An-Najah National University

Faculty of Graduate Studies

EARLY PRONE POSITION FOR NON-INTUBATED COVID-19 PATIENTS WITH SEVERE HYPOXIA

By

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This Thesis is Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Critical Care Nursing, Faculty of Graduate Studies, An-Najah National University, Nablus - Palestine.

2023

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Dedication

This thesis is dedicated to the sake of ALLAH, my Creator, and my Master.

To my beloved father Butros, who has always loved me unconditionally and whose good examples have taught me to work hard for the things I aspire to achieve.

To my beloved mother Ferial, who has been a constant source of support and encouragement to overcome the challenges of graduate school and life. I am really grateful to have you in my life.

This work is also dedicated to my sisters, brothers and everyone in my family.

To my husband John Abdelnour and parents-in-law.

To my supervisor and everyone who helped and supported me to complete this work.

Acknowledgements

Thank you, GOD, for the chance to learn.

First and foremost, I would like to offer all admirations and glory to our Almighty God. His inspiring words and his unfaltering love and mercy are lamps and lights on my way guiding me from the beginning to the end of this study.

To complete research like this, a quite few minds are necessary. Nevertheless, God sent people who were very cooperative, helpful and contributors to the completion of this study. I am forever grateful to those people who have supported and encouraged me along the way.

I would like to express my sincere appreciation to my supervisors, Dr. Hanood Abu Rass and co-supervisor Dr. Mohammad Al Saleh, for their firm belief in me and their great support during this study. Thank them for coordinating and walking through the process. They provided so many opportunities and achievements in my personal and professional life and taught me the importance of perseverance and patience to achieve the goals of my life. Moreover, I would like to express my sincere appreciation to An-Najah National University and all my teachers there. Also, to my colleagues in the Nursing Department at Al Hilal Hospital for their assistance in data collection. My love to all my sisters and brothers for their constant support, love and permanent care; Their encouragement was my motivation. I would like to thank Fadi Islam who helped me, especially in statistical analysis. Finally, I must gratefully appreciate the help and support of my best husband, John Abdelnour, to whom I owe deep gratitude for care, patience and inspiration; You are the main support and comfort.

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

EARLY PRONE POSITION FOR NON-INTUBATED COVID-19 PATIENTS WITH SEVERE HYPOXIA

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher’s own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: ______________________________________

Signature: ______________________________________

Date: ______________________________________

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ABSTRACT

Background: COVID-19 is an emerging infectious disease that was first recognized in Wuhan, China, and had then spread rapidly in the whole globe. Around 29 percent of patients with COVID-19 may develop ARDS. Previous research indicated that the average ratio of arterial oxygen tension to the fraction of inspired oxygen (PaO2/FiO2) can be increased by prone positioning and mortality in moderate to extreme ARDS can be decreased.

Aim: The study aims to evaluate the effect of early prone position on non-intubated COVID-19 patients with severe hypoxia.

Method: A Randomized Controlled Trial (RCT) design was used in this study. The population of the study was COVID-19 patients aged 18 years or more, with severe hypoxia. The sampling method was simple random sampling. Patient checklist was introduced in the present study for data collection.

Results: The gender were matched between experimental and control (25 (50%) and female (25 (50%)). The mean of experimental group was significantly higher than control group for Partial pressure of oxygen "PaO2" (mmHg) at 2 hours (79.6±17.6 vs. 67.9±12.3, t=3.87 & P< 0.001), Partial pressure of oxygen "PaO2" (mmHg) at 4 hours (87±19 vs. 66.9±14.3, t=5.969 & P< 0.001), Oxygen saturation "SpO2" at 0 minute (84.9±7.6 vs. 80.5±10.3, t=2.426 & P< 0.001), Oxygen saturation "SpO2" at 2 hours (91.3±6.2 vs. 83.4±8.7, t=5.202 & P< 0.001), Oxygen saturation "SpO2" at 4 hours (94.7±5.8 vs. 82.8±9.7, t=7.39 & P< 0.001) and total number of cycles: (13.9±10.8 vs. 0.4±3.1, t=8.44 & P< 0.001). Early prone positioning of non-intubated COVID-19 patients with severe hypoxia is associated with lowering complications and there is statistically significantly different between experimental group and control group regarding discharged to home, transfer to ICU department (60% vs. 8.0%, P <0.05) and death (0.0% vs. 8.0%, P<0.05). While there is not statistically significantly different in others complication resulting from prone positioning of the non-intubated COVID-19 patients with severe hypoxia.

Conclusion: Early prone position on non-intubated COVID-19 patients is associated with elevated partial pressure of oxygen "PaO2" (mmHg) at 2 hours, Partial pressure of oxygen "PaO2" (mmHg) at 4 hours, Oxygen saturation "SpO2" at 0-minute, Oxygen saturation "SpO2" at 2 hours, Oxygen saturation "SpO2" at 4 hours & Total number of cycles. As well as it associated with lowering respiratory rate "RR" (breath per minute) at 4 hours. However, early prone position on non-intubated COVID-19 patients is associated with decreased complications.

Key words: Prone position, non-intubated, COVID-19, hypoxia, Palestine.

Chapter One

Introduction and Theoretical Background

1.1 Introduction

1.1.1 Research Overview

A pandemic of Coronavirus Disease 2019 (COVID-19), distinguished by atypical pneumonia, began in December 2019 in Wuhan, China. This has triggered a global pandemic with growing incidence, consumption of medical resources, mortality, and social-economic pressures (Ni et al., 2020).

The most serious global health pandemic in 2020 is COVID-19 which was caused by infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In certain patients, the progression to respiratory failure and the need for mechanical ventilation (MV) have exhausted global health care systems (Mittermaier et al., 2020).

COVID-19 is also distinguished with acute respiratory distress syndrome (ARDS) and hypoxia that results in respiratory failure (ŞAn et al., 2021).

COVID-19 has a wide range of symptoms, ranging from mild, self-limiting respiratory disease to severe, progressive pneumonia, most commonly seen as ARDS and may require admission to an intensive care unit (ICU) (Ni et al., 2020).

The deteriorating hypoxia that, if left untreated, might progress to acute respiratory syndrome coronavirus and respiratory failure has been a major cause of morbidity and mortality attributed to COVID-19. Previous studies have demonstrated that intubated ARDS patients having physiological advantages due to the prone position (PP), since it recruits dependent parts of the lungs, improves matching of pulmonary perfusion to ventilation and increased clearance of secretion (Jiang et al., 2020).

In patients with respiratory compromise, persistent and unaddressed hypoxia may contribute to negative consequences. In several hypoxic patients, increasing fraction of inspired oxygen (FiO2) is a beneficial treatment, but positive pressure may be needed in patients with severe physiological shunting. Invasive or non-invasive ventilation (NIV) is frequently used to achieve this. Such actions need resources that are typically accessible under ordinary circumstances but are scarce in times of surge. In ARDS patients, awake prone posture has been shown to reduce intubation and help in getting better outcomes (Caputo et al., 2020).

In the early stages of COVID-19 pneumonitis, lung compliance is indicated to be high, recruit ability is limited, and hypoxemia is primarily caused by impaired regulation of pulmonary perfusion patterns. Awake prone posture could improve perfusion/ ventilation mismatch temporarily, but in highly compliant lungs it is unlikely that persistent advantages can be obtained. As the disease progresses, COVID-19 pneumonitis is believed to be increasingly starting to act like ARDS, showing lesser compliance and greater recruit ability with a more desirable long-term response to prone posture (Koeckerling et al., 2020).

Prone ventilation in intubated patients has been a suggested recruitment strategy for several years for ARDS. Awake prone position therapy has provided significant benefits in recent times. This approach increases oxygenation and reduces the requirement to ventilate invasively. With the global pandemic placing a strain on the finances of several nations, in non-intubated patients, a high-flow oxygen treatment with a prone position is also of low risk, simple-to-implement, and low-cost technique (Singh et al., 2020).

The primary mainstay of therapy is supplementary oxygen. In the early phases of the associated coronavirus SARS and in COVID-19, noninvasive ventilation (NIV) has been demonstrated to be an effective alternative to mechanical ventilation with no requirement for a subsequent invasive mechanical ventilation. Prone position in individuals with moderate to extreme refractory hypoxia along with ARDS has also been adopted to boost gas exchange (Burton-Papp et al., 2020).

Patient's prone positioning is considered an efficient basic intervention to reduce mortality and enhance the gas exchange (Taylor et al., 2021).

Prone positioning results in enhanced oxygenation by several strategies. It leads to a lowering in intrapulmonary shunt by raising aeration in the dorsal lung, which tends to obtain higher blood flow even in the prone position. It is also thought that by decreasing atelectrauma and enhancing secretion drainage, ventilator-induced lung injury (VILI) is minimized (Sryma et al., 2020).

Reducing ventilation/perfusion mismatching, hypoxemia and shunting is the physiological reasoning behind prone positioning in ARDS. Prone positioning reduces the pleural pressure gradient between dependent and non-dependent lung parts, because of the effect of gravity, and conformational shape matching of the lung to the chest cavity (Koeckerling et al., 2020).

In hypoxemic patients, the prone posture stands out as a savior technique. The pleural pressure gradient falls during the prone position because of the gravitational impact and the lung's three-dimensional structure. Lung ventilation and load distribution are becoming more homogeneous as a consequence of this physiological change (ŞAn et al., 2021).

1.1.2 Research questions

- What is the effect of early prone position on non-intubated COVID-19 patients with severe hypoxia?
- What are the changes in clinical outcomes associated with prone positioning of COVID-19 patients?
- What are the differences in outcomes between patients who received early prone position and those who received standard care only?
- What are the risks associated with prone positioning of COVID-19 patients?

1.1.3 Problem Statement

COVID-19 is a new infectious disease that was first recognized in Wuhan, China, then it had rapidly spread in the whole globe.

COVID-19 has rapidly become a global pandemic. Acute viral pneumonitis, marked by worsening hypoxia and ultimately contributing to acute respiratory distress syndrome (ARDS) and respiratory failure is a significant contributor to the disease's mortality and morbidity (Jiang et al., 2020).

In 1st of April 2022 the worldwide epidemiological statistics of COVID-19 revealed that the total number of COVID-19 cases is about 490,182,772; the total number of recovered is about 424,905,101; and the total number of deaths is about 6,172,029 (Worldometers, 2022).

Figure 1.1

Global daily new COVID-19 cases (Worldometers, 2022).

