

Sanyar Video Laryngoscope Improved Time and First Pass Success of Tracheal Intubation in Intensive Care Unit in Compared to Direct Laryngoscopy

Mohammad Reza Khajavi¹, Razieh Ramezani^{1*}, Hamid Reza Sharifnia¹, Atabak Najafi¹, Khosro Barkhordari²

¹Department of Anesthesiology and Critical Care, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran.

²Department of Anesthesiology and Critical Care, Tehran Heart Center, Tehran University of Medical Sciences, Tehran, Iran.

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ABSTRACT

Background: Airway management and tracheal intubation in the ICU is a difficult procedure that may be concomitant with major complications. The purpose of this study was to evaluate the effect of the SANYAR® video laryngoscope(S-VL) on laryngeal view and first Pass Success of tracheal Intubation compared with direct laryngoscopy.

Methods: This comparative, prospective clinical study was conducted on 120 adult patients in a single-center, in a surgical ICU under the supervision of an anesthesiologist in a university hospital. Difficult airway predictors, glottic view, first Pass Success of tracheal Intubation and time of intubation were evaluated with Macintosh laryngoscopy (ML) or the SANYAR® Video Laryngoscope(S-VL).

Results: Tracheal intubation was performed in 58 critically ill patients using ML and 62 patients using S-VL. According to Cormack and Lehane (C&L) grading glottic visualization was more difficult using ML (41%, C&L grade 3 and 4) compared with S-VL (13%, C&L grade 3 and 4) $p < 0.001$. Intubation of trachea was more successful in the first attempt, in patients with at least one difficult airway predictor with a S-VL compared to ML (87% vs. 38%; $P = 0.001$), time of intubation was also shorter by using S-VL.

Conclusion: Among critically ill patients in the intensive care unit, who require intubation, the SANYAR video laryngoscopy improved glottis view compared to the Macintosh direct laryngoscopy and first-pass orotracheal intubation rate especially in patients with potentially difficult airways.

Airway management in critically ill patients is often associated with high morbidity and mortality, especially in emergencies and severe cardiorespiratory failure. In these critical conditions, the incidence of difficult intubations increases up to 20% [1]. In tracheal intubation visualizing the glottis is very important. In ICU patients, intubation conditions due to space constraints, patient position and comorbidities are very difficult.

Video laryngoscopes (VL) have revolutionized the practice of airway managements in routine and in the predicated difficult airway. VL has been used successfully in the operating room and ICU [2-3].

Various VLs with its design and specific features are currently available [4].

SANYAR® Video Laryngoscope(S-VL) is a Macintosh blade-shaped that has a high-resolution camera, surrounded by eight LED lamps working as a light source. Inside the handle, there is a rechargeable battery

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*Corresponding author.

E-mail address: r.ramezani87@yahoo.com

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and an electronic board that sends images via Wi-Fi to multiple mobile phones, tablets, or any device which have its application (Figure 1).

This device was very easy to use in the operating room and this study was designed to evaluate the glottic view, time of intubation, number of intubations attempts and success rate of intubation in a surgical and trauma ICU using the SANYAR® Video Laryngoscope(S-VL) or Macintosh laryngoscopy (ML).

Methods

The protocol study was reviewed and approval by the Ethical Committee of Tehran University of Medical Sciences (IR.TUMS.SINAHOSPITAL.REC.1400.019, Date: May 23, 2021). The trial was registered prior to patient enrollment at irct.ir (IRCT20130304012695N10, Date of registration: July 22, 2021). The study was performed in a 30-bed adult ICU under the supervision of anesthesiologists at a university teaching hospital. In this prospective clinical comparative study, endotracheal intubation of critically ill patients in the ICU was evaluated from July 2021 to May 2022. Prior to intubation, predictors of potentially difficult tracheal intubation such as restricted mouth opening, restricted neck movement, short thyromentum distance, short neck, and large tongue were recorded for each patient before tracheal intubation.

