Original Article

Investigation Pulmonary Complication In Patients With Covid-19 And Infection & Prevalence Of Intubation In ICU Based On Radiological Stereotypes

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Abstract

The use of current modified rules for intubation can result in better outcome with respect to preventing transmission of COVID-19 infection to healthcare providers. We aimed to assess the effect of implementing preventive and managerial protocols related to tracheal intubation of COVID-19 patients on preventing adverse clinical and psychological outcomes in personnel of intensive care units.

Methods:
This randomized single-blinded clinical trial study was performed on all personnel of ICU in a referral center for COVID-19 patients in Tehran in April 2020. The personnel were assigned into two group as the intervention group including personnel who received the necessary training to perform intubation based on existing standard and modified protocol and the control group that did not participate in the training sessions and continued their routine performance. Along with the clinical assessments, the personnel were assessed for depression and stress symptoms using the short form of Depression Anxiety and Stress Scale (DASS), 14 days after educational session.

Results:
There was no difference in clinical symptoms, hemodynamic condition, and laboratory findings across the two groups of personnel. The assessment of psychological aspects in both intervention and control group showed no difference in mean depression score as well as the severity of depressive mood, but the mean stress score in the two groups was 7.42±2.00 and 14.92±5.79 respectively indicating a significant difference ($p = 0.007$). In this regard, stress in any of its severity was not found in the personnel of education-based intervention group, however more than half of the personnel in control group suffered from mild to moderate stress.

Conclusion:

The scheduling and conducting training sessions and curricula related to intubation of COVID-19 patients can be very effective in reducing the level of personnel stress and therefore may reserve their occupational performance and minimized the likelihood of exposure to COVID-19.

Keywords: Intubation, Curriculum, COVID-19, Intensive Care Unit

Introduction:

The respiratory activities of the patients suffering COVID-19 disease especially those who undergo medical procedures such as chipping, bronchoscopy or aspiration are thought to cause airborne particles remaining in the air and thus putting health care workers at risk for such infection (Reddy et al., 2020). As the number of COVID-19 cases is fluctuating exponentially around the world, invasive procedures particularly those requiring intubation has declined in many centers to allow the transfer of resources to areas of need, the intensive care unit (ICU) as well as reduce the risk for infection transmission from its main resources (Shang et al., 2020). Patients with COVID-19 may face with progressive feature of the disease as hypoxic respiratory failure or multisystem failure and thus they may require intubation and special care management. According to the recent reports by the World Health Organization, the needing for tracheal intubation for COVID-19 patients has been estimated to be 2.3% (Guan et al., 2020). The remarkable thing about this is that healthcare providers especially anesthesiologists are at the forefront of the COVID-19 related epidemic and to guide the medical management of patients with COVID-19, they need to be aware of the best evidence available and keep themselves safe (Tobaiqy et al., 2020). Preventing the transmission of pathogenic transmission is of particular importance, especially given the limited availability of personal protective equipment that we currently face. Anesthesiologists and other prenatal care providers are at risk, especially when providing respiratory care and tracheal intubation in patients with COVID-19 (Greenland et al., 2020). In this regard, the World Federation of Societies of Anaesthesiologists (WFSA) draws the attention of anesthesia teams to the importance of proper precautions when providing respiratory cares for these patients (Şentürk et al., 2020). Therefore, along with high predictive risk for critically ill patients suffering COVID-19, tracheal intubation carries own a high risk to the intubators of such patients (Yao et al., 2020). In this regard, it seems that following-up the current guidelines for intubation of the pointed patients as well as the use of current modified rules for intubation can result in better outcome with respect to preventing transmission of infection to healthcare providers, but we could not find any data on these protective approaches. Hence, we aimed to assess the effect of implementing preventive and managerial protocols related to tracheal intubation of COVID-19 patients on preventing adverse outcome in personnel of ICUs.

Materials and Methods:

This randomized single-blinded clinical trial study was performed on all personnel of ICU (including anesthesiologists, residents, and nurses) in a referral center for COVID-19 patients in Tehran in April 2020. The personnel with the experience less than 1 year or could not involveed or uneducated for tracheal intubation were excluded from the present study. A written informed consent was taken from all eligible personnel entering the trial. Using the random number table, the personnel were assigned into two group as the intervention group including personnel who received the necessary training to perform intubation based on existing standard and modified protocol and the control group that did not participate in the training sessions and continued their routine performance. Both groups were completely unaware of the plan which considered for another group. Also, the personnel of the intervention group were asked not to transfer information about the nature of their training program to the personnel of the control group. In a two-hour, face-to-face training session, the intervention team personnel were trained on the basis and specific methods of the intubation of COVID-19 patients. The training session was held in the college and out of ICUs environment. For structuring the curriculum of such educational session, “the safe airway society principles of airway management and tracheal intubation specific to the COVID-19 adult patient” published by Brewster et al in 2020 (Brewster et al., 2020) was employed. Briefly, the major topics of such guiding principles included intensive training, early intervention, meticulous planning, vigilant infection control, efficient airway management processes, clear communication, and standardized practice. Moreover, the last principle for modified tracheal intubation was also trained for the interventional personnel. The personnel of the control group continued

