube
5. Simultaneous real time bulk training of medical and paramedical staff which shall help in dealing with the emergency airway access during the current pandemic

The authors have modified the video laryngoscope as the commercially available video laryngoscopes are costly, require specialized training and difficult to acquire during pandemic because of increased demand. This video laryngoscope, a brainchild of the first author, has been designed by hospital biomedical engineering team under supervision of the first author. The total making cost of the device is 150$ which is 90% cheaper than the average cost of commercially available video laryngoscope. Video laryngoscopy over conventional laryngoscopy provides a better glottic view that leads to reduced number of intubation attempts and increased distance between patient's and intubator's airway thereby reducing the risk of aerosolization during airway management. This high quality HD image can be directly transmitted for tele-medicine guidance of remote intubation (Telebation) [4]. This can be used remotely for real-time training of the junior staff (Figure 2). Moreover, the oxygen insufflation during laryngoscopy will prevent the immediate desaturation which is very often seen in COVID-19 patients due to hypoxemic respiratory failure.

Studies have shown that deep laryngeal oxygen insufflation increases the time to desaturate during laryngoscopy. According to a retrospective observational case series from UK Centre first pass success rate was 85%, video laryngoscopy was used as a first line in 79% of patients, 21% patients developed hypotension and oxygen desaturation was seen in 49% of emergency tracheal intubations in COVID-19 patients [5]. The baseline SpO2 of the reported patient after preoxygenation was 90% and it was maintained during laryngoscopy and no desaturation episode was observed. The absence of desaturation may be due to apnoeic oxygenation via oxygen channel during laryngoscopy. Haithum et al. retrospectively compared the effectiveness of C-MAC video laryngoscope with TruView EVO2 laryngoscope and showed that the time to intubation was prolonged when TruView EVO2 was used due to apnoeic oxygenation.

Moreover there was less fogging of the camera when TruView EVO2 was used because of supplemental oxygen insufflation [6]. For similar reason the authors too didn't notice any fogging of camera while intubating by using their modified video laryngoscope. Similarly in another randomized control trial conducted by Steiner et al in children, there was not only an increase in time to 1% desaturation but also a reduction in overall rate of desaturation [7].

 doi: 10.32114/CCI.2021.4.2.38.43

Figure 2. Real time remote teaching of junior staff via Telebation.

The authors believe that while dealing with the current COVID-19 pandemic not only does the latest technology need to be utilized for better patient care but also low cost alternatives should be looked for. Keeping this in mind the authors have been routinely using this modified video laryngoscope for intubating COVID-19 patients during the current pandemic. The authors have not encountered any problem with the use of the modified video laryngoscope in day to day ICU patients' airway management, rather it has turned out to be user-friendly as the blade is similar to conventional Macintosh laryngoscope blade. Authors are also using the same device for telemedicine guided intubations because of which this device is proving to be a powerful educational and patient care gadget.

CONCLUSIONS

In the current pandemic situation, the authors attempt at the oxygenation by insufflation during laryngoscopy would be a novel step towards achieving a definitive airway in an efficient manner at a much lower cost than the commercially available counterparts, with no additional cost of training to the medical/paramedical personnel. The device is being used routinely in COVID-19 patients for intubation and telebation at authors institute with encouraging results. This 'easy to use' modified video laryngoscope at minimal expenses with wide ranging advantages and low maintenance would be a valuable asset in the armamentarium of the intensivist during the COVID crisis and thereafter.

SUPPLEMENTARY INFORMATION

Funding: *This research received no external funding.*
Institutional Review Statement: *The study was conducted according to the guidelines of the Declaration of Helsinki.*
Informed Consent Statement: *Informed consent was obtained from all subjects involved in the study.*
Data Availability Statement: *The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.*
Conflicts of Interest: *The authors declare no conflicts of interest.*

REFERENCES

[1] World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19. March 11, 2020
[WWW]: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020
(accessed 01 May 2021)

[2] De Jong A, Pardo E, Rolle A, Bodin-Lario S, Pouzeratte Y, Jaber S. Airway management for COVID-19: a move towards universal videolaryngoscope? Lancet Respir Med. 2020; 8(6): 555.
doi: https://doi.org/10.1016/S2213-2600(20)30221-6

[3] Hamal PK, Chaurasia RB, Pokhrel N, Pandey D, Shrestha GS. An affordable videolaryngoscope for use during the COVID-19 pandemic. Lancet Glob Health. 2020; 8(7): e893-e894.
doi: https://doi.org/10.1016/S2214-109X(20)30259-X

[4] Mosier J, Joseph B, Sakles JC. Telebation: next-generation telemedicine in remote airway management using current wireless technologies. Telemed J E Health. 2013; 19(2): 95-98.
doi: https://doi.org/10.1089/tmj.2012.0093

[5] Gandhi A, Sokhi J, Lockie C, Ward PA. Emergency Tracheal Intubation in Patients with COVID-19: Experience from a UK Centre. Anesthesiol Res Pract. 2020;2020: 8816729.
doi: https://doi.org/10.1155/2020/8816729

[6] Mutlak H, Rolle U, Rosskopf W, Schalk R, Zacharowski K, Meininger D, et al. Comparison of the TruView infant EVO2 PCD™ and C-MAC video laryngoscopes with direct Macintosh laryngoscopy for routine tracheal intubation in infants with normal airways. Clinics (Sao Paulo). 2014; 69(1): 23-27.
doi: https://doi.org/10.6061/clinics/2014(01)04

[7] Steiner JW, Sessler DI, Makarova N, Mascha EJ, Olomu PN, Zhong JW, Setiawan CT, Handy AE, Kravitz BN, Szmuk P. Use of deep laryngeal oxygen insufflation during laryngoscopy in children: a randomized clinical trial. Br J Anaesth. 2016; 117(3): 350-357.
doi: https://doi.org/10.1093/bja/aew186