

## Intubation of Critically Ill COVID-19 Patients Using Conventional Laryngoscope in the ICU

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**Background:** Video laryngoscopy is recommended for critically ill COVID-19 patients due to safety concerns and avoid complications. It is not available in some places and thereby forcing the operator to rely on conventional laryngoscope. Intubations in critically ill COVID-19 patients are challenging and may lead to adverse complications which may be affected by the laryngoscope used. The aim of the study was to analyse predictors of difficult intubation, complexity of intubation and complications of using conventional laryngoscopy in intubations of COVID-19 patients in ICU.

**Methods:** A prospective observational study was done in COVID Intensive Care Unit of the Base Hospital- Teldeniya, Sri Lanka from 1<sup>st</sup> of January 2021 to August 2021. The data was collected using a Performa filled by operator at the end of the intubation. Apart from demographic data and clinical parameters, data related to intubation including MACOCHA score which is a validated score predicting difficult intubation in ICU<sup>(3)</sup> and Intubation difficulty scale (IDS) which measures the actual complexity of intubation<sup>(4)</sup> were collected. The complications related to intubation were also analysed.

**Results:** Approximately 84 out of 91 emergency intubations were done using conventional laryngoscope. Out of them 50.72 % were male and 49.27% were female. Mean age was 50.75 years. First pass success rate was 83.3%. 25% had MACOCHA score more than 3. Most patients scored on the desaturation component of the score. Despite this only 50% of the predicted difficult intubations actually had major difficulty in intubation. The commonest complication was hypotension. 12 had suffered cardiac arrest, and 4 of them were fatal.

**Conclusions:** Intubation of Critically ill COVID-19 patients are challenging but can be done successfully with conventional laryngoscope. However, one must prepare for complications including cardiac arrest.

**Key words:** COVID-19, ICU intubation, Conventional laryngoscope, video laryngoscope, intubation complications

### Background

With the onset of COVID-19 pandemic in 2019, the Intensive care units around the world have experienced increasing number of ICU admissions of patient requiring invasive ventilation.<sup>1</sup> Due to the infective nature of the SARS-CoV-2 virus through aerosol generation, the intubation procedure was regarded as a high risk procedure.<sup>2</sup> Many guidelines exist providing safe instructions to intubate critically ill COVID-19 patients.<sup>3</sup> Personnel protective equipment (PPE) were considered mandatory. In most institutions the intubations were done by the most

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experienced person which ensures rapid intubation reducing the time of exposure to the aerosol generation.<sup>4</sup>

Intubation of SARS-CoV-2 patients were usually done using video laryngoscope. This has shown to reduce the time required for intubation and hence the time of exposure to aerosols and has been regarded as the gold standard for intubating COVID-19 patients.<sup>4,5</sup> Institutions around the world have been purchasing video laryngoscope for this purpose. Video laryngoscopes are expensive and were not freely available during the time of the pandemic. This was the fate of the ICUs in most third world countries.

In most institutes in Sri Lanka which were managing COVID-19 critically ill patients did not have video laryngoscopes. Intensive care unit of the Base hospital Teldeniya, which was a designated COVID-19 treatment centre for COVID-19 in the central region of the country did not have the video laryngoscopy facilities at the start of the pandemic. All patients admitted to the ICU were intubated using conventional laryngoscopes. The unit acquired a video laryngoscope after 5 months of the commencement of the pandemic. Despite adequate training, the doctors preferred conventional laryngoscope over video laryngoscope to intubate these patients.

There are minimal data available on patients with COVID-19 who requires intubation in ICU. Furthermore, no literature available when intubation was performed using conventional laryngoscope. This study is one of the first studies which will assess the feasibility of using conventional laryngoscopes in intubating COVID-19 patients.

### **Objectives**

The study was designed to assess the intubation process of patients who were infected with COVID-19 with respect to prediction of difficulty in intubation and the presence of actual intubation when using conventional laryngoscope. The complications that occur during intubation were also assessed.