Inclusion criteria include: All patients who need an endotracheal intubation for respiratory support over the 18 years old.

Exclusion criteria include: Patients who have an airway pathology and a history of neck fixation surgery

During a 5-month evaluation period, direct laryngoscopy was done using a standard size 3 or 4 Macintosh blade(ML) for endotracheal intubation. Intubation was performed by the second year ICU Fellowship. The standard for all intubations was the presence of at least three intensive care nurses.

The patients were pre-oxygenated for 3 minutes at non-invasive positive-pressure ventilation before intubation. The medication before intubation was fentanyl (1 to 3 $\mu\text{g}/\text{kg}$) in every patient, with propofol (1mg/kg) based on patients' hemodynamic conditions. Atracurium (0.4 mg / kg) has always been used for neuromuscular block.

For all patients, a flexible hockey stick stylet was used for endotracheal intubation. Capnography was used for confirmation of the successful placement of the endotracheal tube. After 4 months the endotracheal intubation of patients was done by Sanyar ® video laryngoscope.

Necessary training to work with this device was given to the ICU staff. Two intensivists who had previously worked with this device in the operating room became responsible for endotracheal intubations.

The methods and drugs used for intubation were the same in both groups.



Figure 1- The SANYAR® Video Laryngoscope: 1) Mobile LCD display; 2) Handle with on / off button and battery charging connection; 3) Blade with a 65° field angle; 4) Camera with an antifog lens; 5) bite lock

Patients' characteristics and causes of intubation were recorded. Glottic view grading during laryngoscopy and first Pass Success of tracheal Intubation and time of intubation in each patient was recorded.

Statistical Analysis

After completing the study analyses of all data were performed using IBM SPSS (version 23.0).

Categorical outcome variable such as first-pass success was tested using Pearson's chi-squared test. Continuous variables were tested using an independent t- student test. Continuous data were presented as mean \pm standard deviation, while categorical data were presented as absolute values (numbers and percentages). A P value of less than 0.05 was considered statistically significant.

Results

At the end of data collection and completion of the study, 120 eligible patients were enrolled (Figure 2). The characteristic and clinical status of patients are described in (Table 1). Clinical status of patient base on the Simplified Acute Physiology Score was similar between groups (Table 1). Indications for intubation were not different in the two groups (Table 1). All intubations were performed by intensivists with 2 years of experience.

There was no difference in the airway characteristics of the patients in terms of prognosis for potentially difficult intubation in the two groups (Table 2).

By according to the Cormack & Lehane grading the rate of difficult laryngoscopy was more common with ML. Sanyar ® video laryngoscope improve glottis view and rate of difficult laryngoscopy significantly reduced in compare with ML (Table 3).

The success rate in the first intubation attempt was 87% in the S-VL group and 38% in the ML group. In ML group five patients' tracheal intubation was failed and intubation was achieved by VL.

The mean intubation time was significantly different between the two groups. In the Sanyar –VL group it was 13 seconds less than the Macintosh group.

