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Research Paper

Invasive mechanical ventilation and clinical parameters in COVID19 patient: Can age be a factor?

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Abstract
Background: Severe of corona virus disease 2019 (COVID19) is presented with respiratory distress and requires mechanical ventilation. Advanced age is one of the significant risk factors of the worst prognosis and mortality in this disease. The aim of this study is to investigate the clinical parameter among COVID19 patients under mechanical ventilation in regard to the age groups.

Method: In this retrospective study, COVID19 patients under invasive mechanical ventilation at Shahid Beheshti Hospital in Qom were included. The patients were divided in two age groups, those aged ≥50 years and <50 years. Clinical parameter of these patients like blood pressure, heart rate, respiratory rate, oxygen saturation and body temperature were recorded at the time of mechanical ventilation and 24, 48 and 72 h under the mechanical ventilation.

Result: A total of 317 patients were included in the study where 214 patients were over the age of 50 years and 98 were under 50 years. The mean age of patients was 59.71 ± 16.46 year. At the start of mechanical ventilation and 24, 48 and 72 h during the ventilation, blood pressure, pulse rate, rate of respiration, oxygen saturation, Glasgow coma scale and temperature were not significantly different at among the two age groups, p > 0.05, respectively.

Conclusions: The findings of the study indicated that prognosis of COVID19 patients under invasive mechanical ventilation in terms of changes in clinical parameters might not be associated with the age.

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1. Introduction

Globally, more than 93 million people have been reported with coronavirus disease 2019 (COVID19), with 2 million deaths [1]. COVID19 is caused by novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus and is associated with system-wide presentations, primarily and commonly seen as dry cough, dyspnea, fever, sore throat and involvement of the lungs [2]. In case of severe acute respiratory syndrome, mechanical ventilation is required [3,4].

Invasive mechanical ventilation provides oxygen and ventilation via positive pressure into the airways. The procedure is commonly conducted by endotracheal tube [5]. It is gold standard to support breathing in patients with respiratory failure. These patients are also at a greater risk of developing secondary infections [6].

Studies have reported high mortality rate among COVID19 patients admitted to the intensive care unit (ICU), whereas, intubation may result death in approximately 80% of the patients [7–10]. This has resulted in ICU saturation and increased a significant burden on the over all health care system. 66.6% patients entering critical care units are likely to require mechanical ventilation within first 24 h of the admission [11]. Additionally, patients undergoing mechanical ventilation might not respond well to the therapeutic protocol, including antiviral drugs [12,13].

Jackson, Gold [14] reported that advanced age is one of the strongest predictors of the mortality-related to mechanical ventilation in COVID19 patients. The conclusion of the study stated that this
predictor can be superior to other risk factors such as abnormal vital and labs and comorbid condition. We hypothesized that advanced age can be associated with poor prognosis following mechanical ventilation. Therefore, the aim of this study is to evaluate the age-associated changes in the clinical parameters of the patients under mechanical ventilation at different time intervals.

2. Methods

This retrospective study was performed to evaluate the prognosis of invasive ventilation in patients with COVID-19 at Shahid Beheshti Hospital in Qom from January 2020–June 2020. Patients confirmed with COVID19 via positive PCR test from nasal or lower respiratory sample and were admitted to the hospital were included in the study. We excluded the patients with significant comorbidities like malignancies, cardiovascular disease, pulmonary disease and renal problems, patients receiving non-invasive ventilation, history of usage of glucocorticoids and corticosteroids, those who underwent cardiac arrest before intubation, received extracorporeal carbon dioxide removal and those who were smokers and drug users. In our study, invasive mechanical ventilation was performed using endotracheal tube or tracheostomy.

Data regarding the rate of invasive ventilation was collected from the files of the patients in regards with demographic characteristics and clinical and laboratory signs. Parameters such as heart rate, pulse rate, respiration rate, blood pressure and body temperature were evaluated at the start of mechanical ventilation and 24, 48 and 72 h of the ventilation. These variables were compared among the patients aged 50 years and above and those less than 50 years.

The mean and variance indices were used to describe the concentration and dispersion of quantitative data and relative frequency and frequency indices for qualitative variables. Chi-square and Fisher’s exact tests were used to compare the rate of invasive ventilation in qualitative variables. Independent t-test was also used to compare quantitative variables according to the state of invasive ventilation. Comparison of clinical symptoms before and after invasive ventilation was performed using paired t-test.

Statistical calculations were performed with SPSS 24 software. Significance level was considered as p < 0.05.

This study was approved by the Research Ethics Board of Shahid Beheshti Hospital in Qom.

The study is reported in accordance with STROCSS criteria [15]. The registry and the unique identifying number (UIN) of your study. Researchregistry6230.