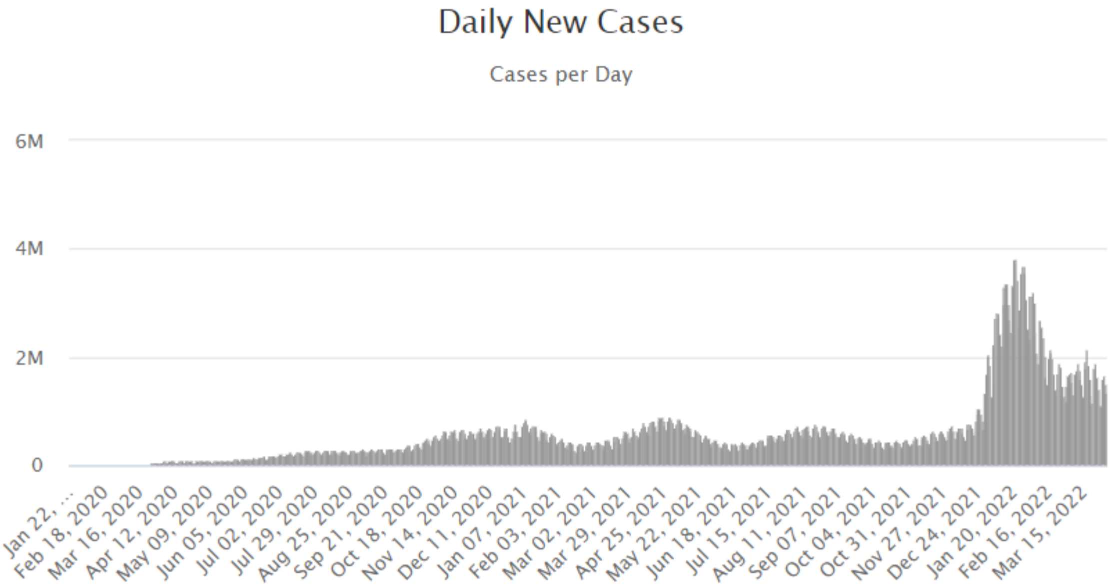
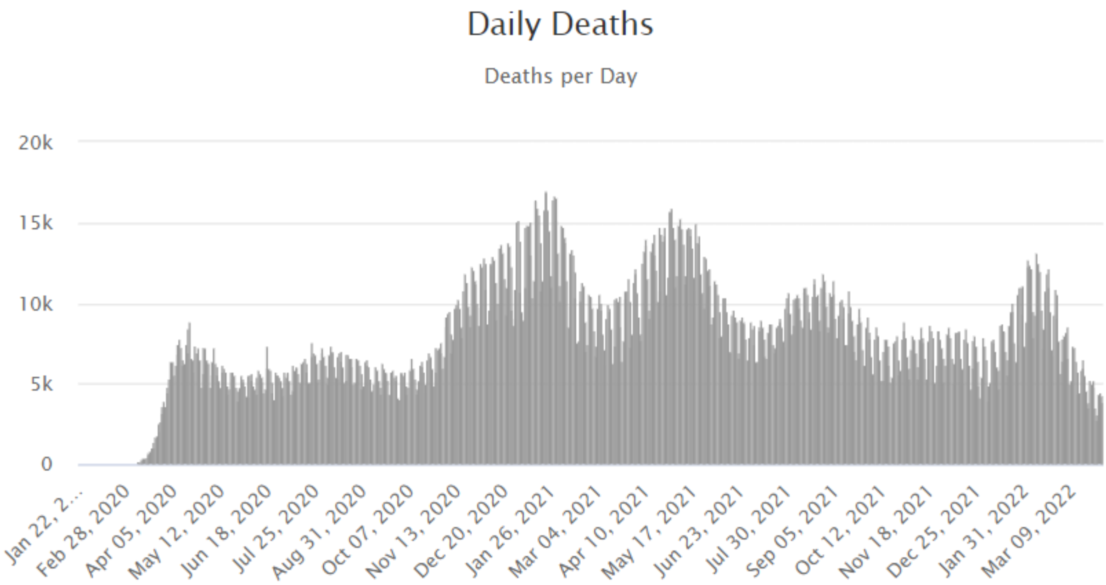


Figure 1.2

Global daily new COVID-19 deaths (Worldometers, 2022).



While in Palestine in 1st of April 2022 the total number of COVID-19 cases reached to about 655,750; And the total number of recovered is about 648,885; While the total number of deaths is about 5,655 (Palestinian Ministry of Health, 2022a).

Figure 1.3

Cumulative number of total cases in Palestine (Palestinian Ministry of Health, 2022a).

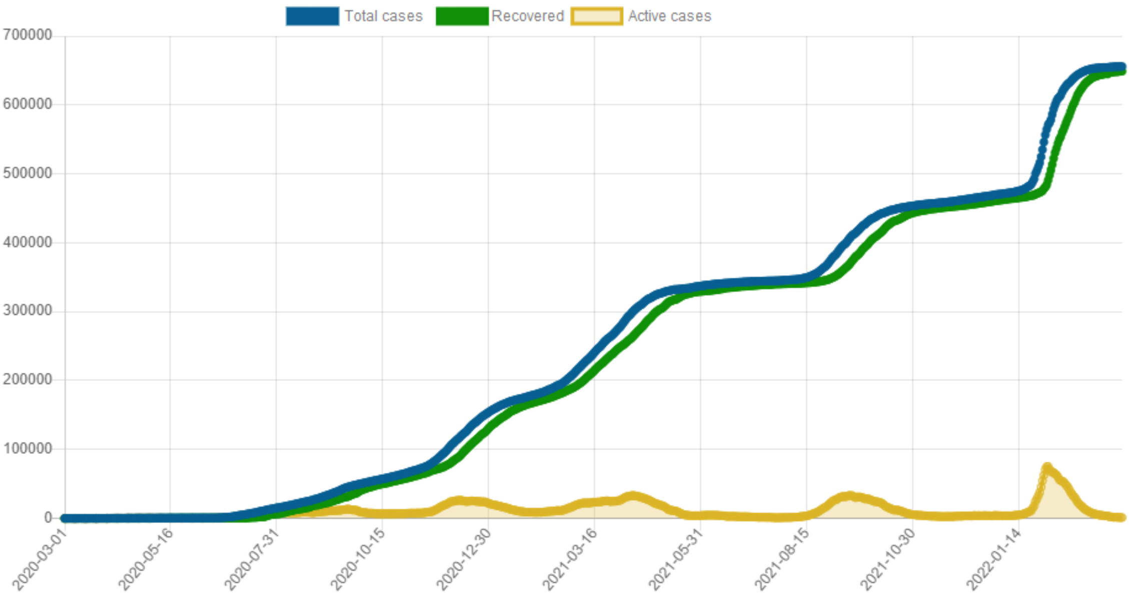
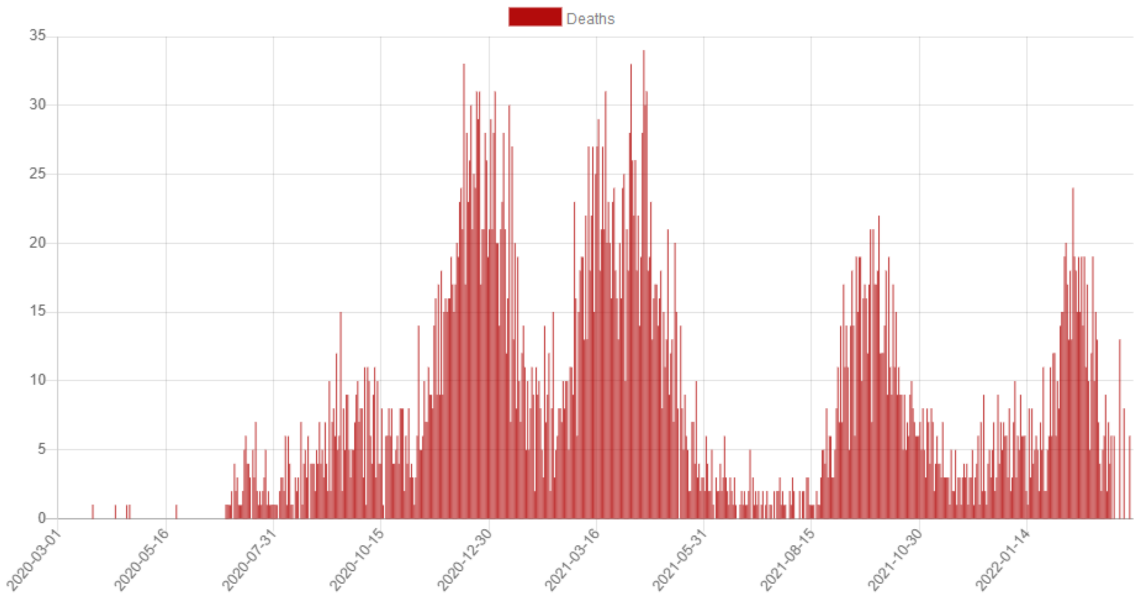


Figure 1.4

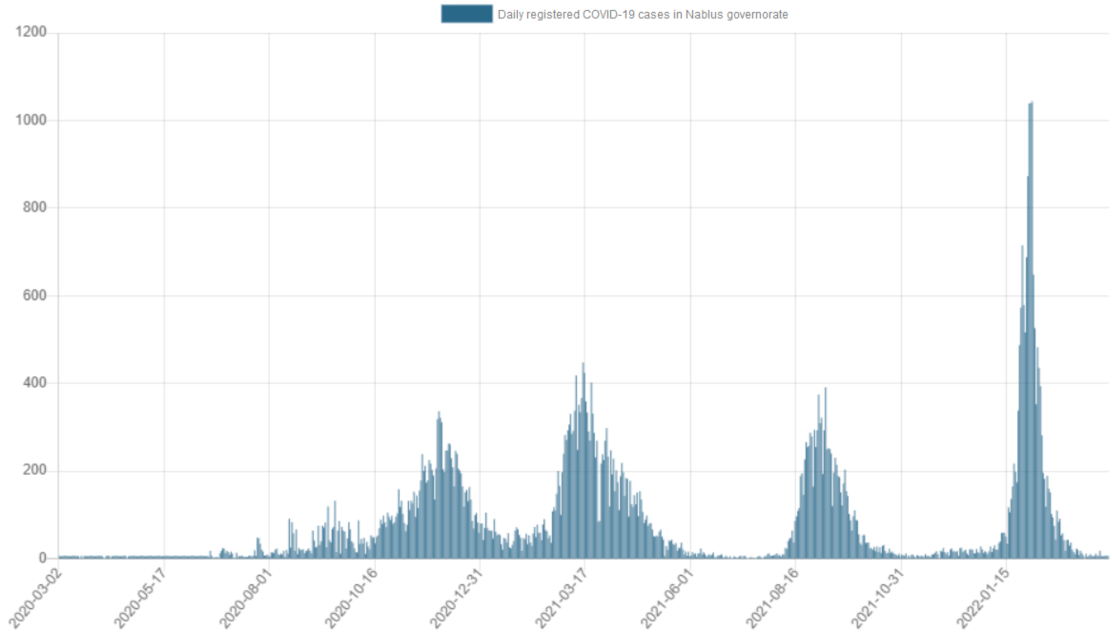
Cumulative number of total deaths in Palestine (Palestinian Ministry of Health, 2022a).



