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Prolonged Use of Noninvasive Ventilation in COVID-19 Geriatric Patients with Acute Respiratory Failure, can it be Tolerated?

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ABSTRACT

We report six cases of the use of Non-invasive ventilation (NIV) in the COVID-19 geriatric patients with acute respiratory failure. The one case continued with intubation or invasive mechanical ventilation (IMV) and five cases did not do IMV. The novel Coronavirus disease 2019 (COVID-19) infection can occur acute respiratory failure from mild to severe. The Severe Acute respiratory failure due to COVID-19 requires oxygen therapy in the form of NIV or IMV. NIV can reduce complications related to IMV, especially the incidence of nosocomial infections and complications due to invasive procedures. The geriatric group with COVID-19 has higher risk than the young group. The many comorbidities, decreased immune function and organ systems that occur in geriatrics worsening of COVID-19 symptoms and course. NIV is only an introduction or the first step before IMV is done with close monitoring before the patients get worse. The use of NIV that is not in accordance with the indications and IMV delaying can increase the risk of COVID-19 patients mortality.

Keywords: geriatric; noninvasive ventilation; acute respiratory failure; COVID-19

INTRODUCTION

Early in the pandemic, international experiences highlighted the potential risk that intensive care unit (ICU) might become overwhelmed, and high mortality was observed in patients requiring invasive mechanical ventilation (IMV). In Corona Virus Disease 2019 (COVID-19) patients with acute hypoxemic respiratory failure who require high concentrations of Oxygen, Noninvasive Ventilation (NIV) provide potentially attractive strategies for avoiding IMV. According to the epidemiological investigation of The Chinese Center for Disease Control and Prevention, one third of COVID-19 patients are patients aged 60 years and over (1). Indonesia has the 8th largest geriatric population worldwide and the 4th largest in Asian countries with approximately 21 million (8.2%) of the total population in Indonesia and this number is the largest in Southeast Asia (2).

The NIV indications are : 1) Trial NIV before intubation, 2) Additional Therapy of respiratory failure used early to prevent intubation, 3) The last therapy for patients who refuse intubation. The contraindication of NIV are : 1) patients with worsening respiratory status, 2) hemodynamic instability, 3) multiorgan failure, 4) abnormal mental status. The guidelines recommended close monitoring and clinical evaluation of each patient to prevent intubation delaying (3). The experts from the National Health Commission of China divide COVID-19-related Acute Respiratory Distress Syndrome (ARDS) categories based on oxygenation index (PaO_2/FiO_2) on Positive End-Expiratory Pressure (PEEP) ≥ 5 cmH_2O into three : 1) mild (200 mmHg ≤ PaO_2/FiO_2 < 300 mmHg), mild-moderate (150 mmHg ≤ PaO_2/FiO_2 < 200 mmHg), and moderate-severe (PaO_2/FiO_2 < 150 mmHg).

The new stratification for COVID-19-related ARDS determines personalized treatment for different patients. In fact, a number of ARDS treatments, including prone positioning and neuromuscular blockers, are recommended for patients with PaO_2/FiO_2 less than 150 mmHg. This indicates that Berlin classification is not suitable to define the severity of ARDS and is not accurately guide the corresponding treatments. The absence of evidence to support use of NIV in patients with COVID-19 led to significant variability both in international guidelines and clinical practice (4).

CASE REPORT

The Characteristics and underlying conditions before ICU admission.

All of 6 patients ranged in age from 70 to 83 years and included three women and three men. One patient had no reported underlying medical conditions; three had poorly controlled diabetes mellitus type 2, one had hypertension and poorly controlled diabetes mellitus type 2 and one had osteoarthritis genu with NSAID therapeutics. All of 6 patients had dyspnea for ≥ 24 hours. Four patients came to the ICU from the isolation ward and two patient from the emergency room. Five patients had stable hemodynamic without inotropic/vasopressor support, one patient had hypertension. All of 6 patients ranged in heart rate 72 to 103 times/minute, Oxygen saturation 78-89% and had bilateral infiltrate and consolidation identified on chest imaging.

The Laboratory before ICU admission

All of 6 patients had pH 7.320-7.400, pO_2 38.2-70.9 (pO_2 <80), pCO_2 25.7-47.2 and PF ratio 47.75-87.5 (<100).

Two patients had random blood sugar <200, three patients had >300. One patient had D dimer 1.79, four patients had 15.86-48.36. All of 6 patients had positive SARS-CoV-2 testing confirmation.