3. Results

Of the 317 patients in COVID19 patients included in the study, 167 were male and 139 were female. 214 patients were over the age of 50 years and 98 were under 50 years (Fig. 1). The mean age of patients is 59.71 ± 16.46 years. Seventy-five percent of patients were aged between 48 and 72 years.

Descriptive statistics on clinical symptoms before and after invasive ventilation by age for patients under invasive ventilation are reported in the table below: Independent t-test was used to compare clinical signs between people over and under 50 years of age was not significant (Table 1).

Descriptive statistics on clinical symptoms before and after invasive ventilation by gender for patients under invasive ventilation are reported in the table below: Independent t-test was used to compare clinical signs between people over and under 50 years of age was not significant (Table 2).

Descriptive statistics on clinical symptoms before and after invasive ventilation by smoking for patients under invasive ventilation are reported in the table below: Independent t-test was used to compare clinical signs between people over and under 50 years of age was not significant (Table 3).

Blood pressure at the time of ventilation and 24, 48 and 72 h after ventilation was not significant among the two age groups, p = 0.49, p = 0.84 and p = 0.764, respectively. Similarly, GCS was also not significant at these intervals in the two group, p = 0.53, p = 0.55, p = 0.60 and p = 0.367, respectively. Other parameters like PO2, pulse rate, respiration rate and temperature were also not significantly different at different time intervals, in these two age groups, p > 0.05, respectively, Table 3.

3.1. Descriptive statistics and statistical test of saturated oxygen before and after invasive ventilation for patients under invasive ventilation

Paired t-test showed that the amount of saturated oxygen after invasive ventilation was significantly different from the previous saturated oxygen (p < 0.001) (Fig. 2).
3.2. Comparison of hospitalization days by patients with invasive ventilation

Independent t-test showed that the average number of hospitalization days for patients who underwent invasive ventilation was higher than patients who did not have invasive ventilation (p < 0.001) (Table 4).

4. Discussion

In this retrospective study, we reported that the age of COVID19 patients undergoing mechanical ventilation is not associated with any significant changes in the clinical parameter. Age might not be the determinant of mechanical ventilation in these patients.

Studies have shown that advanced aged COVID19 patients are presented with greater pneumonia severity score, need of oxygen therapy, lymphopenia and need of mechanical ventilation, relative to young and middle-aged population. In a prospective study, Wang, Tang [16] reported 141 mechanical ventilation cases where advanced age and abnormal vitals were common in these patients compared to those who did not undergo mechanical ventilation. Nonetheless, the findings of the study reported that advanced age may not be a significant determinant of mechanical ventilation among these patients. The two age groups studies were patients aged 65 years or less and those aged above 65 years. A study has also reported that the age of COVID19 patients undergoing invasive and non-invasive mechanical ventilation may not differ. Nonetheless, gender and clinical parameters like neutrophils and leukocyte count, comorbidity and use of glucocorticoid can be predictors of invasive ventilation [17,18]. Gamberini, Tonetti [19] evaluated factors that can predict liberation from mechanical ventilation and reported that respiratory system compliance less than 40 mL/cm H2O, advanced age, reduced arterial oxygen partial pressure to inspired fraction of oxygen ratio, increased sequential organ failure

Table 1

Descriptive statistics before and after invasive ventilation by age.