Regarding Nablus governorate in 1st of April 2022 the total number of COVID-19 cases reached to about 59,872; And the total number of recovered is about 59,203; while the total number of deaths is about 640 (Palestinian Ministry of Health, 2022b).

Figure 1.5

Daily registered COVID-19 cases in Nablus governorate (Palestinian Ministry of Health, 2022b).



Around 29 percent of patients with COVID-19 may develop ARDS, in which hypoxemia requiring oxygen therapy is the primary symptom. For hypoxemic patients, HFNC has been shown to avoid intubation and to improve oxygenation. Previous research indicated that the average ratio of arterial oxygen tension to the fraction of inspired oxygen (PaO2/FiO2) can be increased by prone positioning and mortality in moderate to extreme ARDS can be decreased (Li, 2020).

In general, the Low-flow systems for oxygen delivery include Simple face mask, non-re-breather face mask (mask with oxygen reservoir bag and one-way valves which aims to prevent/reduce room air entrainment), Nasal prongs (low flow), Tracheostomy mask, Tracheostomy HME connector, and Isolette - neonates (usually for use in the Neonatal Intensive Care Unit only). Note that in most low flow systems the flow is usually titrated (on the oxygen flow meter) and recorded in liters per minute (LPM). Where the Airvo2 is used as an oxygen delivery device the flow from this device is independent to the flow of oxygen. While the high flow systems include Ventilators, CPAP/BiPaP drivers, Face mask or tracheostomy mask used in conjunction with an Airvo2 Humidifier and High Flow Nasal Prong therapy (HFNP). NB: There is separate CPG for HFNP use in the neonatal intensive care unit (Kemp, 2017).

There are considerable uncertainties concerning the efficacy of prone positioning in ARDS and COVID-19. High-quality studies are therefore important and essential to determine the degree to which prone positioning can be advantageous, and to select those who may benefit from it more than others (Koeckerling et al., 2020).

Therefore, and based on the potential beneficial mechanisms of prone position, the researcher will focus in the proposed study on this subject. This is because early use of prone position may enhance oxygenation, decrease the requirement for intubation in COVID-19 patients, and decrease the mortality rate.

1.1.4 Significant

Prone positioning is a new concept in non-intubated patients that, if successful, could have far reaching effect on the COVID-19 pandemic at this time (Sryma et al., 2020).

Prone positioning for intubated patients with severe ARDS has been used as an adjunctive treatment for several years. Earlier than usual in the COVID-19 pandemic, with the intention of avoiding invasive mechanical ventilation, clinicians started using prone positioning for non-intubated patients. When resources are limited, the use of this affordable intervention makes the most sense (Thompson et al., 2020).

In some patients with COVID-19 requiring oxygen supplementation or NIV/CPAP, prone positioning is effective, safe and can delay respiratory deterioration. In turn, this will decrease Invasive Mechanical Ventilation (IMV) demand, easing the burden imposed on intensive care facilities across the globe. This low-cost and simple intervention will help to raise the ceiling of treatment for patients in resource-limited settings who would otherwise have no further choice (Koeckerling et al., 2020).

Finally, because of the urgent necessity to discover successful COVID-19 treatments, this study would have importance in assisting caregivers in using the early prone position to treat non-intubated COVID-19 patients with severe hypoxia; Also, in reducing the mortality rate of COVID-19 patients with severe hypoxia; And in helping to direct the treatment of future potential patients in an acceptable and effective manner.

1.1.5 Objectives

1.1.5.1 General objective

The main objective of the study is to evaluate the effect of early prone position on non-intubated COVID-19 patients with severe hypoxia.

1.1.5.2 Specific objectives

- Assess the changes in clinical outcomes associated with prone positioning of COVID-19 patients.
- Compare the clinical outcomes between patients who received early prone position and those who received standard care only.
- Identify the risks associated with prone positioning of COVID-19 patients.

1.1.6 Research Hypothesis

H0: There is no effect of early prone position on non-intubated COVID-19 patients with severe hypoxia at the level of 0.05.

H0: There is no change in clinical outcomes associated with prone positioning of COVID-19 patients at the level of 0.05.

H0: There is no significant difference related to clinical outcomes between patients who received early prone position and those who received standard care only at the level of 0.05.

H0: There are no risks associated with prone positioning of COVID-19 patients at the level of 0.05.

1.1.7 Operational Definitions

1.1.7.1 Prone position

It is the process in which the person turns from his / her back onto their abdomen with careful, specific, secure movements, so that the person lies face down. This facilitates greater expansion of the dorsal lung regions, improved body movement, and promoted removal of secretions which can eventually contribute to oxygenation advances (Brianna, 2020).

Early prone positioning was defined as awake prone positioning initiated within 24 h of high-flow nasal cannula (HFNC) start (Kaur et al., 2021).

1.1.7.2 Hypoxia

It is a lower-than-normal oxygen concentration in arterial blood. Any interruption or disruption in normal breathing will result in hypoxia (Davis, 2021).

The COVID-19 binds to receptors on the lung's alveolar cells, which produce surfactant. Surfactant is a substance that breaks up surface tension of water within the alveoli, preventing the alveolar space from collapsing during exhalation. However, infection reduces surfactant production and the consequent collapse of air spaces, which reduces the bloodstream's access to oxygen and can result in hypoxia. In some cases, infected patients can develop hypoxia without experiencing any breathlessness, a phenomenon known as silent hypoxia (Quezada & Kattapuram, 2021).

Hypoxia is classified into normal (Spo2 >95%), mild (Spo2 90-94%), moderate (Spo2 75-89%), and severe (Spo2 <75%) (Quezada & Kattapuram, 2021).

As for this study, it depends on the data from Gandhi et al., (2020) about clinical practice and management of Covid-19 according to disease stage or severity, which considers a patient to be in severe stage of Covid-19 if an oxygen saturation is less than 94%.

1.1.7.3 Coronavirus disease (COVID-19)

It is an infectious disease caused by the newly discovered coronavirus. Most COVID-19 infected persons may experience mild to moderate respiratory symptoms and will recover with no need for special treatment. Critical symptoms are more likely to emerge in the elderly and people with medical conditions or diseases like cardiovascular disease, diabetes, cancer, and chronic respiratory disease. The COVID-19 virus spreads mostly by nasal discharge or saliva droplets when an infected person sneezes or coughs (WHO, 2020).

1.2 Theoretical framework

1.2.1 Signs and symptoms of COVID-19

Initial diagnosis of COVID-19 disease and identification of persons with COVID-19 pneumonia are based on signs and symptoms. Signs such as lung auscultation findings or oxygen saturation, and symptoms such as cough or fever, are the initial and most readily accessible diagnostic indications (Struyf et al., 2020).

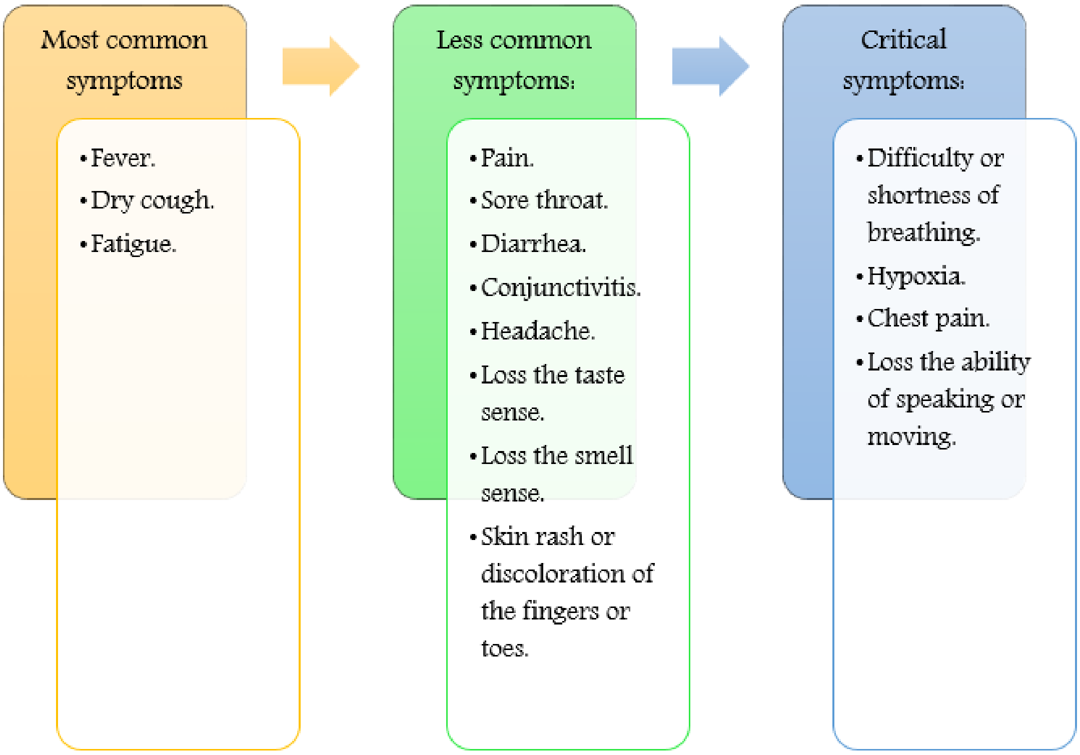
Symptoms are what patients experience. Persons with mild COVID-19 may complain of loss of sense of taste and smell, fatigue, joint or muscle pain, headache, diarrhea, high temperature, sore throat, and cough. COVID-19 pneumonia has a variety of symptoms including high temperature (above 38 °C), pressure or pain in the chest, confusion, loss of appetite, and breathlessness. As well as the main and most common symptoms that linked with mild to moderate COVID-19 disease include loss of sense of taste and smell, fatigue, muscle pain, breathlessness on light exertion, headache, diarrhea, fever greater than 37.8 °C, and bothersome dry cough (for example, coughing more than normal in 1 hour period, or 3 or more coughing episodes in 24 hours). Red flags indicating potential pneumonia involve temperature above 38 °C, pressure or pain in the chest, confusion, loss of appetite, and breathlessness at rest (Struyf et al., 2020).

Signs are what is clinically examined and evaluated, and include lung auscultation findings, heart rate and blood pressure (Struyf et al., 2020).

It has been postulated that patients with COVID-19–related ARDS can develop typical ARDS (recently called “H type,” characterized by high elastance, high shunt, and high lung weight) or have an atypical presentation (recently called “L type,” characterized by low elastance, low shunt, and low lung weight). Patients with H-type ARDS may benefit from lower tidal volumes and higher positive end-expiratory pressure (PEEP), and patients with L-type ARDS may benefit from higher tidal volumes and lower PEEP (Bos et al., 2020).

Figure 1.6

Symptoms of COVID-19 (WHO, 2021).



1.2.2 Causes

The virus that causes coronavirus-19 (COVID-19) disease is COVID-19/severe acute respiratory syndrome coronavirus 2 (CoV-19/SARS-CoV-2) which considered a highly pathogenic virus (Conti & Younes, 2020).