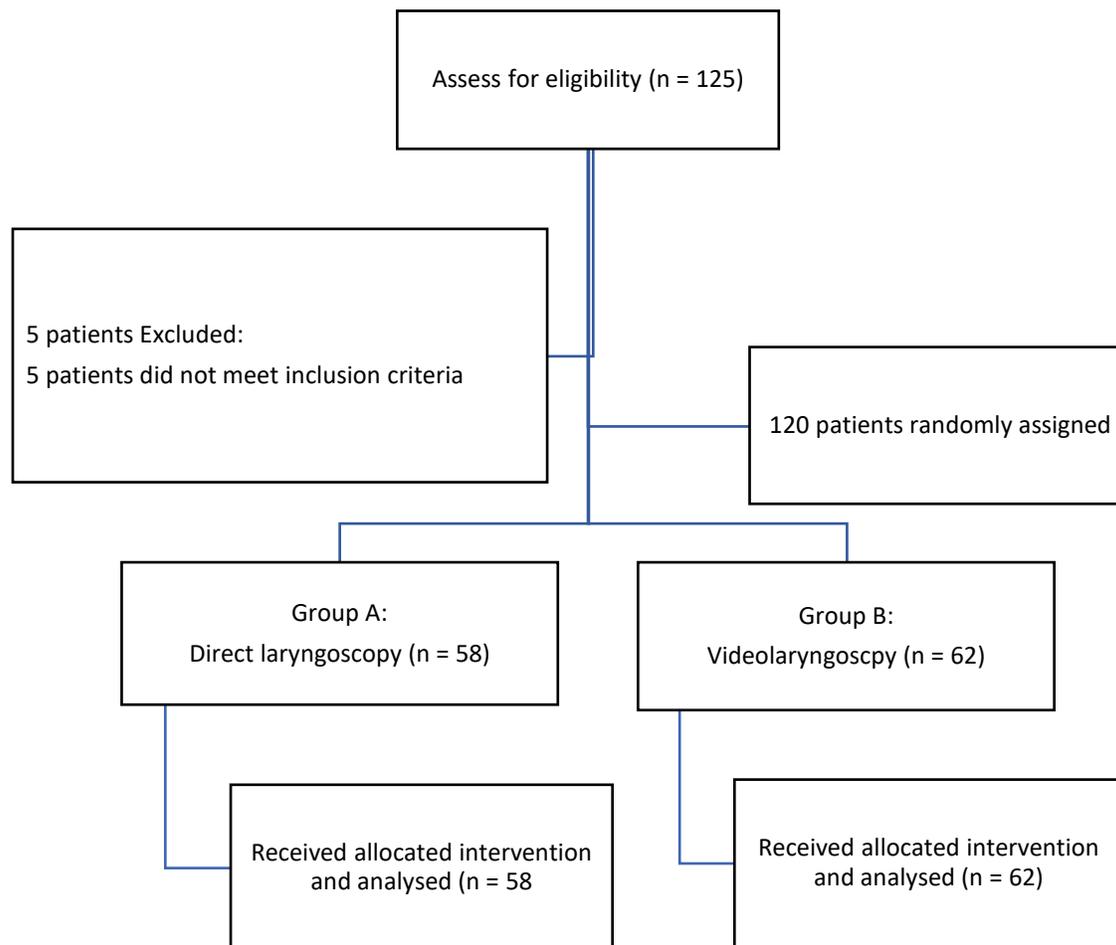


Figure 2- Flowchart of the study groups

Table 1- Characteristic and clinical status of patients during study

Variables	Macintosh laryngoscopy (n = 58)	Sanyar ® video laryngoscope (n = 62)	P value
Age (years)	45.82± 15.81	50.31± 14.53	0.12
Gender (male/female)	38/20	41/21	0.71
Simplified Acute Physiology Score	38.2 ± 14.8	36.9 ± 13.6	0.33
Indication for endotracheal intubation			
Reduced consciousness	23(39.6%)	26(41.9%)	0.21
Respiratory insufficiency	18(31%)	20(32.2%)	0.22
Self extubation	7(12%)	5(8%)	0.11
Endotracheal tube change	10(17.2%)	11(17.7%)	0.11

Data are presented as mean ± standard deviation or n (%)

Statistics: unpaired *t* test or Chi square test, as appropriate

Table 2- Comparison of predictors for difficult intubation in ML and VL groups

Predictors for difficult intubation	Macintosh laryngoscopy (n= 58)	Sanyar ® video laryngoscope (n= 62)	P value
Restricted mouth opening	3(5.1%)	4(6.4%)	0.9
Restricted neck movement	11(18.9%)	13(20.9%)	0.8
Short thyromental distance	6(10.3%)	8(12.9%)	0.6
Short neck	4(6.8%)	6(9.6%)	0.5
Large tongue	3(5.1%)	4(6.4%)	0.9

Data are presented as n (%).

