Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Perspective

Evaluation of invasive ventilation (intubation) prognosis in patients with Covid-19 symptoms☆,☆☆

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ABSTRACT

Background: Coronavirus 2019 (COVID 19) has been reported as a pandemic by the world health organization. Increasing number of cases and associated mortality have demanded the need for clinical studies and researches.
Objective: The aim of this study is to evaluate intubation prognosis of the COVID 19 patients referred to Shahid Beheshti hospital in Qom city.
Method: COVID 19 patients referred to (XXX)were included in this study. Clinical sign and symptoms were recorded for each patient in a questionnaire. The diagnosis was made using real time polymerase chain reaction and chest CT scans. Lab findings from renal and liver function tests, blood count, c-reactive protein and electrolytes were also recorded. Shortness of breath was measured using oxygen saturation levels in these patients. The data was recorded in the electronic form and was analyzed using SPSS v21.
Result: Of 317 patients included in this study, the average age of COVID 19 patients were 59.71 ± 16.46 years. The need of ventilation among the patients older than 50 years was significantly higher than younger patients, $p = 0.013$. Smoking status, gender and drug addiction was not associated with the need of invasive mechanical ventilation, $p = 0.73$, $p = 0.44$ and $p = 0.76$. Patients need invasive mechanical ventilation compared to those receiving non-invasive ventilation were significantly older, $p = 0.001$.
Conclusion: The need of mechanical ventilation is significantly greater in advanced age COVID-19 patients.

1. Introduction

First case of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) causing COVID 19 was reported in December 2019, in Wuhan, China and has spread broadly around the world. According to the situation report 119 by the World Health Organization (WHO), 4,618,821 cases have been reported till May-18-2020, along with 311,847 deaths. The United State and European regions have been reported with the highest number of cases so far, 2,017,811 and 1,890,467 [1]. The infection is known to have zoonotic origin associated with COVID 19 similar to severe acute respiratory syndrome (SARS)-coronavirus (80% nucleotide sequence identity) derived from bats. The virus is, therefore, evident to belong to orthocoronavirinae subfamily and betacoronavirus genus. The initial transmission of the virus was reported from the people who visited wet market in Wuhan City. Person-to-person transmission of the virus is believed by the close contact and aerosol droplets from sneezes and coughs [2]. Nonetheless, vertical transmission from pregnant mother to the fetus/child is not reported so far [3].

☆ This study was approved by the Research Ethics Board of Qom University of Medical Sciences.(IR.MUQ.REC.1399.066).
☆☆ https://ethics.research.ac.ir/ProposalCertificateEn.php?id = 130336&Print = true&NoPrintHeader = true&NoPrintFooter = true&NoPrintPageBorder = true&LetterPrint = true.

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The virus is known to cause respiratory tract infection similar to pneumonia. Commonly, patients are known to be presented with fever, dry cough and breathing difficulty. The mean period for the onset of the symptoms has been reported to be 14 days [2]. However, factors such as age, comorbidities such as diabetes, hypertension and coronary heart disease and increased D-dimer are characterized with poor prognosis [4]. Computed Tomography (CT) scan from the patients with COVID 19 pneumonia is seen to show ground glass opacity which progresses into craving patterns and consolidation [5]. Additionally, throat samples or sputum is used to detect viral RNA via real time polymerase chain reaction (RT-PCR). Chest CT is more sensitive for the screening of COVID 19 among patients with clinical signs and symptoms [6].

The Islamic Republic of Iran is reported to be presented with 120,198 cases with 6988 deaths according to the 119th situation report by the WHO [1]. We hypotheses that advanced age, smoking, and male gender are likely to be associated with worse prognosis and corresponding need of mechanical ventilation. The aim of this study is to evaluate the requirement of invasive mechanical ventilation among COVID 19 patients presented in Qom's Shahid Beheshti hospital.

2. Methods

All COVID 19 patients aged 18 years and above referred to Shahid Beheshti Hospital in Qom from February to March 2020 were included in this study. The sample size of 317 patients was obtained using d = 0.04, P = 0.75,$\alpha = 0.05$ in the following function:

$$n = \left(\frac{z1 - \alpha/2}{d}\right)^2 pq$$

Following the approval of the research proposal by Research Council of the Faculty of Medicine and University Ethics Committee, the data was collected in the form of a questionnaire for each patient. Written consent was obtained from the patients to access their medical information for the evaluation. Inclusion criteria of the study included the patients presented with clinical symptoms of the virus such as dry cough, fever, sore throat, myalgia, headache, breathing illness, nausea and vomiting and hemoptysis and were recorded. Shortness of breath was marked with oxygen saturation (SaO 2) levels below 93%.

Demographic data was entered in the questionnaire along with the data regarding following lab-based findings; CBC (complete blood count), CRP (c-reactive protein), electrolytes, RFT (renal function test), LFT (liver function test) and coagulation test. Diagnosis of COVID 19 was confirmed using RT-PCR of nasal and pharyngeal mucosa samples. CT findings were also recorded for all the patients. Management of the infection was based on 3–4 medicines.