Therapy in the ICU

All patients received standard therapy according to the National COVID-19 therapy guidelines : injection of Levofloxacin 1x750 mg iv, injection of Pantoprazole 1x40 mg iv (Proton Pump Inhibitor), injection of N-Acetylcysteine 2x600 mg iv, injection of vitamin C 1 gr iv, Azythromycin 1x500 mg orally for 5 days. Anticoagulant therapy (injection of Heparin/Fondaparinux 2.5 mg sub cutaneous) according to the value of D dimer. Supportive therapy is given according to the symptoms obtained in the form of antipyretics (injection of metamizole 1 gr iv, paracetamol 1 gr iv or Paracetamol 500 mg orally), antitussive (Codein). Nutrition is also given according to calorie needs. Insulin therapy for blood sugar regulation. When the patient is admitted to the ICU, 100% NIV continuous positive airway pressure (CPAP) is given from the start. Five patients received ranged 30-71 hours NIV duration and didn't have an IMV approval letter, one patient received ranged 5 hours NIV duration then continued IMV 6.5 hours. Patients who received IMV were treated according to the ARDS algorithm in the form of : Tidal Volume 6-8 ml/kg PBW, Plateau Pressure ≤ 30 cmH2O, PEEP > 5 cmH2O and reassessment of ventilator setting and of the management strategies at least every 24 hours. Patients monitoring is carried out by clinical evaluation through a glass room installed with closed circuit television (CCTV) and vital signs recorded on the electronic monitoring screen. In the end All the patients died.

TABLE 1: Clinical Condition Patient 1 – 3 Before ICU Admission

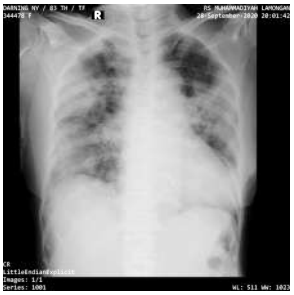
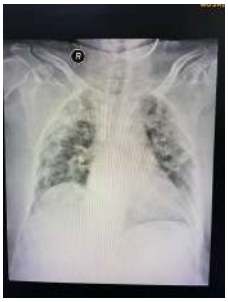
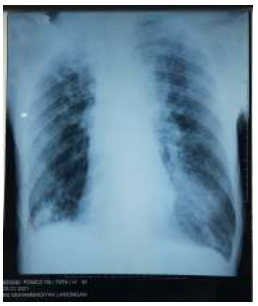
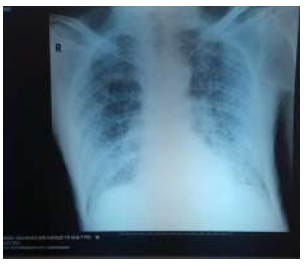
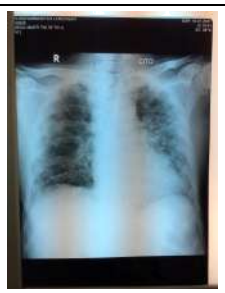
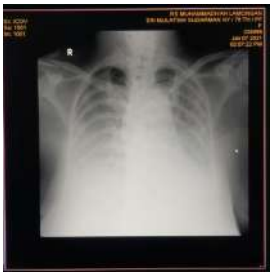
Identity	Patient 1	Patient 2	Patient 3
Age	83	77	74
Gender	F	F	M
symptoms	dyspnea	dyspnea	dyspnea
Co-morbide	Osteoarthritis genu	Diabetes	-
The origin before ICU	Isolation ward	Isolation ward	Isolation ward
GCS	356	356	356
Blood Pressure	120/60	100/60	130/70
Heart Rate	72	86	78
Respiratory rate	22-24	24-26	26-28
Oxygen Saturation	88	89	89
Chest imaging			
pH	7.320	7.380	7.390
pO2	39.7	70.9	61.7
pCO2	47.2	30.8	26.8
HCO3	24.2	17.7	15.7
BE	-2.2	-6.1	-8.0
Glucose	172	393	170
Sodium	139	127	135
Potassium	3.5	4.9	3.8
Chloride	97	108	111
D Dimer	1.79	44.5	18.36
PF Ratio	48.75	87.5	76.25
SARS-CoV-2 testing	+	+	+
IC letter for IMV	-	-	-
NIV (hours)	51	30	43
Outcome	Deceased	Deceased	Deceased

TABLE 2: Clinical Condition Patient 4-6 Before ICU Admission

Identity	Patient 4	Patient 5	Patient 6
Age	70	71	78
Gender	M	M	F
symptoms	dyspnea	dyspnea	dyspnea
Co-morbide	Diabetes, Hypertension	Diabetes	Diabetes
The origin before ICU	Isolation ward	Emergency room	Emergency room
GCS	356	356	356
Blood Pressure	180/90	120/65	125/75
Heart Rate	90	103	101
Respiratory rate	26-28	30-32	26-28
Oxygen Saturation	86	80	78
Chest imaging			
pH	7.470	7.400	7.320
pO2	49.2	57.6	38.2
pCO2	37.9	25.7	46.8
HCO3	26.9	15.5	24.0
BE	3.2	-8.2	-2.2
Glucose	318	415	302
Sodium	134	117	139
Potassium	4.1	3.8	3.3
Chloride	106	102	111
D Dimer	23.44	15.86	48.36
PF Ratio	61.25	71.25	47.75
SARS-CoV-2 testing	+	+	+
IC letter for IMV	-	-	+
NIV (hours)	52	71	5
IMV (hours)	-	-	6.5
Outcome	Deceased	Deceased	Deceased

