



# Intubation Rate In COVID-19 Patients: A Brief Review

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**Keywords:** Intubation; COVID-19; Intensive care unit; Pulmonary disease; Infectious disease.

## Abstract

**Background:** Tracheal intubation is the placement of a flexible plastic tube into the trachea to maintain or keep an open airway. COVID-19 includes a wide range of symptoms such as fever, cough, and tiredness. Also, some complications of COVID-19 like respiratory failure and respiratory distress are life-threatening, therefore; they need conservation and supportive treatment strategies.

**Methods:** This review study aimed to investigate the rate of intubation in COVID-19 patients. Studies with inclusion criteria from 2020 were included in this study.

**Results:** 15 studies were included in this review. Studies were conducted in the USA, Spain, Italy, China, and Iran. Most patients were intubated in the intensive care unit. Rapid sequence induction was mostly used for intubation. According to the previous studies the intubation rate reported 5 to 88 %.

**Discussion and conclusion:** The most important reasons that require endotracheal intubation were hypoxia, respiratory distress, loss of consciousness, and cardiopulmonary arrest. Studies showed that during a pandemic, due to overcrowding in the intensive care unit, tracheostomy might be a suitable solution for patients to get off the mechanical ventilation, reducing the respiratory effort in patients with limited pulmonary reserves, shortening the dead space, and enabling the suctioning of accumulated mucous. The discrepancy in statistics may be due to the variety of study population, study environment, or intubation criteria. There were a few shreds of evidence regarding extubation. Due to the lack of definitive treatment for COVID-19, and the empirical treatments based on research, it seems that a comprehensive intubation algorithm in covid-19 patients is extensively required.



## Background

Tracheal intubation, usually simply referred to as intubation, is the placement of a flexible plastic tube into the trachea to maintain or keep an open airway. In some cases (e.g. Cardio-pulmonary resuscitation) it is used to deliver administer certain medications. Intubation is a invasive procedure for individuals that have respiratory disease and uses for number of people that have deprived from having a open air way and oxygenation. Some circumstances might require intubation such as; loss of consciousness, major surgeries, decreased oxygen saturation (hypoxemia), airway obstruction (laryngospasm), or respiratory disease such as acute respiratory distress syndrome [1]. Since this is an invasive and uncomfortable procedure, intubation is often performed under general anesthesia and a neuromuscular-blocking medication.

In common with emerging COVID-19 in Wuhan-China and the spread of COVID-19, COVID-19 patients (hypoxemic or ARDS) management is one of the most important issues for healthcare providers. Decreased oxygen saturation, respiratory failure, and acute respiratory syndrome are the most prevalent causes of covid-19 patient intubation [1,2]. Approximately 14–30% of hospitalized patients diagnosed with COVID-19 develop a severe respiratory failure requiring intensive care [3,4,5] so that roughly 3.2% of patients with COVID-19 required intubation and invasive ventilation at some point in the disease periods [6]. The need for intubation and mechanical ventilation in those who are critically ill is vary ranging from 30 to 100 percent [7].

Currently, different statistics are provided on the intubation rate of COVID patients in intensive care units. There are various statistics on the intubation of patients with covid-19. On March 4, 2020, 80,409 cases were diagnosed in China, of which 3.2% required intubation [8]. Also, in a study conducted in New York, 12.2% to 33.1% of covid-19 patients needed intubation [9,10]. The duration of intubation is different for each patient. The duration of intubation is different for each patient. Wali et al examined the course of 5 Covid-19 patients who needed invasive oxygen therapy [11]. It was found that most patients were intubated in the first 2 days of admission. The duration of ventilation with an endotracheal tube was between 4 and 30 days. Intubation can be due to various reasons, such as loss of consciousness, decreased oxygen saturation, and most vital is ARDS [12]. In this situation, intubation at the right time is very important and if delayed in intubation might cause patient death [13]. Xiao Lu's studies show that mortality in intubated patients with Covid-19 is higher than in patients who did not intubate [14]. Most intubations are performed in the ICU. According to recent studies, more than 10% of COVID-19 patients

in northern Italy who suffer from hypoxia were intubated in the ICU [15]. A unique syndrome from hypoxed patients affected covid-19 under "Happy Hypoxia" has introduced. This patients haven't respiratory symptoms and are alert intellectually, but is observed that often suddenly involve sever hypoxia [16].

The timing of intubation as well as the decision to endotracheal intubation may be unique to COVID-19 patients' case by case [17]. The threshold for intubation may be lower in COVID-19 since the use of high-flow nasal oxygen [2] or non-invasive ventilation may potentially increase the risk of transmission to healthcare workers. Should attend that intubation is a dangerous procedure and certainly necessary for patient affected acute respiratory symptoms and able to risk of transmission respiratory viral infections increases. The application of airborne precautions is highly recommended throughout [18,19]. The most important clinical manifestation in patients with Covid has been respiratory failure in 2020. Attention should be paid to the different effects of different oxygen therapy concentrations to avoid prolonged high-concentration oxygen therapy [20]. Due to the involvement of the alveoli in covid-19 pneumonia, it is vital to deliver oxygen at the right concentration to maintain oxygen saturation and avoid decreased partial pressure of oxygen.

Currently, scattered statistics of COVID-19 patients' intubation have been presented in various studies and countries. This study aiming a review of intubation rate statistics in COVID-19 patients in different countries.