### **Methodology**

This prospective observational study was approved by the Ethical review committee of the National Hospital- Kandy, Sri Lanka (Ref NHK/ERC/17/2021) The study was carried out in COVID designated Intensive care unit, Base Hospital, Teldeniya, Sri Lanka from 1<sup>st</sup> of January 2021 to 31<sup>st</sup> of August 2021.

### **Intubation**

Intubation procedure was protocol based and the procedure was done by the most experienced person in the shift. Most of the staff had experience more than 2 years in ICU and some of the doctors had anaesthesia experience. All confirmed cases of COVID-19 were intubated with full personal protective equipment with KN 95 masks and face shields.

Possibility of potential difficult intubation was assessed using the MACOCHA score which is a validated tool in predicting difficult intubation in ICU patients.<sup>6</sup> This was done during the preparation stage of the intubation. Each procedure of intubation was performed with short acting muscle relaxants except for ones done during unexpected cardiac arrests.

An intubation attempt was described as insertion of the laryngoscope into the oropharynx. Preoxygenation was defined as providing supplementary oxygen prior to administration of sedation and muscle relaxants. Failed tracheal intubations were defined according to Difficult Airway Society (London, United Kingdom) guidelines as four or more attempts at intubation, the final recorded airway device being a supraglottic airway device, or the need for emergency surgical airway.<sup>7</sup>

Objective assessment of intubation difficulty was done using Intubation difficulty scale which is widely accepted in ICU set up.<sup>8</sup> Intubations performed outside the regular working hours (8:00 am to 4:00 pm) were defined as out of hour intubations.

Most patients were managed with non-invasive ventilation using a tight-fitting mask prior to

intubation via ventilators. This was continued until the time of intubation. Bag and mask ventilation was avoided. All attempts of endotracheal intubation were confirmed by capnography

### Data collection

All patients requiring intubation after admission to Intensive care unit was included in the study. No sample calculations were done as this was our first experience with a pandemic. The Performa which includes the technical details and clinical details related to intubation was filled by the person performing the intubation at the end of the procedure.

### Statistical analysis

Continuous variables are reported as mean  $\pm$  SD for normally or uniformly distributed data, or median (interquartile range) for data with skewed distributions. Categorical variables were summarized as number (%) and compared using a Pearson's chi-square test or two-tailed Fisher's exact test at a two-sided significance level of 0.05.

**Table 1:** Comparison of demographic data among non-difficult intubation and difficult intubation patient groups.

	Non-difficult intubation group N=70	Difficult intubation group N=14	Significance (p value)
Mean age (yrs)	55.59	54.29	0.12
Mean height (cm)	160.76	162.86	0.08
Mean Weight (in Kg)	70.71	73.64	0.18
<b>Gender</b>			
<b>M</b>	34(48.57%)	9(64.2%)	0.36
<b>F</b>	36 (51.4%)	5(35.7%)	
<b>Out of hour intubations (%)</b>	21 (30%)	5 (29.411%)	0.28

Emergency intubations in COVID ICU were performed due to many reasons.

In our intensive care unit, the commonest cause was hypoxic respiratory failure which accounts for 60% of intubations. Out of these patients 10%