their normal performance without any training or advice. During the next 14 days, each of the personnel in intervention and control groups who had performed at least three cases of intubation in COVID-19 patients was evaluated for disease-related manifestations, hemodynamic status, routine laboratory indices followed by tested for the COVID-19 infection. Along with the pointed assessments, the personnel were assessed for depression and stress symptoms using the short form of Depression Anxiety and Stress Scale (DASS), 14 days after educational session. This tool consists of 21 scales, each of which measures a psychological factor or structure. The subject should indicate the severity of the symptoms in each component experienced during the past week (Asghari et al., 2008). The scale uses the Likert four-level scoring system, with 0 to 3 points representing non-conformity 0 to very consistent 3, the higher the score, the higher the level of negative emotions.

For statistical analysis, results were presented as mean ± standard deviation (SD) for quantitative variables and were summarized by frequency (percentage) for categorical variables. Continuous variables were compared using t test or Mann-Whitney test whenever the data did not appear to have normal distribution or when the assumption of equal variances was violated across the study groups. Categorical variables were, on the other hand, compared using chi-square test. Based on the review of resources, potential variables affecting the response were determined. P values of ≤ 0.05 were considered statistically significant. For the statistical analysis, the statistical software SPSS version 24.0 for windows (IBM, Armonk, New York) was used.

Results:

Comparing the baseline characteristics including demographics, educational level, work experience, type of shifts, and medical history showed no difference between the intervention and control groups (Table 1). In clinical and laboratory assessment of both groups of personnel 14 days after initiating the intervention (Table 2) showed no difference in clinical symptoms, hemodynamic condition, and laboratory findings. The positive molecular test for COVID-19 was revealed in none of the personnel. The assessment of psychological aspects in both intervention and control group showed no difference in mean depression score as well as the severity of depressive mood (Table 2), however the mean stress score in the two groups was 7.42±2.00 and 14.92±5.79 respectively indicating a significant difference ($p = 0.007$). In this regard, stress in any of its severity was not found in the personnel of education-based intervention group, however more than half of the personnel in control group suffered from mild to moderate stress. Using multivariable linear regression model (Table 3), holding of education session for intubation could not affect the likelihood of depression in personnel, but in similar model (Table 4), such educational intervention could improve the level of personnel stress effectively (beta = 7.007, $p = 0.038$).

Discussion :

With the advent of COVID-19 epidemics, public fear has developed and is growing in human societies. This fear was especially acute among medical staff, especially in the ICU, which had to deal with such patients on a regular basis. The consequences of such intimidation among medical staff were a significant increase in the risk of the disease, as well as the resulting psychological consequences. Unfortunately, at the time of writing, some countries, including Iran, are struggling with the second wave of outbreaks, so the re-emergence of patients for hospitalization and intensive care services is quite predictable. On the other hand, burnout among physicians and nurses in inpatient centers of such patients is also quite noticeable. According to available statistics, a significant number of physicians and nurses have contracted the disease due to direct exposure to patients. During the first month of the epidemic, the disease killed more than a hundred doctors and nurses whole of the world (Abdi, 2020). About 10,000 members of the medical staff in Iran have contracted corona, and the death toll among them has been significant (Bhagavathula et al., 2020). Most of these casualties are directly related to the time of diagnostic and therapeutic interventions in these patients, such as patient resuscitation. We therefore tried to assess for the first time the clinical and psychological sequels of exposing the ICUs personnel to critically ill COVID-19 patients admitting to ICUs. In this regard, along with the outbreak of the disease and its-related manifestation among such personnel, we evaluated the depression and stress due to such exposure among personnel. In the next step, assuming that standard training on how to integrate this group of patients could have a potential impact on the clinical and psychological burden of the disease, the impact of such training

curricula on the improvement of clinical and psychological status of personnel was also tested. In this regard, we planned a single educational session with the aim of training novel methods for intubation of COVID-19 patients for a group of personnel and compared the consequences with the control group without such programming. According to our findings, although such educations could not affect the prevalence rate of COVID-19 exposure or its-related clinical manifestations in exposed personnel, planning such programs could reduce the level of stress among personnel independent to their demographic characteristics, medical history, and job status. In other words, although education of standard principles of intubation in COVID-19 patients may not clinically support the personnel against the disease, by reducing stress during their activity, they improve their performance and ensure their quality of performance. This improvement in performance significantly reduces the likelihood of medical errors occurring, thus reducing the likelihood of exposure to the virus. The present study is the first of its type in assessing the effects of educational curricula on the risk for exposure of ICUs personnel to COVID-19 infection. However, due to the lack of sample size, it was not possible to evaluate the preventive effects of such programs. Overall, it should be noted that among all aerosol-generating procedures in ICUs, endotracheal intubation is especially hazardous for all personnel involved. According to recent literatures, an absolute risk increase ranged 10% to 15% has been reported for transmission of SARS-CoV-1–associated infection to healthcare personnel performing intubation (Tran et al., 2012). Therefore, endotracheal intubation should also be viewed as a high-risk procedure for exposure to and transmission of COVID-19 (Cook et al., 2020) and thus we also believe that providing more relevant training to the personnel involving intubation can minimize the risk of disease exposure.