1.2.3 Pathophysiology

1.2.3.1 Viral Invasion

The viral invasion via its target host cell receptors is the initial step in COVID-19 pathogenesis. The SARS-CoV-2 is made up of 4 main structural glycoproteins: envelope (E), membrane (M), nucleocapsid (N), and spike (S). The spike protein is critical for viral binding and entrance into host cells, whereas the envelope, membrane, and nucleocapsid proteins are required for viral particle assembly and release. Like SARS-CoV, human angiotensin converting enzyme 2 (ACE2), has been identified as an entrance receptor for SARS-CoV-2 by multiple studies. SARS-CoV-2 is transmissible mostly through large respiratory droplets, that directly infect cells of both lower and upper respiratory tract, mainly nasal ciliated and alveolar epithelial cells. In addition to the lungs, ACE2 is also expressed in variety of human tissues, including the adipose tissue, testis, thyroid, heart, kidneys, and small intestine, indicating that when viremia is present, the virus may directly infect cells of different body organs, Figure (7), (Bohn et al., 2020).

1.2.3.2 Host Response

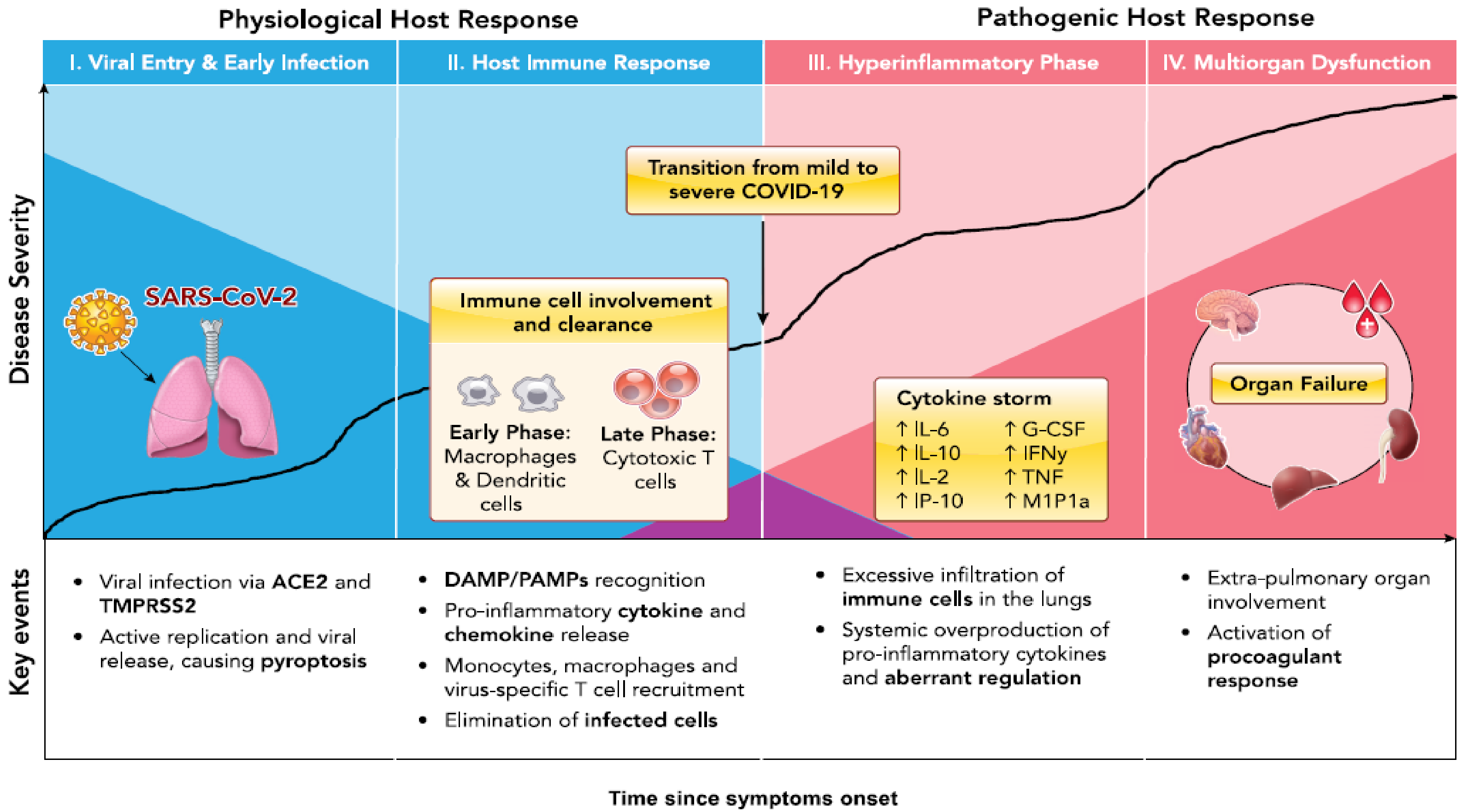
The first line of physiological protection against SARS-CoV-2 infection is a well-coordinated, localized, and timely immune response. SARS-CoV-2 infection, like other cytopathic viruses, causes cellular death and damage in airway epithelial cells via different processes like pyroptosis. Viral-mediated cell death causes release of various pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs), which are thought to be identified by pattern-recognition receptors on alveolar macrophages and endothelial cells. Nucleotide-binding domain leucine-rich repeat (NLR) proteins, for example, identify DAMPs expressed intracellularly, triggering activation of inflammasomes and converting of proIL-1B to active IL-1B. On the other hand, Toll-like receptors (TLRs) identify PAMPs predominantly in the extracellular space, triggering induction of proinflammatory cytokine transcription factors like NF-κB and activating interferon regulatory factors that mediate the type I interferon-dependent antiviral response. In patients with COVID-19, circulating levels of IL-1B indicate local inflammasome activation with no systemic symptoms. Overall, these processes promote an increased production of proinflammatory cytokines and chemokines, like interferon gamma-induced protein 10 (IP-10), monocyte chemoattractant protein 1 (MCP1), and IL-6, type II interferon (IFNγ), as well as subsequent pulmonary recruitment of immune cells, including dendritic and macrophages cells. Direct viral infection of macrophages and/or dendritic cells is estimated to promote more chemokine and cytokine production, triggering activating late-phase immune cell recruitment of antigen-specific T cells to destroy virally infected alveolar cells. In addition to cytokine production and immune cell recruitment, antibody neutralization is another possible mechanism that might contribute to efficient viral clearance. Many studies indicate that seroconversion occurs 7–14 days after the beginning of symptoms in patients with COVID-19, Figure (8), (Bohn et al., 2020).

1.2.3.3 Extra pulmonary Involvement and Progression to Multisystem Organ Failure

One of the key hallmarks of COVID-19 severity is the progression to systemic disease characterized by multisystem organ damage or failure, Figure (9), (Bohn et al., 2020).

Figure 1.7

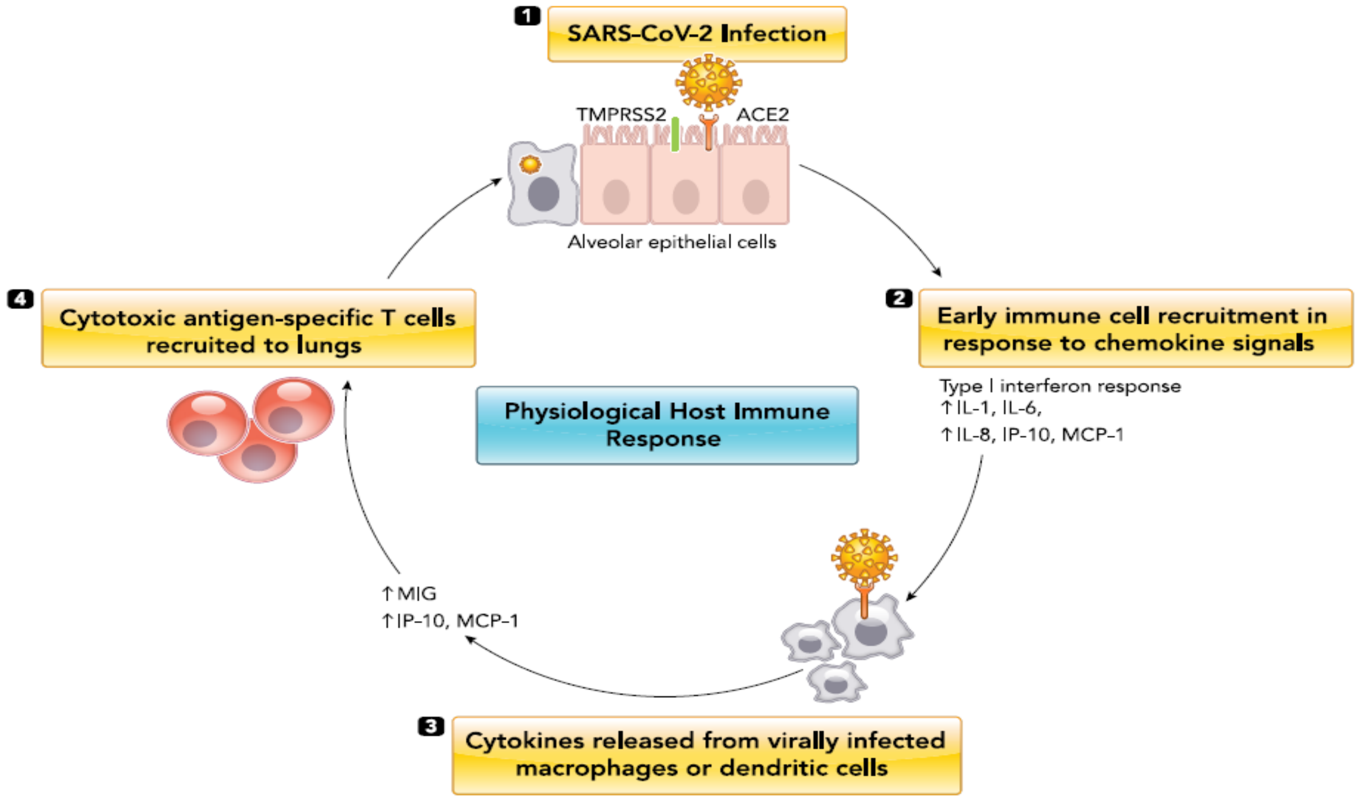
Characterization of key events in COVID-19 disease pathophysiological progression (Bohn et al., 2020).



Note. Pathogenic hyperinflammatory host response over time is indicated by dark red shading, whereas physiological viral host response is indicated by dark blue shading. **PAMPs**: Pathogen-associated molecular patterns; **DAMPs**: Damage-associated molecular patterns; **ACE2**: Angiotensin converting enzyme 2; **TMPRSS2**: Transmembrane serine protease 2.