### Results

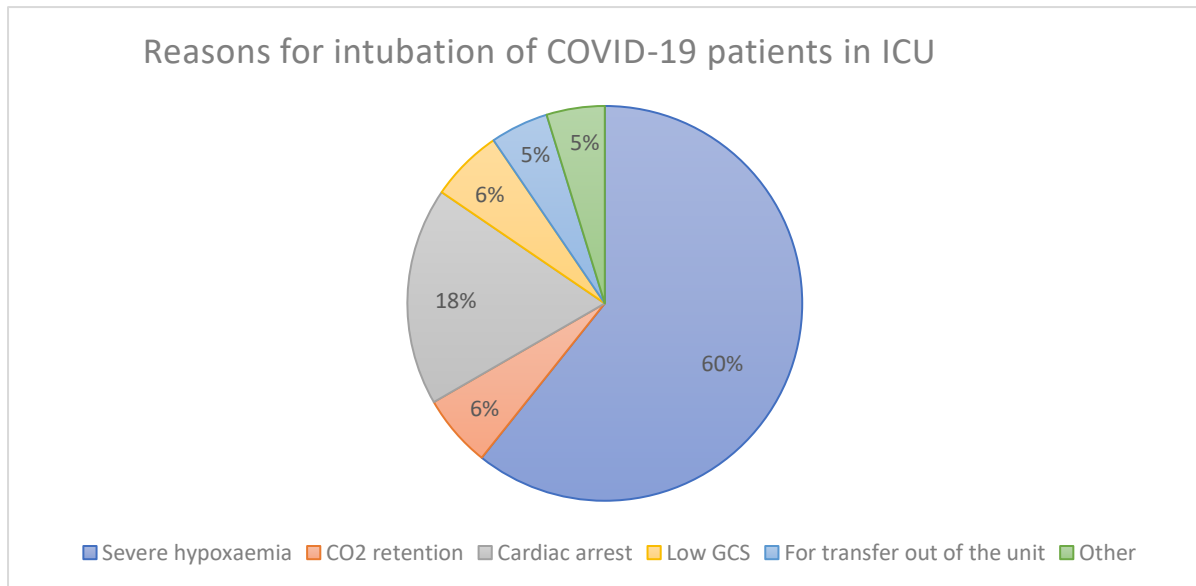
The intensive care unit had 202 patients with COVID -19 during the study period. Out of them 91 patients required emergency intubation and 84 of such intubations were done using conventional laryngoscope. Fourteen patients had difficult intubations having Intubation difficulty score more than 6. Rest of the 70 patients had first pass success in intubation which accounts for 83.33%.

In the total intubation cohort 50.72 % were male and 49.27% Were females. Mean age was 50.75 years. (SD 14.9). The demographic features were compared between the two groups; difficult intubation and non-difficult intubation groups. There were no significant difference in age, height and weight among the 2 groups. ( Table 1) Although statistical significance was not evident, male gender had a tendency for difficult intubation compared to females. Furthermore, performing intubations outside the regular working hours (8.00 – 16.00) had no impact on difficulty of intubation.

had hypercapnia at the time of intubation. The reasons for intubations are illustrated in figure 1. In addition, patients required intubation due to low loss of consciousness and cardiac arrests.

18% of the patients were intubated after cardiac arrest.

**Figure 1:** Reasons for intubation in COVID-19 patients in the Intensive Care Unit



Intubation difficulty was predicted using MACOCHA score in each patient. MACOCHA score is a validated scoring system to predict difficult intubations in ICU patients.

Table 2 shows the percentage of patients who had a positive value for each component of the MACOCHA score.