## Methods and materials

The literature search using the following search strategy was conducted on the google scholar database on October 1st, 2020 to identify eligible articles: (COVID-19 and intubation) and (intubation in COVID-19). The publication time was limited to 2020 onward. A total of 6340 papers were identified by the initial search. Two reviewers independently reviewed the abstracts and full texts. Inclusion criteria: The studies in which, among the study population, a percentage of COVID-19 infected patients (not all patients) required endotracheal intubation. Reports regarding intubation in COVID-19 which consist of the patient's intubation rate were included in this review. The main question of this review is how many patients infected by covid-19 were intubated?.

## Results

Overall, 15 studies regarding the intubation rate in COVID-19 patients were included in the final analysis. Most of the patients were intubated in the intensive care unit. Studies were conducted in the USA, Spain, Italy, China, and Iran (Table 1).

**Table 1:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram.

Sex	Age	Ward	Extubation Rate %	Intubation Rate %	Cause of intubation	Country	Authors
210 men 128 women	39 (31- 45)	ED <sup>1</sup>	–	8% (28/338)	Respiratory failure	USA, New York (10-26 March)	Danielle Toussie, et al [21]
78 (Not specified)	58.4 ± 13.7	ICU	–	12.82% (10/78)	Respiratory failure	Iran, Tabriz	Khalil Ansarin [22]
60 % men 40 % women	59	ED	–	13 %	Long term Hypoxia	USA	ND Caputo, et al [23]
Mostly Men	50 – 81	Oncology	–	5 %	Hypoxia and Lung injury caused by Oxygen decreased	USA	H Miyashita, et al [24]
Mostly Men	47 -70	Infectious	–	26.7 %	Hypoxia	USA	P Sinha, et al [25]

52 % (53/102) men 48% (49/102) women	68 (61-75)	ICU	–	57% women (59/102)	Hypoxic respiratory failure	USA, New York (12 March – 6 May)	Jia Luo, et al [26]
78 % (83/108) men 22 % (25/183) women	64 (57-70)	ICU	12/822 (1.4%)	20% 163/822	–	Italy, Bologna	Michele Bartoletti, et al [27]
men 137 (71%)	60 ± 13.8	–	–	62.7 %	–	USA	G_Rojas_marte [28]
men 90 (53%)	57 ± 11	ICU	–	38.29%	–	USA	Marcus R.Pereira [29]
men 53 (33%)	62 ± 14.3	ICU	–	–	ARDS	USA	Tiffany N. Chao [30]
35 (67%) men 17 (33%) women	59.7 ± 13.3	ICU	–	42 % 22 out of 52	ARDS	China	Xiabo Yang, et al [31]
1304 men 287 women	63 (56 – 70)	ICU	–	88 % 1150 out of 1591	Hypoxia and ARDS	Italy, Lombardy	Giacomo Grassellie, et al [32]
49% men in the PE group 45% men in the non-PE group	62 ± 16 in the PE group 59 ± 15 in the non-PE group	ICU	–	65% in the PE <sup>2</sup> group 67% in the non-PE group	Hypoxia and PE		N Poyiadji, et al [33]
No data available	No data available	ICU	44.5% 842 out of 1890	16.4 % 1890 out of 11493	–	Spain	Martin-Villares C, et al [34]
9 men 7 women	58 (47 – 68)	ICU	–	56.25 % 9 out of 16	Respiratory failure	Wuhan, China	Lu X, et al [35]

Various statistics of intubation rates in COVID-19 patients are reported ranging from 5–88 %. This difference in statistics can be due to differences in sample size, study environment (wards), and intubation criteria [23,26]. Rapid Sequence Induction (RSI) or modified RSI was mostly used for intubation [36]. Studies showed that factors affecting COVID-19 severity (such as underlying disease, age more than 50, smoking, body mass index, and comorbidity condition) could exacerbate a patient's condition and accelerate the necessity for endotracheal intubation [24,26]. The most important reasons that require endotracheal intubation are hypoxia, respiratory distress, loss of consciousness [21,22]. The cardiopulmonary arrest also could be one of the intubation causes. In a study by Xu, et al. It was found that the intubation of critically ill patients with COVID-19 is mostly due to respiratory failure, but there is also a small number of patients who undergo intubation due to secondary acute Heart Failure or Airway Obstruction [37].

Some studies revealed that due to the limited capacity of intensive care units during the COVID-19 pandemic [38], tracheostomy seems to be a suitable solution for patients to get off the mechanical ventilation [39], reducing the respiratory effort in patients with limited pulmonary reserves, shortening the dead space and enabling the suctioning of accumulated mucous [34].

Despite the rarity of available studies regarding extubation in COVID-19 patient, some evidences revealed the extubation rate ranging 1.4 % - 44.5% [27,34].

As this study is a retrospective study, the number of studies included in this investigation is relatively small, and further large-scale prospective studies are needed to confirm our findings.

### Conclusion

SARS-CoV-2 is the coronavirus responsible for the COVID-19 pandemic of 2020. It is one of seven human transmissible coronaviruses and is thought to have originated from the bat Coronavirus. COVID-19 might induce severe respiratory distress. Acute respiratory distress in covid-19 patients would demand endotracheal intubation and mechanical ventilation.

According to the previous studies the intubation rate reported 5 to 88 %. This discrepancy in statistics may be due to the

variety of study population, study environment, or intubation criteria. However, there are a few pieces of evidence regarding extubation, therefore; more investigations are required to determine intubation outcomes and extubation. Due to the lack of definitive treatment for COVID-19, and the empirical treatments based on research, it seems that a comprehensive intubation algorithm in Covid-19 patients is extensively required.

The findings of this study are a review of intubation rates based on previous studies. These statistics are preliminary and more research is needed to examine the correlation and the factors affecting the intubation of patients.

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