Figure 1.8

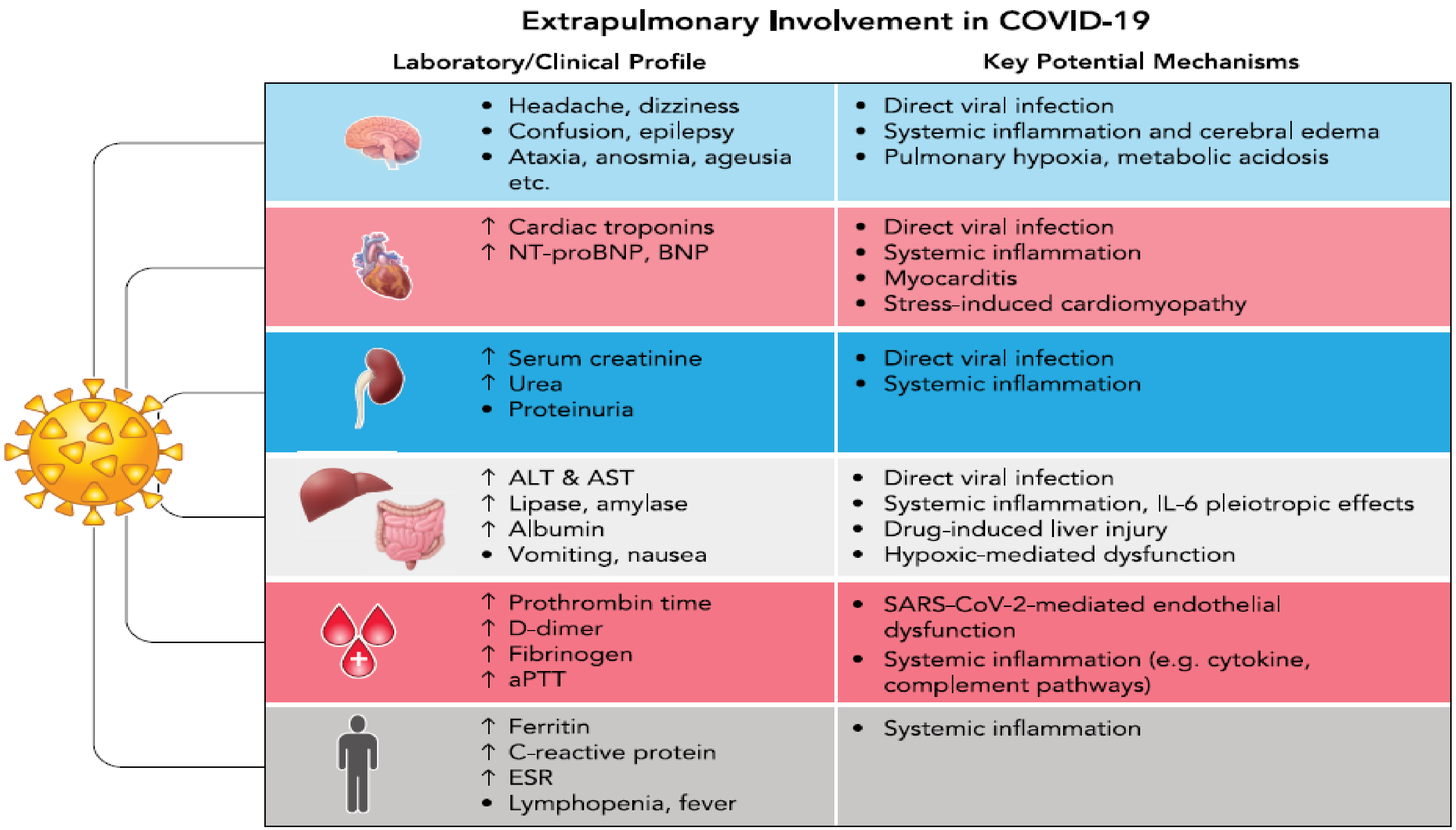
Physiological host immune response to SARS-CoV-2 infection (Bohn et al., 2020).



Note. 1: SARS-CoV-2 enters alveolar epithelial cells by binding to angiotensin converting enzyme 2 (ACE2) through surface spike (S) protein mediated by transmembrane serine protease 2 (TMPRSS2). 2: pulmonary recruitment of macrophages and dendritic cells in response to chemokine and cytokine release (early phase). 3: direct viral infection of pulmonary macrophages and dendritic cells causes expression of several proinflammatory cytokines and chemokines. 4: dendritic cells phagocytose virus in the lungs, migrate to secondary lymphoid organs, and activate antigen-specific T cells, which travel to the lungs and destroy virally infected alveolar cells.

Figure 1.9

Laboratory/clinical profile and key potential mechanisms underlying extrapulmonary manifestations observed in severe COVID-19 patients (Bohn et al., 2020).



Note. **ALT**, alanine aminotransferase; **aPTT**, activated partial thromboplastin time; **AST**, aspartate aminotransferase; **ESR**, erythrocyte sedimentation rate; **NT-proBNP**, NH2-terminal-proB-type natriuretic peptide; **SARS-CoV-2**, Severe Acute Respiratory Syndrome Coronavirus 2.

1.2.4 Diagnosis

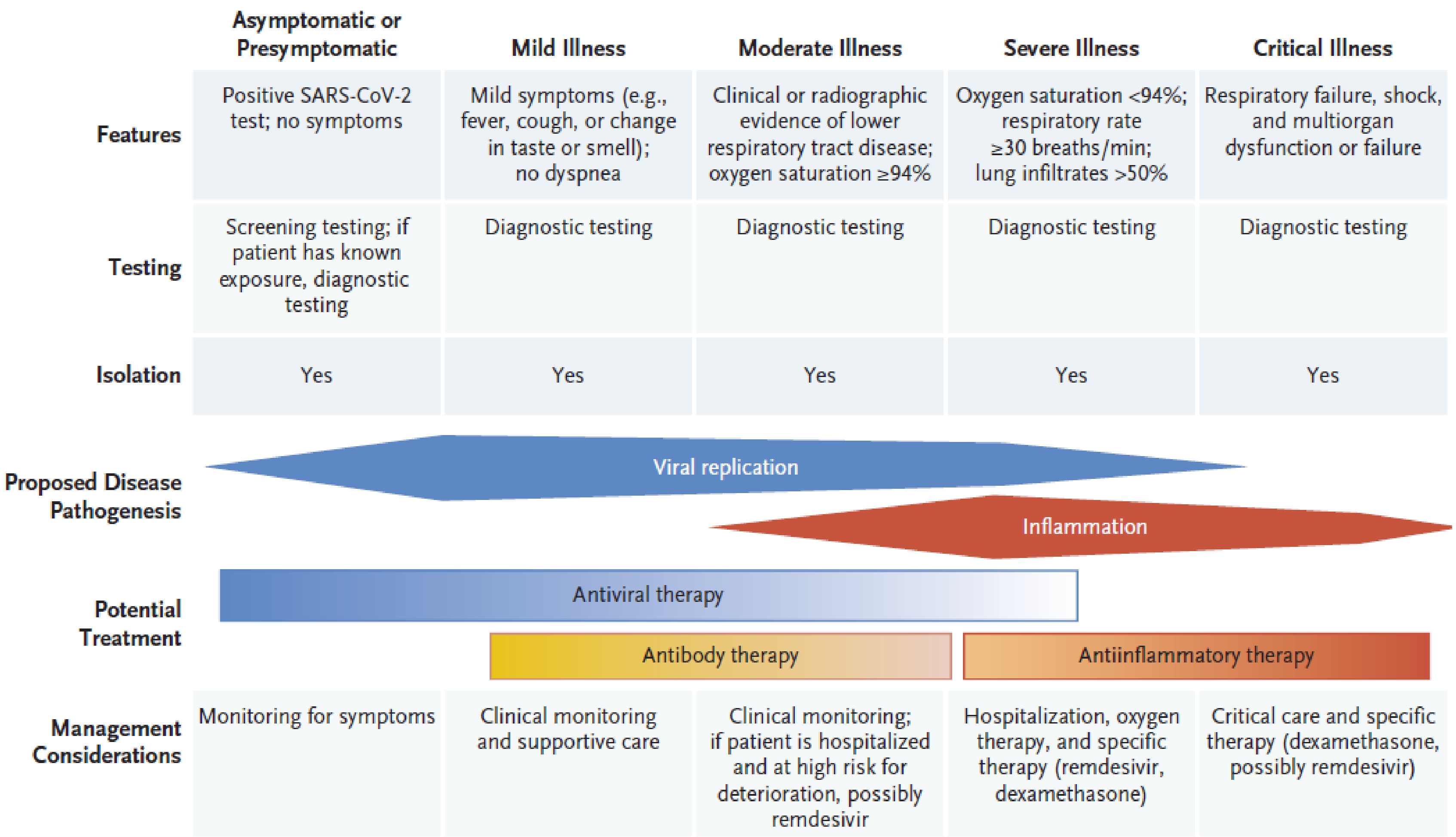
Current coronavirus diagnostic tests involve reverse-transcription polymerase chain reaction (RT-PCR), real-time RT-PCR (rRT-PCR), and reverse transcription loop-mediated isothermal amplification (RT-LAMP). Laboratory tests, involving oropharyngeal and nasopharyngeal swab tests, have become a basic examination for diagnosis of COVID-19 infection, according to current diagnostic criteria established by the China National Health Commission. For individuals who have fatigue, sore throat, fever, dyspnea or coughing and have recently been exposed, COVID-19 infection should be diagnosed with typical chest computerized tomography (CT) characteristics despite negative results of RT-PCR. Chest CT scans can be used to determine the severity of COVID19 (Zhai et al., 2020).

1.2.5 Management and Treatment

Evaluation and management of Covid-19 depends on the severity of the disease. Patients with mild disease often recover at home, but patients with intermediate disease must be constantly observed and, in certain cases, hospitalized, Figure (10), (Gandhi et al., 2020).

Figure 1.10

Clinical practice and management of Covid-19 according to disease stage or severity (Gandhi et al., 2020).



1.2.6 Preventative Actions

COVID-19 can be prevented with both non-pharmaceutical measures (for example, hand hygiene, physical distancing, masking) and pharmaceutical (i.e., vaccination). Every one of these preventative interventions are necessary to protect people from acquiring and transmitting the SARS-CoV-2 virus and should be carried out in tandem with one another (CDC, 2021).

1.2.6.1 Vaccination

Getting vaccinated is a prophylactic approach that individuals can take to avoid becoming ill with COVID-19 and to avoid infecting others. Despite effective and safe vaccinations are an extremely useful tool for prevention, it is critical to maintain additional preventative measures like as avoiding crowded and poorly ventilated areas, physically distancing from people, practicing hand hygiene, and wearing masks (CDC, 2021).

It is worth noting that currently there are many types of COVID-19 vaccines that a person can receive.