The data was computerized and statistically analyzed using SPSS v21 software. The outcomes were reported in the form of frequency distribution tables and graphs. A paired *t*-test was conducted to compare oxygen levels before and after intubation.

Fisher's chi-square and precision tests were used to compare the rate of invasive mechanical ventilation in qualitative variables. Independent T-test was also used to compare quantitative variables with respect to invasive ventilation status. Comparison of clinical symptoms before and after invasive ventilation was also performed using paired T-test.

Statistical calculations were performed using SPSS 22 software. The significance level was considered to be 0.05.

This study was approved by the Research Ethics Board of (XXX).

3. Results

3.1. Descriptive statistics

As shown in Table 1, of the 317 patients 167 were male and 139 were female. The number of patients over the age of 50 years was 214 and 98 patients were below the age of 50.

The average age of patients was 59.71 ± 16.46 years. 75% of patients are between the ages of 48 and 72, Table 2.

3.2. The relationship between age and invasive ventilation

The rate of invasive mechanical ventilation was 11.8% for patients under 50 years of age and 24.9% for patients over 50 years of age. The Chi-Square test showed a significant relationship between age and the need of mechanical ventilation, therefore, the risk of need of mechanical ventilation among patients over the age of 50 was 2.5 time more, p = 0.013, (Table 3) (Fig. 1).

3.3. The relationship between gender and mechanical ventilation

The rate of invasive mechanical ventilation was 29.9% in men and 19.3% in women. The Chi-Square test showed that there was no significant relationship between gender and the need of mechanical ventilation and the need of mechanical ventilation was same in men and women, p = 0.44.

3.4. The relationship between smoking status and mechanical ventilation

The rate of invasive mechanical ventilation was 23.3% for smokers and 20.7% for non-smokers. The Chi-Square test showed no significant relationship between smoking status and the need of mechanical ventilation, p = 0.733.

3.5. The relationship between drug addiction status and mechanical ventilation

The rate of invasive mechanical ventilation was 93.7% among drug addicts and 94.5% among non-addicts. Fisher's exact test showed that there was no significant relationship between addiction status and the need of mechanical ventilation, p = 0.762.

Table 1
Frequency of genders.

Sex					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	167	52.7	54.6	54.6
	female	139	43.8	45.4	100.0
	Total	306	96.5	100.0	
Missing	System	11	3.5		
Total		317	100.0		

Table 2
The average age of patients.

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	≤50	98	30.9	31.4	31.4
	>50	214	67.5	68.6	100.0
	Total	312	98.4	100.0	
Missing	System	5	1.6		
Total		317	100.0		

Table 3
The relationship between age and invasive ventilation.

Crosstab					
			intubation		Total
			yes	no	
age (Binned)	≤50	Count	11	82	93
		% within age (Binned)	11.8%	88.2%	100.0%
	>50	Count	51	154	205
		% within age (Binned)	24.9%	75.1%	100.0%
Total		Count	62	236	298
		% within age (Binned)	20.8%	79.2%	100.0%

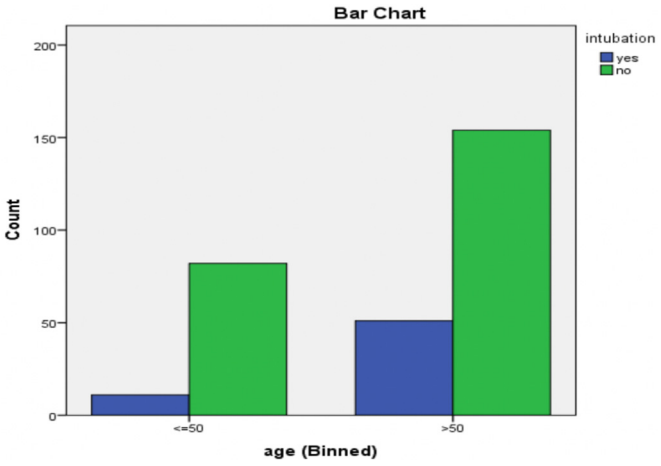

Fig. 1. The Chi-Square test showed a significant relationship between age and the need of mechanical ventilation.

3.6. The comparison of age between invasive mechanical and non-invasive ventilation among patients

The mean age of patients with invasive mechanical and non-invasive ventilation was 65.82 ± 15.307 and 58.24 ± 16.35 years. The independent T-test showed that the age of patients needing invasive mechanical ventilation was significantly higher than patients receiving non-invasive ventilation ($p = 0.001$) (Table 4) (Fig. 2).

4. Discussion

Respiratory failure due to novel SARS-CoV-2 infection is associated with prolonged need of mechanical ventilation [7]. Studies have reported mortality rate of 25 and 57% among patients requiring intubation and mechanical ventilation [4,8]. Data from studies conducted in China has revealed that older people with chronic comorbidities are likely to be presented with severe prognosis and have higher mortality rate than younger population. 80% of deaths reported in China are among the patients aged ≥60 years. Similar data has been provided through initial studies in the United States [9]. The outcomes of our study indicated that the advanced age among COVID 19 patients is associated with an increased in of mechanical ventilation. The need of invasive mechanical ventilation does not differ significantly with smoking status, drug addiction and gender.

