Predictors of Mortality in critically ill patients with COVID-19 infection on mechanical ventilation

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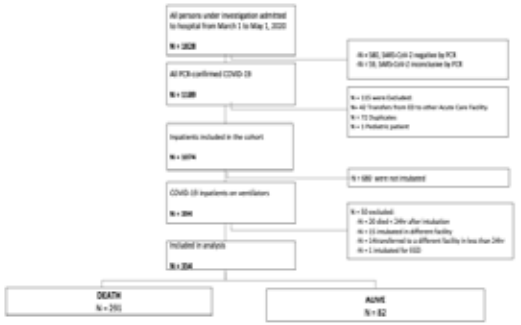
BACKGROUND

On March, New York was declared in "State of Emergency"; all Emergency Room and hospital facilities in NYC were overwhelmed by the rapid and high influx of patients with COVOD-19 infection. At least 20% of patients with criteria for hospitalization received mechanical ventilation, and the Mortality reached 80% in a time when the only treatment option was oxygen support. South Bronx has a different population compared with other Boroughs in NYC. Disparities as income inequality, housing issue, and high comorbidities prevalence make this population unique to assess the clinical course and outcomes (1,2). We aimed to evaluate baseline characteristics and clinical features as predictors of mortality in mechanically ventilated patients due to COVID-19 infection.

METHODS

The retrospective cohort study included SARS-CoV2 positive patients by RT-PCR that underwent mechanical intubation during their hospital course between March-May 2020. Death in less than 24 hours after endotracheal intubation, patient intubated in the field, or transferred intubated from other facilities to our hospital were part of the exclusion criteria (figure 1). Simple logistic regression was performed to recognize variables for our model and Multiple logistic regression to identify covariates and cofounders for Mortality. A significant *p-value* was considered as <0.05. IBM SPSS v22 for Windows was used for analysis.

Figure 1. Flow diagram of process for patient inclusion as participant of the study



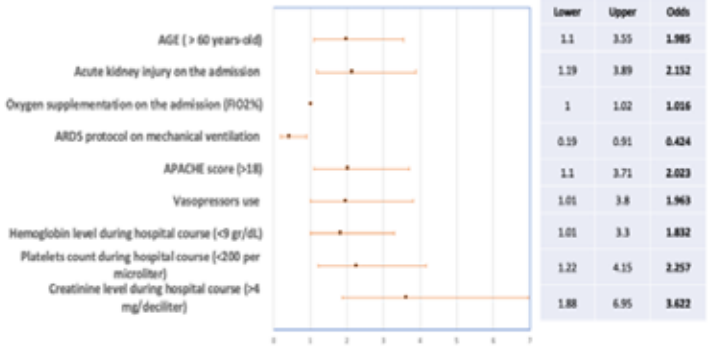
RESULTS

Table 1: Univariate analysis for mortality in mechanical ventilated patient due to COVID-19 infection