1.2.6.2 Masks

Wearing masks is another crucial COVID-19 prevention measure that should be continued. There are several aspects to consider while choosing a mask. Masks should:

- Contains two layers or more of breathable, washable fabric.
- Cover the mouth and nose completely.
- Fit comfortably and well-protected against the face sides and does not have gaps.
- Have a nose wire to prevent air from leaking out of the top of the mask.

(CDC, 2021).

1.2.6.3 Other preventative actions

Notwithstanding the introduction of vaccinations as a tool for COVID-19 prevention and the proper use of masks, CDC advises the following critical COVID-19 preventative practices: avoiding crowded and poorly ventilated areas or wearing a mask in these areas; practicing good hand hygiene; keeping high touch surfaces clean; monitoring symptoms; and getting tested if sick (CDC, 2021).

1.2.7 Complications

Some individuals, around one in every six, may experience complications, some of which are life-threatening. Many of these complications may occur due to a condition known as cytokine release syndrome or a cytokine storm. This occurs when the infection causes the immune system to flood the bloodstream with inflammatory proteins known as cytokines. They can kill tissue and damage organs such as kidneys, heart, and lungs (Smith, 2021).

Complications can be neurological, cardiac, systemic, respiratory, vascular, hematologic and cutaneous, as shown in Figure (11) in Appendix F.

1.3 Literature Review

Through a review of various previous research, the researcher read and reviewed the studies that focused on COVID-19 patients in health care centers and the effect of prone position on these patients.

The review of literature was done based on all available and accessible literature such as: systematic reviews, published research papers, theses, journal articles and websites and of course books. The researcher reviewed and looked at the positioning of non-intubated COVID-19 patients, especially prone position, and the effect of prone position on clinical outcomes.

The researcher had used medical research sources (PubMed, Google Scholar, CINAHL, LILACS, WHO website and Cochrane Library) to pick the related studies and articles on this subject, in single or combined phrases, with the following main words: prone position for COVID-19 patients, prone position and ARDS, prone position for non-intubated patients, and effect of prone position. Further consideration was given to the related papers cited in the references of selected articles for inclusion in the literature review. Original literatures that have been typed and published in English were involved. Moreover, the literatures documents were chosen after cross-referencing the sources and removing the duplicates and irrelevant documents.

There are a small number of research that studying the effect of prone positioning on non-intubated COVID-19 patients.

Research on prone positioning gained importance because of the excessive use of health care resources (i.e., MV and ICU beds) during COVID 19 pandemic, which lead to depletion of these resources. Therefore, other methods of treatment (such as prone position) were needed (ŞAn et al., 2021).

It was revealed through a recent study that prone positioning could enhance gas exchange in COVID-19 patients through oxygen therapy and non-invasive support (Schifino et al., 2021).

According to results that have been revealed by Alhazzani et al. (2020), the clinical trials have not evaluated the prone position formally in COVID-19 AHRF, also they showed that the use of prone positioning was reinforced by several global guidelines including the ANZICS COVID-19 guidelines and the surviving sepsis campaign.

In addition, according to a recent study done by Elharrar et al. (2020), oxygenation improved through a single episode of prone positioning in conscious non-ventilated COVID-19 patients.

While another study conducted by Sartini et al. (2020). It aimed to assess the respiratory parameters for fifteen non-ICU patients before, during, and after receiving noninvasive ventilation in the prone position. It showed that there was an improvement in peripheral oxygen saturation in 12 of 15 patients with COVID-19 who treated with pronation and NIV (median total of two cycles, 3 hours), while the remainder had either deteriorated or stabilized. Therefore, it demonstrated its feasibility in non-critical care areas.

At the same way, in a retrospective study that was done by Sun et al. (2020) on 610 patients from China. It showed that a multipronged intervention involving early and aggressive use of HFNC and NIV combined with prone position for awake patients lead to lower mortality rate.

A recent review of conscious proning in ARDS and COVID-19 infection was prepared by Chad and Sampson (2020), it involved a variety of studies with small number of patients and indicated that the prone position led to short-term enhancements in oxygenation. This review provides evidence on the usage of the prone position for conscious non-ventilated COVID-19 patients, to help the staff members in deciding.

Anesi (2022) advises the hospitalized COVID-19 patient to spend as much time as possible in the prone position while receiving oxygen or non-invasive support methods such as HFNC or NIV. The reasoning for this approach has been based on limited direct evidence and observational field findings, as well as indirect evidence of its influence in ventilated patients with ARDS. Emerging evidence indicates that in some COVID-1 patients, proning is favorable and results in enhanced oxygenation, regardless of whether they receive either supplemental oxygen, NIV or HFNC.

As an example, from New York city, during the first progression phases of the COVID-19 pandemic, a substantial number of patients suffered from moderate to severe hypoxia. Many of those patients were deteriorated rapidly, distressed and needed endotracheal intubation. COVID-19, however, created another category of patients whose pathophysiology confounded existing disease patterns. These patients had poor oxygen saturations ($SpO_2 < 90\%$) but did not experience severe respiratory distress and seemed to be in good clinical condition. Since most of those patients were distinctly tachypneic, had hypoxemia that did not response to supplemental oxygen, had chest radiographic findings close to ARDS, and many of them were needed to be intubated early in their hospital course due to infectious aerosolization issues about alternative oxygenation methods. The consequence of extensive early intubation of patients with COVID-19 lung disease has rapidly exhausted ventilator stockpiles and critical care resources. It was believed that the applying of prone position for awake COVID-19 patients would enhance patient's oxygenation and avoid intubation or delay it (Caputo et al., 2020).

A recent preliminary study of twelve patients seriously ill with COVID-19 conducted by Pan et al. (2020) showed that the position intervention was correlated with enhanced oxygenation and lung recruit-ability.

In addition, Singh et al. (2020) performed a retrospective case study to find out benefits of conscious proning with oxygen therapy on fifteen non-intubated patients with COVID-19. Co-operative patients who had been hemodynamically stable and $SpO_2 <$ 90% participated in the study. Oxygen was provided through non-rebreathing mask, facemask and NIV to patients as required. Patients were instructed to maintain their prone position and the target time was 10-12 hours daily. In COVID-19 patients with progress in clinical symptoms with decreasing intubation rate, awake prone positioning showed noticeable progress in P/f ratio and SpO2.

Also, in prospective study that was done by Elharrar et al. (2020) on 24 COVID-19 patients with hypoxemic respiratory failure, one third of whom had oxygen flow of four liters or more (involving HFNC), fifteen patients (63%) were able to tolerate prone positioning for more than three hours. Of those who tolerated prone positioning, 6 (40%) experienced enhancements in oxygenation during applying prone position, but resupination in three of those enhancements was not sustained.

likewise, in another prospective cohort that was performed by Coppo et al. (2020) on 56 patients, to examine the feasibility and impact of prone position on gas exchange in awake, non-intubated patients with pneumonia associated with COVID-19. Prone positioning was maintained in most participants (89%) for 3 hours at least. Oxygenation improved from a partial arterial pressure of oxygen/fraction of inspired oxygen (PaO2/FiO2) ratio of 181 mmHg (supine) to 286 mmHg (prone) for the whole group. In half of responders, improved oxygenation was sustained. Eventually, almost a quarter of participants were intubated regardless of whether they had been responders or non-responders.

Furthermore, a single-center, prospective observational study which had been done by Zhong Ni and others to assess the effectiveness of early position intervention on non-invasively ventilated critical COVID-19 patients. It gave the first prove that the early position intervention influenced lung lesion absorption and oxygenation improvement (Ni et al., 2020).

Moreover, Thompson et al. (2020) examined if the prone position is linked with improved oxygenation and reduced risk for intubation in spontaneously breathing patients with severe COVID-19 hypoxemic respiratory failure. In this research, researchers in New York City studied 29 patients with COVID-19 and acute hypoxemic respiratory failure (i.e., oxygen saturation, ≤93% and RR ≥30 breaths per minute) supported with 15 L per minute of oxygen via facemask and 6 L per minute of oxygen via nasal cannula. Patients were requested to lie on their abdomens for the whole day as tolerable. All patients who had been able to apply prone position (25 of 29) had raises in SpO2, although the proportion of improvement diversified vastly (range, 1%–34%). 2

thirds of patients had SpO2 ≥95% after 1 hour of applying prone position. These patients were significantly less potential to need intubation eventually than patients whose SpO2 stayed under 95% after 1 hour of applying prone position (37% vs. 83%).

Also, another study was conducted by Caputo et al. (2020) and aimed to describe the early use of prone position in the emergency department (ED) for conscious, non-intubated patients during the COVID-19 pandemic. Fifty patients were participated. This study showed that the early self-applying of prone position in the emergency department (ED) showed improved SpO2 in COVID-19 patients. Overall, the median SpO2 at triage was 80%. After the patients were receiving of supplemental oxygen on room air it improved to 84%. After 5 minutes of applying prone position, SpO2 was reached to 94%.

According to González Moreno et al. (2020), almost up to 5% of COVID-19 patients require to be treated in the intensive care departments. up to 71% of all these patients will develop ARDS. In patients with refractory hypoxemia secondary to ARDS, the technique of applying prone position for COVID-19 patients has shown satisfactory results. There is also a good response with hypoxemia improvement as well as chest X-ray image.

A retrospective chart review was made by Wendt et al. (2020) to evaluate changes in pulse oximetry linked with prone positioning on alert, conscious, spontaneously breathing non-intubated COVID-19 patients with ARDS. The main outcome was a change in pulse oximetry linked with prone positioning, evaluated on room air, with supplemental oxygen, and about 30 minutes after beginning prone positioning. it showed that the initially low pulse oximetry reading enhanced with prone positioning; where the median pulse oximetry raised as 83% on room air, 90% with supplemental oxygen, and 96% with prone positioning.

Finally, there is a study performed by Burton-Papp et al. (2020) to evaluate the effect of prone positioning in spontaneously ventilating patients receiving non-invasive ventilation in critical care departments. It showed a total of twenty patients have received prone position in conjunction with non-invasive ventilation, which lead to oxygenation improvement as assessed by a change in PaO2/ FiO2 (P/F) rate of 28.7 mmHg during prone without considerable change in RR or HR. On average, the patients underwent five cycles with a median period of 3 hours. No recorded deaths occurred, seven out of twenty patients (35%) had failed non-invasive ventilation, and consequently needed intubation and mechanical ventilation. In this research, prone positioning with non-invasive ventilation resulted in improved oxygenation of 20 COVID-19 patients with moderate acute hypoxic respiratory failure.

1.4 Summary

It is attracting attention that the studies have agreed on a range of results, including: based on high quality data, prone positioning is widely adopted into routine treatment for COVID-19 patients with hypoxia or ARDS; prone positioning can often be used in noncritical care areas for not intubated patients with hypoxic respiratory failure who are conscious and breathing spontaneously to decrease mortality, reduce dyspnea and also to enhance oxygenation; and the risks or complications that COVID-19 patients can suffering from it as a result of applying the prone position are minimal.

While they differed in number of subjects (COVID-19 patients); Variables that have been studied; and the applying duration of prone position on COVID-19 patients.