| Group Statistics | Age (Binned) | N  | Mean  | Std. Deviation | Std. Error Mean |
|------------------|--------------|----|-------|----------------|-----------------|
| N. Farzan, S. Vahabi, S.S. Hashemi Madani et al. International Journal of Surgery Open 32 (2021) 100344 |
| Sign bp0        | ≤ 50         | 11 | 12.464 | .9394          | .2833           |
|                  | > 50         | 51 | 12.169 | 1.3350         | .1869           |
| Sign bp24       | ≤ 50         | 11 | 12.209 | 1.0587         | .3192           |
|                  | > 50         | 50 | 12.126 | 1.3206         | .1868           |
| Sign bp48       | ≤ 50         | 11 | 11.518 | 1.8798         | .5668           |
|                  | > 50         | 46 | 11.407 | 1.1797         | .1739           |
| Sign bp72       | ≤ 50         | 10 | 11.680 | 2.4462         | .7736           |
|                  | > 50         | 38 | 11.482 | 1.6670         | .2704           |
| Sign.gc0        | ≤ 50         | 15 | 11.500 | 0.0000         | .0000           |
|                  | > 50         | 50 | 10.030 | 0.6727         | .0887           |
| Sign.gc24       | ≤ 50         | 10 | 14.950 | 0.6324         | .2000           |
|                  | > 50         | 35 | 15.624 | 0.5079         | .0857           |
| Sign.gc48       | ≤ 50         | 9  | 15.100 | 0.0000         | .0000           |
|                  | > 50         | 33 | 15.084 | 0.3481         | .0606           |
| Sign.gc72       | ≤ 50         | 9  | 14.927 | 0.6667         | .2222           |
|                  | > 50         | 30 | 15.083 | 0.6515         | .0667           |
| Sign.o2sat0     | ≤ 50         | 11 | 75.55  | 14.376         | 4.335           |
|                  | > 50         | 51 | 79.20  | 12.035         | 1.685           |
| Sign.o2sat24    | ≤ 50         | 11 | 80.82  | 11.496         | 3.466           |
|                  | > 50         | 50 | 80.30  | 12.176         | 1.722           |
| Sign.o2sat48    | ≤ 50         | 11 | 78.55  | 12.144         | 3.662           |
|                  | > 50         | 46 | 76.74  | 14.570         | 2.148           |
| Sign.o2sat72    | ≤ 50         | 10 | 79.00  | 13.944         | 4.410           |
|                  | > 50         | 38 | 72.34  | 13.765         | 2.233           |
| Sign.pr0        | ≤ 50         | 11 | 108.73 | 22.522         | 6.790           |
|                  | > 50         | 51 | 98.45  | 15.964         | 2.235           |
| Sign.pr24       | ≤ 50         | 10 | 100.09 | 12.739         | 3.841           |
|                  | > 50         | 50 | 96.30  | 14.579         | 2.062           |
| Sign.pr48       | ≤ 50         | 11 | 90.73  | 15.793         | 4.762           |
|                  | > 50         | 47 | 93.68  | 16.720         | 2.439           |
| Sign.pr72       | ≤ 50         | 10 | 92.20  | 13.861         | 4.099           |
|                  | > 50         | 38 | 95.97  | 18.241         | 2.959           |
| Sign.r0         | ≤ 50         | 11 | 25.55  | 8.263          | 2.491           |
|                  | > 50         | 51 | 23.14  | 9.031          | 1.265           |
| Sign.r24        | ≤ 50         | 11 | 20.09  | 4.110          | 1.239           |
|                  | > 50         | 50 | 21.00  | 9.643          | 1.364           |
| Sign.r48        | ≤ 50         | 11 | 19.27  | 2.724          | .821            |
|                  | > 50         | 46 | 22.41  | 12.487         | 1.841           |
| Sign.r72        | ≤ 50         | 10 | 19.40  | 2.171          | .686            |
|                  | > 50         | 38 | 24.97  | 15.255         | 2.475           |
| Sign.t0         | ≤ 50         | 11 | 37.536 | 5.259          | 1.586           |
|                  | > 50         | 51 | 37.261 | 6.809          | .953            |
| Sign.t24        | ≤ 50         | 11 | 37.036 | 5.409          | 1.631           |
|                  | > 50         | 50 | 37.010 | 4.912          | .6953           |
| Sign.t48        | ≤ 50         | 11 | 36.864 | 5.988          | 1.805           |
|                  | > 50         | 46 | 36.926 | 5.603          | .8826           |
| Sign.t72        | ≤ 50         | 10 | 36.940 | 7.306          | 2.310           |
|                  | > 50         | 36 | 36.981 | 5.450          | .9080           |
assessment score at the time of admission and cardiovascular complication can prolong the duration of invasive mechanical ventilation. In a cohort study, Singer, Morley [20] showed that increased respiratory rate and hypoxemia are significant predictors of mechanical ventilation whereas blood pressure and temperature might not be the significant predictors. Mukhtar, Lotfy [21] also reported that drop in oxygen saturation is significantly greater in invasive ventilation patients compared to non-invasive ones.

Our study is a single-centered retrospective study, that has a small sample size. Furthermore, a number of biochemical parameters that are associated with bad prognosis of the disease are not investigated in this study.

5. Conclusion

The findings of our study showed that age might not contribute to the changes in clinical parameters among COVID19 patients under invasive mechanical ventilation. COVID19 patients under mechanical ventilation are likely to present similar prognostic outcomes, provided that other risk factors (comorbidities, drug history) are absent. We recommend further studies regarding the risk of undergoing mechanical ventilation among different age groups and associated biological factors.

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: Planned the study, wrote the protocol, collected the data and drafted the manuscript and accepted the final draft.

Dr. Sepideh Vahabi and Dr. Shima Sadat Hashemi Madani: Planned and designed the study, collected the data.

Dr. Behrooz Farzan: analyzed the data and critically revised the draft and finally approved the manuscript.

Conflict of interest statement

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

Guarantor

Dr. Nina Farzan.
Research registration number

Not applicable.

Consent for publication

Not applicable.

Availability of data and material

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jiiso.2021.100344.

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