Variable	Death (n=274), n(%)	Alive (n=80), n(%)	OR (95% CI)	p-value
Age (≥60 years-old)	109 (39.8%)	31 (37.0%)	1.39 (1.43-2.98)	0.001
Female	110 (38%)	32 (39%)	1.09 (0.65-1.83)	0.737
Race				
Non-LatinX	86 (31.4%)	23 (28.7%)	Reference	
LatinX	188 (68.6%)	57 (71.3%)	1.13 (0.65-1.96)	0.653
BMI* (≥30 kg/m²)	153 (55.8%)	44 (55.0%)	1.03 (0.62-1.70)	0.894
Hypertension	129 (47.1%)	32(40.0%)	1.33 (0.80-2.21)	0.234
Diabetes	133 (48.5%)	29 (36.3%)	1.65 (0.99-2.77)	0.053
Obstructive lung disease	56 (20.4%)	10 (12.5%)	1.79 (0.87-3.71)	0.113
Chronic kidney disease	39 (14.2%)	6 (7.5%)	2.04 (0.83-5.02)	0.118
COVID severity				
Moderate	16 (5.8%)	13 (16.3%)	Reference	
Severe	87 (31.8%)	29(36.6%)	2.43 (1.04-5.66)	0.039
Critical	171 (62.4%)	38 (47.5%)	3.65 (1.62-8.23)	0.002
Sepsis*	183 (66.8%)	33 (41.3%)	2.86 (1.71-4.77)	0.000
Acute kidney injury	191 (69.7%)	34 (42.5%)	3.11 (1.86-5.19)	0.000
ARDS* on admission	171 (62.4%)	38 (47.5%)	1.83 (1.11-3.03)	0.018
Vasopressor during the hospital course	230 (83.9%)	53 (66.3%)	2.66 (1.51-4.68)	0.001
APACHE score (≥18)	115 (42.0%)	26 (32.5%)	1.50 (0.88-2.54)	0.129
ARDS Protocol	31 (11.3%)	16 (20.0%)	0.51 (0.26-0.99)	0.047
Tidal volume by IBW*	49 (17.9%)	20 (25.0%)	0.65(0.36-1.18)	0.159
Hydroxychloroquine	239 (87.2%)	73 (97.3%)	0.65 (0.27-1.53)	0.330
Therapeutic anticoagulation	102 (37.2%)	33 (41.3%)	0.84 (0.50-1.40)	0.515
Steroids stress dose	77 (28.1%)	25 (31.3%)	0.86 (0.50-1.47)	0.585
Proning by protocol	74 (27.0%)	19 (23.8%)	1.18 (0.66-2.12)	0.561
WBC count during hospital course (> 18x10³ microliter)	138 (50.4%)	34 (42.5%)	1.37 (0.83-2.26)	0.217
Hemoglobin during hospital course (> 9 gr/dL)	128 (46.7%)	43 (53.8%)	0.75 (0.45-1.24)	0.269
Platelet count during hospital course (<200x10³ per microliter)	137 (50.0%)	27 (33.8%)	1.96 (1.16-3.30)	0.011
Creatinine during hospital course (>4 mg/deciliter)	168 (61.3%)	19 (23.8%)	5.0 (2.87-8.99)	0.000

*BMI, body mass index; ARDS, acute respiratory distress syndrome; MV, mechanical ventilation; IBW, ideal body weight; Sepsis defined by Quick SOFA score.

Table 2: MULTIVARIATE ANALYSIS FOR PREDICTORS OF MORTALITY



	Lower	Upper	Odds
AGE (> 60 years-old)	1.1	3.55	1.985
Acute kidney injury on the admission	1.19	3.89	2.152
Oxygen supplementation on the admission (FIO2%)	1	1.02	1.016
ARDS protocol on mechanical ventilation	0.19	0.91	0.424
APACHE score (>18)	1.1	3.71	2.023
Vasopressors use	1.01	3.8	1.963
Hemoglobin level during hospital course (<9 gr/dL)	1.01	3.3	1.832
Platelets count during hospital course (<200 per microliter)	1.22	4.15	2.257
Creatinine level during hospital course (>4 mg/deciliter)	1.88	6.95	3.622

CONCLUSION

Mortality in mechanically ventilated patients in our cohort was 82% and did not differ from other studies in NYC (3). The WHO guidelines recommend mechanical ventilation support in COVID-19 infection for patients in ARDS or need support for other dysfunctional organs. Older age, AKI, ARDS, and degree of oxygen support are independent predictors of Mortality in critically ill patients with COVID-19 infection. SARS CoV-2 produces diffuse alveolar damage in the lungs that lead the patient toward ARDS. Therefore, ARDS protocol shows benefit in preventing Mortality among critically ill patients with COVID-19. This intervention assures enough oxygen levels in lungs with poor compliance. It seems to be the only measure that improves Mortality among Mechanically Ventilated patients with COVID-19 infection (4-6).

IMPLICATIONS

Identification of predictors of mortality in Mechanically ventilated patients with COVID-19 will be a valuable tool to promptly redirect resources in order to prevent fatalities.

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