**Table 2 :** Presence of predictors of difficult intubation according to MACOCHA score

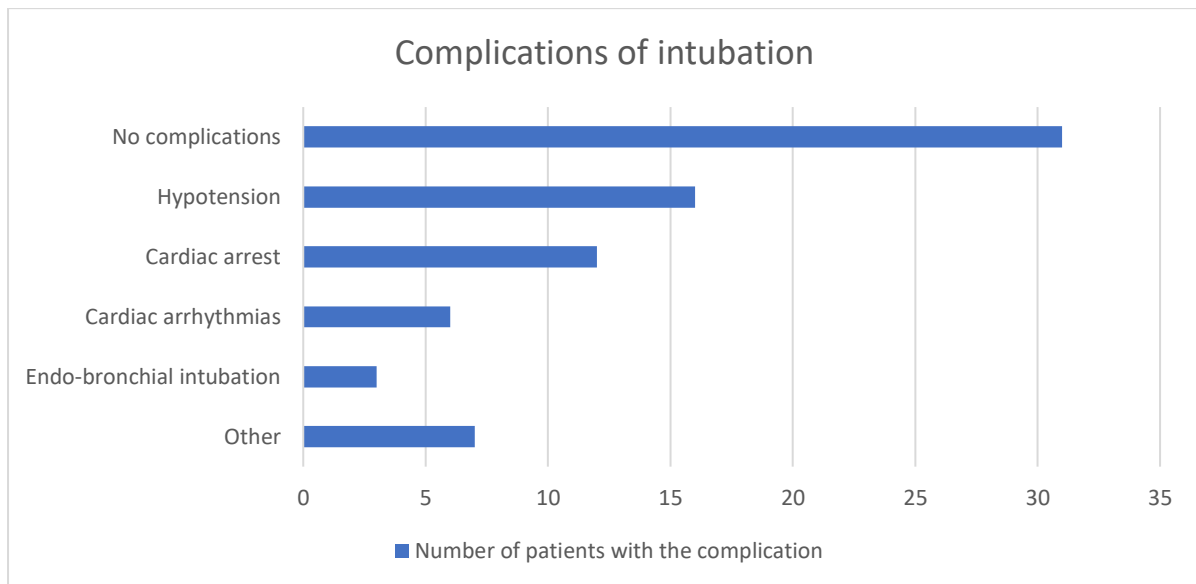
Factor	Points	Number of patients with the relevant factor in non-difficult intubation group (n=70)	Number of patients with the relevant factor in difficult intubation group (n=14)
Malampati 3/4	5	3(4.2%)	3(33.33%)
OSA	2	5 (7.1%)	0
Reduced mobility of the cervical spine	1	3(4.2%)	0
Limited mouth opening	1	3(4.2%)	1 (11.11%)
Coma	1	14 (20%)	4(44.44%)
Severe hypoxaemia	1	21 (30%)	5 (55.55%)
Non anaesthesiologists	1	5 (7.1%)	4(44.44%)

Twenty-five percent had MACOCHA score of more than 3. Most patients scored on the desaturation or severe hypoxaemia component of the score. Other factors like reduced neck mobility and limited mouth opening were not common in these patients.

Despite this only 50 % of the predicted difficult intubations actually had major difficulty in

intubation. Rest of the patients who had difficult intubation had a normal MACOCHA score. There were number of complications that occur at the time of intubation. The commonest complication was hypotension. 12 had suffered cardiac arrest, and 4 of them were fatal accounting for 4.7% of patients dying at the time of intubation. Figure 2 shows complications associated with intubations.

**Figure 2: Complications during intubation**



Only one intensive care doctor contracted SARS-CoV-2 infection during this period. The said doctor also had an outside contact source.

**Recommendations for future studies**

This study was conducted in a set up where only one type of laryngoscope was used ; that is the conventional laryngoscope. Future studies should focus on comparison of conventional laryngoscope and video laryngoscope in these types of challenging situations.

**Discussion**

Intubation is one of the commonest procedures carried out in Intensive care units.<sup>9</sup> In non-COVID patients, complications related to tracheal intubation can occur up to 40% of patients requiring intubation.<sup>10</sup> Therefore, it is regarded as a high risk procedure. To add to this risk , in COVID-19 patients , intubation is regarded as an aerosol generating procedure and possess a risk for the person handling the airway. Therefore, personal protective equipment (PPE) are considered essential.

Video laryngoscopy is the commonly used modality in intubating patients with COVID-19. There are several advantages of using video laryngoscopy in COVID-19 patients. It has shown to increase the first pass success, increase

the distance between the patient and the health care worker and also has shown to improve visibility when wearing PPE.<sup>3,11</sup> Increase distance between patient and health care worker allows having drapes and intubation boxes over patient’s face improving safety.<sup>3,11</sup>

For various reasons, some institutes use video laryngoscope for intubation. This is an expensive piece of equipment and therefore most of the institute in third world countries did not have enough number. At the same time the demand for the video laryngoscopes increased during the time of pandemic causing limited supply. Video laryngoscopy is a procedure which needs adequate training to perform. Most of the studies done among novice trainees in anaesthesia have shown that the skill of video laryngoscopy is easy to acquire when compared to direct laryngoscopy.<sup>12,13</sup> Therefore it should be an easy skill to master among the experienced anaesthetists.