Statistics: unpaired t test

Table 3- Comparisons of glottic views, success rate and difficult tracheal intubation in ML and VL groups

Variables	Macintosh laryngoscopy (n= 58)	Sanyar ® video laryngoscope (n =62)	P value
C&L grading			
I-II	34(59%)	54(87%)	0.002
III	19(33%)	8(13%)	0.001
IV	5(8%)	0	0.001
first Pass Success of tracheal Intubation	22(38%)	53(87%)	0.001
Second attempt success rate	31(54%)	9(13%)	0.001
Non intubate	5(8%)	0	0.001
Time of intubation(second)	34.31±5.3	21.38±6.3	0.001

Data are presented as mean ± standard deviation or n (%)

Statistics: unpaired t test or Chi square test, as appropriate

Discussion

The main purpose of this clinical study was to assess the application of the new Sanyar® video laryngoscope in endotracheal intubation of patients admitted to the intensive care unit. According to the preliminary results of this study, the use of Sanyar video laryngoscope improved glute visualization during airway management of patients in the ICU. The use of Sanyar® video laryngoscope significantly increased the success rate of the first attempt at endotracheal intubation in patients with difficult airway conduction. In our study, the incidence of moderate and difficult laryngoscopy (C&L grade 3 and 4) and intubation by using ML was 41% compared with the VL (13%). In the literature, the range of difficult intubation in critically ill patients admitted to the intensive care unit is about 20 to 30% [5-6]. Therefore, difficult intubation is common in the intensive care unit and may be influenced by the operator, the patient's clinical condition, and the type and quality of laryngoscope used [7-8]. The first goal of laryngoscopy, which is very stressful and time consuming, is to quickly find the complete view of the glottis.

One of the most important advantages of video laryngoscopes is that the glottis can be viewed very quickly and completely. By using these devices, without bending over the patient's face and bringing the eyes closer to the patient's mouth, the glottis can be seen indirectly through the monitor.

Overall, this study shows that, Sanyar ®video-laryngoscopy improved glottic visualization, particularly

in critically ill patients with potential difficult airways in compared to direct laryngoscopy.

This model of video laryngoscope has a low angulation blade with a high resolution camera near the tip of the blade which easily enters the mouth, and the surface of the blade has an angle of about 11 degrees to the left that easily directs the tongue to the left side of the oral cavity and the glottis will appear quickly.

The high successful first-attempt intubation by using VL in compare with ML (87% VS 38%) is the second finding of our study. The goal of intubation in the critically ill patients at the intensive care unit is the first-attempt success. It is dependent to experience of the operators, the use of sedative, hypnotic, neuromuscular blockade drugs and direct laryngoscope or video laryngoscope [9].

There are conflicting results in many studies to evaluate whether the use of video laryngoscopy can increase the success of intubation in the first attempt in the intensive care unit [10-11]. In tow meta-analyses video laryngoscopy improves the visualization of the glottis, first-attempt success intubation, and reduction of mucosal trauma [12-13]. In contrast Huang et al. in a meta-analysis, reported that video laryngoscopy did not improve first-attempt success rate of intubation [14].

In design of this model video laryngoscope, the distance between the tongue surface of the blade and its flange is 11 mm, therefore the endotracheal tube, which is properly shaped with a stylet, very easily enters the patient's mouth and placed in front of the glottis. This type of blade design will increase the speed of tracheal intubation. In this study, intubation time was shorter in

Sanyar® video-laryngoscopy in compared to Macintosh laryngoscopy. In our previous study, tracheal intubation time in patients was reduced using Sanyar® video laryngoscopy during induction of anesthesia [15].

Study Limitations

First, the results of this study are from one hospital, and this should be taken into account when extending the results to other clinical settings. A future multicenter study could further confirm the results of this study. Second, the study did not evaluate the complications of tracheal intubation.

Conclusion

Among the critically ill patients in the intensive care unit requiring intubation, SANYAR® video-laryngoscopy compared with Macintosh direct laryngoscopy improved glottis imaging, time of intubation and first-pass orotracheal intubation rate especially in patients with potentially difficult airways.

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