Conclusion :

It can be finally concluded that the scheduling and conducting training sessions and curricula related to intubation of COVID-19 patients can be very effective in reducing the level of personnel stress and therefore may reserve their occupational performance and minimized the likelihood of exposure to COVID-19. The design and implementation of such training sessions should be considered at the national level by the health managers of the countries.

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Item	Intervention group (n = 12)	Control group (n = 12)	P value
Male gender	5 (41.7)	4 (33.3)	**0.673**
Mean age, year	33.17±5.29	33.50±8.39	**0.908**
Mean BMI, kg/m^2	24.73±1.30	25.18±1.19	**0.067**
Education level			**0.621**
Bachelor	2 (16.7)	4 (33.3)	
Master	8 (66.7)	6 (50.0)	
PhD	2 (16.7)	2 (16.7)	
Years of experience	7.25±3.22	6.17±4.32	**0.494**
Type of shift			**0.653**
8-hour	4 (33.3)	3 (25.0)	
12-hour	8 (66.7)	9 (75.0)	
History of hypertension	1 (8.3)	2 (16.7)	**0.537**
History of diabetes mellitus	1 (8.3)	0 (0.0)	**0.307**
History of ischemic heart disease	1 (8.3)	1 (8.3)	**1.000**

Table 1: Baseline characteristics in the two intervention and control groups

Item	Intervention group (n = 14)	Control group (n = 14)	P value
Clinical symptoms			
Fever	2 (16.7)	3 (25.0)	**0.615**
Cough	2 (16.7)	2 (16.7)	**1.000**
Fatigue	3 (25.0)	2 (16.7)	**0.615**
Hemodynamic status			
Mean heart rate	75.42±5.41	74.58±4.50	
Mean respiratory rate	14.42±1.31	13.92±1.24	
Mean SBP	142.50±16.31	139.17±14.59	
Mean DBP	84.58±9.88	84.58±9.16	
Mean O2 saturation	97.92±0.67	97.58±0.52	
Laboratory findings			
Mean WBC count	4.81±0.46	5.17±0.64	
Mean lymphocyte count	1.51±0.26	1.67±0.52	
Mean AST level	28.33±3.75	27.17±4.54	
Mean ALT level	30.00±3.91	30.50±4.85	
Mean ESR level	8.33±2.38	7.17±2.25	
Mean CRP level	5.08±1.51	5.00±1.13	
Positive COVID-19 test	0 (0.0)	0 (0.0)	
Psychological status			
Mean depression score	11.42±3.12	11.00±3.04	**0.744**
Level of depression			**0.842**
Normal	3 (25.0)	4 (33.3)	
Mild	6 (50.0)	6 (50.0)	
Moderate	3 (25.0)	2 (16.7)	
Mean stress score	7.42±2.00	14.92±5.79	**0.001**
Level of stress			
Normal	12 (100)	5 (41.7)	
Mild	0 (0.0)	4 (33.3)	
Moderate	0 (0.0)	3 (25.0)	

Table 2: 14-day outcome in the two intervention and control groups

Item	Unstandardized Coefficients		Standardized Coefficients	t	P value
	Beta	Std. Error	Beta		
(Constant)	8.023	33.737		0.238	0.816
group	-0.903	2.217	-0.153	-0.407	0.690
gender	-0.005	1.823	0.000	-0.003	0.998
age	0.239	0.507	0.542	0.471	0.645
BMI	0.169	1.038	0.075	0.163	0.873
education	0.189	2.526	0.041	0.075	0.942
shift	-2.359	2.199	-0.363	-1.073	0.303
experience	-0.585	0.790	-0.730	-0.741	0.472
HTN	4.833	12.258	0.540	0.394	0.700
DM	2.654	4.429	0.179	0.599	0.559

IHD	-7.487	13.138	-0.700	-0.570	0.578

Table 3: The effect of educational protocol on level of depression adjusted for baseline variables (R square = 0.164)

Item	Unstandardized Coefficients		Standardized Coefficients	t	P value
	Beta	Std. Error	Beta		
(Constant)	-41.868	46.109		-0.908	0.380
group	7.007	3.029	0.626	2.313	0.038
gender	0.156	2.491	0.013	0.062	0.951
age	-0.011	0.693	-0.014	-0.017	0.987
BMI	0.870	1.418	0.204	0.613	0.550
education	1.849	3.452	0.212	0.536	0.601
shift	1.027	3.005	0.083	0.342	0.738
experience	-0.036	1.079	-0.024	-0.033	0.974
HTN	5.105	16.753	0.302	0.305	0.765
DM	1.813	6.054	0.065	0.299	0.769
IHD	1.298	17.956	0.064	0.072	0.943

Table 4: The effect of educational protocol on level of depression adjusted for baseline variables (R square = 0.564)