Chapter Two

Methods

2.1 Research design

In this research, a single blind study, Randomized Controlled Trial (RCT) design was used.

One of the most powerful and simplest instruments in clinical research is the Randomized Controlled Trial. It is a study in which individuals are selected randomly to receive one of clinical interventions. The standard of comparison or control is one of these interventions. The control may be a placebo, a no intervention at all or a standard treatment. Any person who participates in RCT is called a subject or a participant. Measurement and comparing the outcomes is often required by RCTs after the participants receive the interventions. As the outcomes can be measured, RCTs are considered quantitative studies (Stöppler, 2021).

To sum it all, the researcher can say that RCTs are comparative, quantitative, controlled experiments in which the researchers are studying two or more interventions in a series of the persons who receive them randomly (Stöppler, 2021).

2.2 Study Population

The population of the study was COVID-19 patients aged 18 years or more, with severe hypoxia admitted to COVID-19 department during May 2021, to July 2021. The total number of these populations was 134 patients.

Experimental group: Patients who were admitted to COVID-19 department and suffering from severe hypoxia and positioning on the prone position.

Control group: Patients who were admitted to COVID-19 department and suffering from severe hypoxia and positioning on another position other than prone position.

2.3 Study setting

The study was conducted at COVID-19 departments (intermediate units) in Palestinian Red Crescent Society - Nablus, which treat Covid-19 cases.

2.4 Study period

The study was begun in March 2021, after receiving approval from the Institutional Review Board (IRB) of An-Najah National University and approval from the Research Ethics Committee of the Palestinian Ministry of Health. The pilot study was conducted in April 2021. Data collection was started in May 2021, to July 2021. Data was entry in August 2021. Also, data analysis, reviewing of literature and writing the study was continued until December 2021.

2.5 Sample size

It included 100 COVID-19 patients (50 experimental group and 50 control group). The number of samples was measured by an online sample size calculator (Appendix A). It is accessible on website "Select Statistical Services"; and it used to calculate the accurate sample size (Select Statistical Services Limited, 2018).

2.6 Inclusion & Exclusion Criteria

2.6.1 Inclusion Criteria

Non-intubated COVID-19 patients with severe hypoxia; Living in Nablus governorate (Including City, Camps and Village); Available at the study period; Aged 18 years or over; Hemodynamically constant; Conscious, with a normal mental status; Able to follow instructions and call for help; Able to change position by themselves; Written informed consent; Cooperative; and with lower oxygen saturation & need for supplemental oxygen source.

2.6.2 Exclusion Criteria

Intubated COVID-19 patients.

Non-intubated COVID-19 patients aged less than18 years; Don’t living in Nablus city; Not available at the study period; Impaired consciousness or altered mental status; Unable to change position by themselves; Don’t write informed consent; With extreme respiratory distress & requiring immediate intubation; Hemodynamically not constant; Uncooperative; Don’t able to follow instructions & call for help or communicate with care team; With normal oxygen saturation without need for supplemental oxygen source; In a setting where patient is unable to be closely monitored; Having any contraindication of pp (such as: chest trauma, abdominal wound, pregnancy, obese patients etc.); And who show signs of respiratory fatigue, or receiving end-of-life care.

2.7 Sampling technique

The randomization method was used to select participants. The sequence was generated on a computer using Random Allocation software 2.0.

0001: **Control**	0026: **Experimental**	0051: **Control**	0076: **Experimental**
0002: **Control**	0027: **Experimental**	0052: **Control**	0077: **Control**
0003: **Experimental**	0028: **Experimental**	0053: **Experimental**	0078: **Experimental**
0004: **Experimental**	0029: **Control**	0054: **Control**	0079: **Experimental**
0005: **Experimental**	0030: **Experimental**	0055: **Control**	0080: **Control**
0006: **Experimental**	0031: **Experimental**	0056: **Experimental**	0081: **Experimental**
0007: **Experimental**	0032: **Experimental**	0057: **Control**	0082: **Control**
0008: **Experimental**	0033: **Experimental**	0058: **Control**	0083: **Control**
0009: **Experimental**	0034: **Control**	0059: **Control**	0084: **Experimental**
0010: **Control**	0035: **Experimental**	0060: **Control**	0085: **Control**
0011: **Experimental**	0036: **Control**	0061: **Experimental**	0086: **Experimental**
0012: **Experimental**	0037: **Control**	0062: **Control**	0087: **Experimental**
0013: **Experimental**	0038: **Experimental**	0063: **Control**	0088: **Control**
0014: **Control**	0039: **Experimental**	0064: **Control**	0089: **Experimental**
0015: **Experimental**	0040: **Experimental**	0065: **Experimental**	0090: **Experimental**
0016: **Control**	0041: **Experimental**	0066: **Control**	0091: **Experimental**
0017: **Experimental**	0042: **Experimental**	0067: **Control**	0092: **Control**
0018: **Control**	0043: **Control**	0068: **Control**	0093: **Experimental**
0019: **Experimental**	0044: **Control**	0069: **Control**	0094: **Control**
0020: **Experimental**	0045: **Control**	0070: **Control**	0095: **Experimental**
0021: **Control**	0046: **Control**	0071: **Experimental**	0096: **Control**
0022: **Experimental**	0047: **Control**	0072: **Experimental**	0097: **Experimental**
0023: **Control**	0048: **Control**	0073: **Experimental**	0098: **Experimental**
0024: **Control**	0049: **Control**	0074: **Control**	0099: **Control**
0025: **Experimental**	0050: **Control**	0075: **Control**	0100: **Control**

In this study 100 patients were randomly assigned to one of two groups, each with 50 individuals. The participants' numbers were written on sealed and opaque envelopes, and the type of group was written on a card inside the envelope. The envelopes were opened to determine which group the patients would be allocated to when they were recruited to the study.

2.8 Blindness

A single blindness was used, in which only the researcher doing the study knows which treatment or intervention the participant is receiving until the trial is over.

2.9 Study tool

The patient checklist was used to achieve the purposes of the study. It included demographic characteristics, past medical history, clinical characteristics, medications given, ABGs, and prone position characteristics (Appendix B).

2.10 Validity of the study tool

To validate study tool, the checklist was sent to professionals and academics who have the qualifications and experience in critical care field to validate it, to increase the rate of response and to evaluate if it is scientifically and medically accurate or not. Also, to determine if the questions are significant and relative to the study objectives and variables.

All amendments and feedback are going to be considered. Moreover, a pilot study was done as a pretest for data collection.

2.11 Pilot study

Before data collection, a pilot study was carried out as a pre-test to identify any flaws in the contents of the checklist; to assess the real time required to fill the checklist and to identify areas of vagueness; to predict the answer rate and to test the validity and suitability of the checklist. Five patients from the experimental group and five patients from the control group were recruited. The pilot study sample was used as part of the study sample.

2.12 Data Collection

Data was collected from COVID-19 department in Palestinian Red Crescent Society - Nablus, which treat Covid-19 cases by using the checklist, which includes demographic characteristics, past medical history, clinical characteristics, medications given, ABGs, and prone position characteristics. Data was collected by the researcher side by side with some assistants; and it was carried out at a suitable time with adhering to all ethical considerations.

Interventions for data collection:

- The patients with COVID-19 were enrolled in the study after screened according to inclusion and exclusion criteria.

- The aims of the study were explained to COVID-19 patients while interviewing them.
- The interview began by presenting a full explanation to the patients about the study's aims and the value of participation. Moreover, all ethical issues were considered (such as patients consent and confidentiality).
- Sample randomization was carried out.
- The overall sample was separated into patients in a prone position (experimental group) and patients in a position other than prone (control group).
- Before applying for any positions, the demographic data, past medical history, and data about medications given was collected.
- Clinical characteristics, ABGs, and prone position characteristics were evaluated before the prone position is applied.
- Prone position was applied to (experimental group) for 4 hours.
- At first 2 hours, clinical characteristics, ABGs, prone position characteristics and complication checklist were evaluated to experimental group.
- After 4 hours, clinical characteristics, ABGs, and prone position characteristics and complication checklist were reevaluated again to experimental group.
- Similarly, clinical characteristics, ABGs "in the same machine", prone position characteristics and complication checklist were assessed for control group, before intervention, and at first 2 hours also after 4 hours.
- Outcomes of patients in a prone position were compared with outcomes of patients in a position other than prone.

Protocol for data collection:

- The researcher introduced himself to the patients and a relationship was established with them.
- A proper area was prepared by providing a safe place for interview and collecting the data.
- The patients with COVID-19 were enrolled in the study after being screened according to inclusion and exclusion criteria.
- The aims of the study were explained to COVID-19 patients while interviewing them.

- The patients were getting information sheets to obtain their consent and needed permissions.
- The sample was randomized.
- In this research, total sample size (100 sample) measured by Richard Geiger equation.
- Then the total sample was separated into patients on a prone position (experimental group) and patients on a position other than prone (control group), each group included 50 participants.
- Collection of demographic data, past medical history, and medications given was done for both groups.
- The prone position is putting the patients on their abdomen on an even surface with their heads turned to one side. A staff member was presented to make sure that everything is connected well such as the intravenous lines and other tubing (e.g., Foley catheter). In this study it was applied for 4 hours.
- Before applying the prone position, clinical characteristics, ABGs and prone position characteristics were evaluated.
- At first 2 hours, clinical characteristics, ABGs, prone position characteristics and complication checklist were evaluated again to patients in experimental group.
- Also, after 4 hours, clinical characteristics, ABGs, prone position characteristics and complication checklist had evaluated one another more time to patients in experimental group.
- Patients in control group as a usual treatment were sustained, and clinical characteristics, ABGs "in the same machine", prone position characteristics and complication checklist were evaluated before intervention, and at first 2 hour also after 4 hours.

2.13 Variables

The independent variable: Prone position.

The dependent variables: Age, gender, duration of symptoms, presence of other comorbidities, medications given, position data “number of prone cycles, timing and total duration”, arterial blood gas (ABG), heart rate (HR), respiratory rate (RR) and length of hospital stay.

2.14 Statistical Analysis

Microsoft office programs (such as Excel and Word software) were utilized for insertion and saving the data.

Data were analyzed using Statistical Package for Social Sciences (SPSS) system version 25. The following statistical tests were applied. The researcher used proper statistical calculation including mean and SD for quantitative data. The researcher used repeated ANOVA measure and pairwise comparisons were used to compare between parameters. Student t-test was used to compare whether there is a statistically significant difference between the means in two unrelated groups. P-value is significant at $P \leq 0.05$.

2.15 Ethical Consideration

- Approved letters from the Palestinian Ministry of health and An-Najah National University were received (Appendix C).
- Participation consent form was received from each COVID-19 patient (Appendix D).
- The right to participate or not was given to the patients.
- All information was kept secret and confidential.
- A safe and appropriate area was selected for applying the study.
- Participants were not subjected to any moral or physical hazard.
- Credibility in writing the research results.