A number of studies have concluded that smoking status might not significantly affect the risk of COVID 19 [10–12]. However, it is also indicated that smoking and chronic obstructive pulmonary disease is associated with increased expression of angiotensin converting enzyme (ACE) receptors in lungs, that can lead to worse prognosis [13]. Patients' hesitancy to admit their smoking and drug-addiction status due to cultural or family pressure could have led to these discrepancies in our findings.

A study by Liu W, Tao ZW, Wang L*et al* [14] including 78 COVID 19 patients reported that the severity of the disease is significantly associated with advanced age, history of smoking, fever, respiratory failure and increased serum albumin and c-reactive protein. A meta-analysis by Vardavas CI, Nikitara K [15] concluded that smokers are 2.4 times more likely to need ICU admission and mechanical ventilation. The outcomes of this meta-analysis are in parallel with our findings.

Goyal P, Choi JJ, Pinheiro LC*et al* [16] reported in their study from New York, the USA, that the need of mechanical ventilation is greater among male patients, those presented with atrial arrythmias and are undergoing renal replacement therapy. Additionally, obese patients and patients with elevated serum inflammatory markers also fall under this group. Our study reported that the need of mechanical ventilation did not differ among male and females. We did not provide the data regarding comorbidities and inflammatory markers. In a retrospective study enrolling 56 COVID 19 Liu K, Chen Y, Lin R, Han K [17] described that need of ventilation is significantly greater among elderly patients, aged ≥ 60 years. The results of our study reported that the need of mechanical ventilation is significantly greater among patients older than 50 years.

Table 4
The comparison of age between invasive mechanical and non-invasive ventilation among patients.

Group Statistics					
	intubation	N	Mean	Std. Deviation	Std. Error Mean
age	yes	62	65.82	15.307	1.944
	no	236	58.24	16.358	1.065

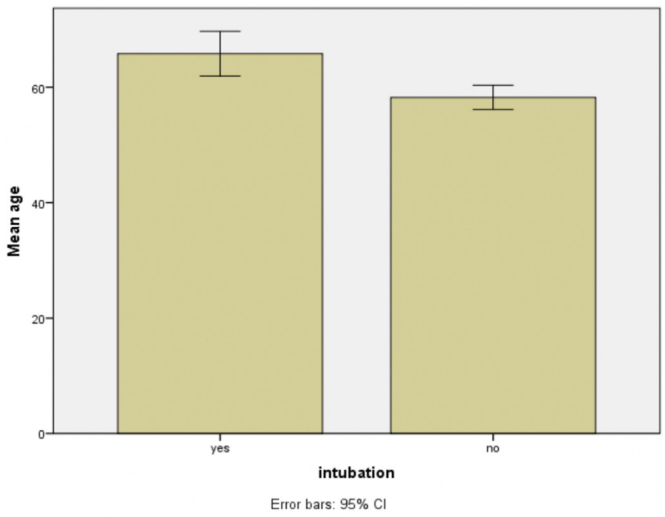

Fig. 2. The independent T-test showed that the age of patients needing invasive mechanical ventilation.

Similarly, presented that mortality rates among COVID patients who received mechanical ventilation aged between 16 and 65 years and 65+ years were 76.4% and 97.2%.

Our study is limited to a relatively smaller sample size and need of invasive mechanical ventilation has not been presented in correlation with comorbidities and biochemical parameters.

A number of evidences from previous studies and our study imply that the load of mechanical ventilators is likely to increase in health care center where greater number of cases include elderly patients. Studies evaluating further patients' characteristics are therefore required to provide immediate and better treatment.

5. Conclusion

Our study indicated that advanced age is associated with an increased need of mechanical ventilation among COVID19 patients. The population of the patients studied here did not present a significant correlation with the need of ventilation with drugs, smoking and gender status. Nonetheless, studies including vast amount of data are required to validate these outcomes.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Author contribution

Dr. Nina Farzan and Dr. Seyed Yaser Foroghi ghomi and Dr. Mehdi Birjandi: Planned the study, wrote the protocol, collected the data and drafted the manuscript and accepted the final draft.

Dr. Sepideh Vahabi and Dr.Reza Shirvani and Dr. Mansoureh Shakeri: Planned and designed the study, collected the data.

Dr. Behrooz Farzan and Dr. Shima sadat Hashemi Madani and Dr. Mahmood Araghi: analyzed the data and critically revised the draft and finally approved the manuscript.

Declaration of competing interest

The authors deny any conflict of interest in any terms or by any means during the study.

Guarantor

Dr. Nina Farzan.

Research registration number

1. Name of the registry: N/a
2. Unique Identifying number or registration ID: N/A
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