In our set up, the unit did not have a video laryngoscopy at the beginning of the pandemic. Therefore, all intubations were performed using a conventional laryngoscope. Even when the video laryngoscope was available, the ICU doctors did not prefer it over a conventional laryngoscope and therefore, a majority of intubations were done with conventional

laryngoscope. This problem is not uncommon. According to the survey done in the UK by Cook and Kelly 92% of the hospitals that were included in the study had access to video laryngoscopy, but only 1/3 of them were actually using them regularly.<sup>14</sup> This attitude is expected to change after the pandemic as most institute are equipped with video laryngoscope.

Critically ill patients require intubation due to several reasons. In this cohort the commonest cause was hypoxic respiratory failure. Several studies have shown this as the commonest reason needing intubation in COVID-19 patients.<sup>15,16</sup> The experience from other COVID ICUs have shown that the patients could be extremely hypoxemic due to rapid deterioration. Rapid deterioration itself will make the intubation challenging and difficult in this population. In addition, considerable number of patients had CO<sub>2</sub> retention other than hypoxia indicating a ventilatory problem as well. Considerable number of patients had unexpected cardiac arrests requiring intubation. The incidence of cardiac arrests during intubation may be higher than that of non-COVID patients, but further studies are needed to assess this.

MACOCHA score has been used in ICU patients in predicting difficult intubation. It had been validated in various critical care settings. In MACOCHA score, desaturation more than 80% carries a high risk and 2 marks are allocated. In our cohort, most patients were scoring on the desaturation part of the score. SARS-CoV-2 mainly affect respiratory system and therefore these patients have more tendency to desaturation.

That makes them to have a higher MACOCHA score with a possibility of difficult intubation. In our study out of the predicted difficult intubations only 50% of patients actually had difficult intubation. Therefore, there may be other factors come into play when intubation is considered in this cohort. Many studies have shown that hypotension is the commonest complication that may arise during the time of ICU intubation in non-COVID patients.<sup>17,18</sup> This was similar in our

cohort and hypotension was the commonest. 12 had cardiac arrest during intubation. In non-COVID population this is as low as 1.5-4%.<sup>19</sup> This is a very low value compared to 14.2% of cardiac arrests that occur at the time of intubation in this cohort. Most of the patients who requires intubation has severe disease and tends to suffer from other complications like myocardial ischaemia and acute kidney injury. Therefore, the cause for cardiac arrest could be multi factorial. Out of 12 cardiac arrests 4 were fatal.

The study mainly focusses on laryngoscopy that are performed with conventional laryngoscope. There is no comprehensive analysis of complications that occur during conventional or video laryngoscopy in SARS-CoV-2 patients. This study will add to the literature as one of such study.

### **Conclusions**

Intubation is a high-risk procedure carried out in ICU. Several methods can use to predict difficult intubation in critically and MACOCHA score is one of them. Intubation of Critically ill COVID-19 patients are challenging, but can be done successfully with conventional laryngoscope. However, one must prepare for complications including cardiac arrest.

### **Ethics approval and consent to participate**

The study protocol is performed in accordance with the relevant guidelines and received ethical approval from the Ethical review committee of National Hospital, Kandy, Sri Lanka (Ref NHK/ERC/17/2021). Informed consent was obtained from the patients or their next of kins.

### **Consent to publication**

Not applicable.

### **Availability of data and materials**

The datasets used and analysed during the current study are available from the corresponding author on reasonable request. The dataset is not publicly available as they contain data that may

compromise the identity of the research participant.

### Competing interests

The authors do not have any competing interests to declare.

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