DISCUSSION

Even before the advent of COVID-19, acute respiratory illnesses in geriatric patients placed a major burden on acute healthcare services. Geriatric patients have been disproportionately affected by a greater severity of disease and mortality, detrimental psychological, cognitive and physical outcomes (5). Five Patients (patient 1 – 5) had a PF ratio of <100 mmHg, bilateral pneumonia thorax with consolidation features and D-dimers >1 before ICU admission. These patients received early NIV for Oxygen therapy and did not receive IMV, all patients died in the ICU. Patients with severe COVID-19 who are successfully treated without intubation will benefit from avoiding sedation, avoiding the inability to communicate, avoiding delirium and avoiding post-illness stress (6).

In the pandemic era, NIV can still be the treatment of respiratory failure in geriatric COVID-19 patients as an intermediary before intubation/IMV. Indication for use of NIV in five patients were cooperative and hemodynamically stable without inotropic/vasopressor support. Severe acute respiratory failure often occurs in COVID-19 patients even though it is not accompanied by circulatory failure (7). Administration of NIV has provided improvement in cases of severe acute respiratory failure in some studies but in this case series failure occurred. This could be due to the fact that NIV is not appropriate in cases of severe respiratory failure in geriatric COVID-19 patients. Noninvasive ventilation failure was associated with severe ARDS, longer duration of continuous NIV, peak D-dimer level of 1000 ng/mL or greater, need for non pulmonary organ support, and nosocomial infections (8).

Direct IMV action could be considered in this patients (patient 1-5) but could not be done because the patient's family had not yet approved the letter of informed consent for medical treatment. The reasons for this were because of old age, the illness is considered severe and our hospital has never produced a success rate for IMV (Patients with severe respiratory failure due to COVID-19 who received intubation experienced 100% mortality). The Cohort study in China, Zhou et al, 2020 found a 97% mortality rate during IMV.

But further investigation is needed that the best time of intubation may be to reduce mortality. The Lung Safe Study with large epidemiology involving 50 countries showed that NIV was associated with increased mortality in conditions where PaO2/FiO2 < 150 mmHg. This is consistent with previous scientific publications that late intubation leads to a poor prognosis (9).

The increase of deaths among older adults aged >80 (>80%) and aged >65 (>65%) as well as in mortality rate (MR) > 80% are not homogeneous among different regions reflecting different impact of COVID-19 outbreak. The incidence of COVID-19 rate does not fully explain the differences of mortality impact in older adults among different regions. The explanation related to the severity of hosts' medical condition are probably one of the factor but not the only one (5).

The failure factors for giving NIV to five patients (patient 1-5) in this case series could be influenced by the state of severe acute respiratory failure (PF ratio < 100), old age with many comorbidities, communication about approval of medical action that was not carried out since the beginning of therapy for COVID-19 patients, inadequate monitoring due to the limited number of health personnel compared to the larger number of covid-19 patients.

From all these case series, only one case (patient 6) received medical approval from the patient's family for IMV. By doing IMV, the NIV is terminated. The initial strategy for this patient was to do IMV immediately, but approval for medical treatment was only obtained after the patient received NIV 5 hours before IMV was performed. In this case the patient also died. Before entering the ICU at the Hospital, all patients should always be asked for approval for medical action in the form of the possibility of intubation / IMV at any time when they first come to the ER. In accordance with the statement of Zareifopoulos et al, 2020 that the course of the disease and the possibility of intubation should be discussed with the patient when first being admitted to the hospital so that a decision has been made on the possibility of getting a mechanical ventilator. Prognosis is the content that must be conveyed in medical action in the form of intubation. Medical staff who decide to intubate, must be careful because this action is not to determine who lives or who dies but rather who can survive (10). The factors of IMV failure in this case could be influenced by the state of severe acute respiratory failure (PF ratio < 100), old age with many comorbidities, inadequate clinical monitoring and blood gas analysis, delay in IMV or other factors that also cause failure of NIV as a bridge before IMV.

CONCLUSIONS

NIV cannot be used for all patients with acute respiratory failure due to COVID-19. If it is considered that IMV is a more appropriate indication than NIV, then the informed consent of medical treatment must be communicated from the beginning of the patient's arrival even though the condition at arrival is not yet indicated for IMV.

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