Chapter Three

Results

3.1 General characteristics of the study population

The current study is an experimental study including 100 participants (50 experimental as cases and 50 control). General and clinical features of the study participants are shown in Table 1 in Appendix E. In terms of age, the age was 43.8±12.9 years among the experimental group and 50.3±11.6 years among the control group, the findings indicated that there is a statistically significant difference between two groups was observed ($P<0.05$). With regard to gender, it was matched between experimental and control, the findings revealed that males (25 (50%) and females (25 (50%) were in similar numbers in both groups and not statistically significantly different ($P>0.05$). Moreover, the table indicated that there are no significant differences were observed between experimental and control groups in terms of duration of symptoms (days), suffering from any medical diseases and medications given ($P>0.05$).

3.2 The Comparison between experimental and control group regarding studied parameters

Table 2 in Appendix E points out that the mean of experimental group was significantly higher than control group regarding Partial pressure of oxygen "PaO2" (mmHg) at 2 hours (79.6±17.6 vs. 67.9±12.3, t=3.87 & $P< 0.001$), Partial pressure of oxygen "PaO2" (mmHg) at 4 hours (87±19 vs. 66.9±14.3, t=5.969 & $P< 0.001$), Oxygen saturation "SpO2" at 0 minute (84.9±7.6 vs. 80.5±10.3, t=2.426 & $P< 0.001$), Oxygen saturation "SpO2" at 2 hours (91.3±6.2 vs. 83.4±8.7, t=5.202 & $P< 0.001$), Oxygen saturation "SpO2" at 4 hours (94.7±5.8 vs. 82.8±9.7, t=7.39 & $P< 0.001$) and Total number of cycles (13.9±10.8 vs. 0.4±3.1, t=8.44 & $P< 0.001$). While the mean of experimental group was significantly lowering than control for respiratory rate "RR" at 4 hours (20.5±4.3 vs. 26.9±5.6, t=-6.472 & $P< 0.001$).

3.3 Complication resulting from prone positioning of non-intubated COVID-19 patients with severe hypoxia

Table 3 in Appendix E illustrates the distribution of complication associated with early prone posture of non-intubated COVID-19 patients with severe hypoxia. The findings indicated that the experimental group had a statistically lower percentages and significant differences compared to control group in present apnea (stop breathing for 15 seconds) at 2 hours (16.0% in control group vs. 88.0% in experimental group, P <0.001), apnea at 4 hours (10.0% in control group vs. 88.0% in experimental group, P <0.001), vomiting at 2 hours (12.0% in control group vs. 56.0% in experimental group, P <0.001), vomiting at 4 hours (12.0% in control group vs. 58.0% in experimental group, P <0.001), discomfort at 2 hours (44.0% in control group vs. 98.0% in experimental group, P <0.001), discomfort at 4 hours (28.0% in control group vs. 96.0% in experimental group, P 0.003), decubitus ulcers at 0 minute (0.0% in control group vs. 8.0% in experimental group, P =0.003), decubitus ulcers at 2 hours (0.0% in control group vs. 14.0% in experimental group, P =0.006), decubitus ulcers at 4 hours (0.0% in control group vs. 18.0% in experimental group, P =0.002) and facial edema at 0 minute (2.0% in control group vs. 16.0% in experimental group, P =0.014). In contrast, the findings indicated that the experimental group had a statistically considerably elevated percentages compared to control group in present facial edema at 2 hours (38.0% in control group vs. 20.0% in experimental group, P =0.047) and facial edema at 4 hours (58.0% in control group vs. 20.0% in experimental group, P <0.001). Also, in terms of other complications, there were not statistically significant differences observed between experimental and control groups.

3.4 Effectiveness of prone position on cardiorespiratory clinical outcomes among the non-intubated COVID-19 patients with severe hypoxia

Table 4 in Appendix E illustrates the effects of prone positioning on cardiorespiratory clinical outcomes in non-intubated COVID-19 patients with severe hypoxia. Repeated ANOVA measures revealed that there is statistically significant difference between experimental and control groups at 0 min, 2 hours and 4 hours in Partial pressure of carbon dioxide "PaCO2" (P < 0.05 & effect size = 4.1%; Figure 13 in Appendix F); Partial pressure of oxygen "PaO2" (P < 0.001 & effect size = 28.3%; Figure 14 in Appendix F), Oxygen saturation "SpO2" (P < 0.001 & effect size = 38.5%; Figure 16 in Appendix F), Heart rate "HR" (P = 0.001 & effect size = 6.8%; Figure 17 in Appendix

F). Respiratory rate "RR" (P < 0.001 & effect size = 23.7%; Figure 18 in Appendix F). Also, Post hoc test (LSD) demonstrated that it is statistically significantly different in 0 minutes compared to 2 hours; 0 minute compared to 4 hours & 2 hours compared to 4 hours (P < 0.05). In contrary, repeated ANOVA tests revealed no statistically significant differences in PH and Bicarbonate "HCO3" between the experimental and control groups (Figure 12 & 15 in Appendix F; respectively; P > 0.05).

3.5 The relationship between complications and prone position among non-intubated COVID-19 patients with severe hypoxia

Table 5 in Appendix E demonstrates the relationship between complications and prone position among non-intubated COVID-19 patients with severe hypoxia. The findings demonstrate that vomiting induced by prone position of the non-intubated COVID-19 patients with severe hypoxia is statistically significantly lower in the experimental group compared control group for 0 min compared to 1 hour and 2 hours (P<0.05), but there is no statistically significant difference in other complication caused by prone position (P > 0.05).

3.6 Distribution of complications of the study population

Comparison between experimental and control groups among non-intubated COVID-19 patients with severe hypoxia regarding complications are illustrated in Table 6 in Appendix E. The table revealed statistically significantly differences between experimental and control groups in terms of discharged to home (42% vs. 4.0%, P<0.05), transfer to ICU department (8.0% vs. 60%, P <0.05) and death (0.0% vs. 8.0%, P<0.05). While it revealed not statistically substantially different in others complication arising from prone position in non-intubated COVID-19 patients with severe hypoxia (P > 0.05).

Chapter Four

Discussions and Conclusions

4.1 Discussion

In patients hospitalized with COVID-19 pneumonia and ARDS during the current pandemic, the prone position was extensively used. This was predicated on the fact that intubated patients with moderate to severe non-COVID-19 ARDS who were placed in the prone position had a lower death rate. Despite the lack of significant medical data supporting the impact of prone position in mild to moderately intubated and non-intubated patients, multiple research projects were conducted during the current COVID-19 pandemic in those specific areas (Kharat et al., 2021).

This study focuses on early prone position for non-intubated COVID-19 patients with severe hypoxia. It included 100 COVID-19 patients. The Mean±SD for age was 43.8±12.9 years among the experimental group and 50.3±11.6 years among the control group.

The findings revealed that males (25 (50%) and females (25 (50%) were in similar numbers in both groups. In terms of age, there is a statistically significant difference was observed between the experimental and control groups. Moreover, there are no significant differences observed between the experimental and control groups in terms of gender, duration of symptoms (days), suffering from any medical diseases and medications given.

- **Effectiveness of prone position on cardiorespiratory clinical outcomes (PaCO2, PaO2, HCO3, SpO2, HR and RR)**

The findings revealed that the mean of experimental group was considerably elevated than control group for PaO2 at 2 hours and at 4 hours; SpO2 at 0 minute, at 2 hours, and at 4 hours; and total number of cycles. While the mean of experimental group was significantly lower than control group for RR at 4 hours.

In addition, there are statistically significant differences in PaCO2, PaO2, SpO2, HR, and RR between experimental and control groups at 0 min, 1 hour, and 2 hours. In terms of PH and HCO3, there is no statistically significant difference was seen between experimental and control groups.

These results agree with the study conducted by Elharrar et al. (2020), which showed that in conscious non-ventilated patients with COVID-19, oxygenation improved by a single episode of prone posture.

It also accords to the findings of Sartini et al (2020), which aimed to assess the respiratory parameters of fifteen non-ICU patients before, during, and after receiving noninvasive ventilation in the prone position and showed that there was an improvement in peripheral oxygen saturation in 12 from 15 COVID-19 patients who managed by pronation and noninvasive ventilation (median total of 2 cycles, 3 hours).

In addition to that, it agrees with another review that prepared by Chad and Sampson (2020), which involved a variety of research projects with a limited percentage of patients and indicated that the prone position led to short-term enhancements in oxygenation.

As well as the study of Anesi (2021) agreed that proning is favorable and results in enhanced oxygenation, regardless of whether they receive either supplemental oxygen, NIV or HFNC.

There is also a concordance between our study and a study of Caputo et al. (2020) in the applying of prone position for awake COVID-19 patients would enhance patient's oxygenation, which may lead to avoid intubation or delay it.

Also, our findings agree with the study of Pan et al. (2020) which demonstrated that the position intervention was correlated with enhanced oxygenation and lung recruit ability for twelve patients seriously ill with COVID-19.

Moreover, it matches with a retrospective case study of Singh et al., (2020) which aimed to find out the advantages of conscious pronation combined with oxygen therapy on fifteen non-intubated patients with COVID-19 and demonstrated that in COVID-19 patients with progress in clinical manifestations with decreasing intubation rate, the PaO_2/ FiO_2 ratio and SpO_2 both improved significantly in the awake prone posture.

At the same way, there is another retrospective study corresponds with our study, it was made by Wendt et al. (2020) to evaluate changes in pulse oximetry accompanying with prone position in non-intubated COVID-19 patients with ARDS who are conscious, aware, and breath spontaneously; and it was observed that prone positioning improved the initially low pulse oximetry reading; where the median pulse oximetry increased and reached to 83 percent on room air, 90 percent with supplementary oxygen, and 96 percent with prone posture.

Furthermore, our results agree with the prospective observational study of Ni et al. (2020) which had given the first prove that the early position intervention influenced lung lesion absorption and oxygenation improvement.

Likewise, there is another prospective study agrees with our study, it conducted by Coppo, et al. (2020) and examined the feasibility and impact of prone position on gas exchange in awake, non-intubated patients with pneumonia associated with COVID-19; and showed that oxygenation improved from a partial arterial pressure of oxygen/fraction of inspired oxygen (PaO_2/FiO_2) ratio of 181 mmHg (supine) to 286 mmHg (prone) for the whole group. In half of responders, improved oxygenation was sustained.

As well as, it agrees with another research guided by Caputo et al. (2020) which aimed to evaluate the early use of prone position in the emergency department (ED) for conscious, non-intubated COVID-19 patients throughout the pandemic, and showed that the early self-applying of PP in emergency department (ED) enhanced SpO_2 for COVID-19 patients, whereas the median SpO_2 at triage was 80%, after the patients were receiving of supplemental oxygen on room air it improved to 84%, and after 5 minutes of applying prone position, SpO_2 was reached to 94%.

Moreover, it matches with the study of Thompson et al. (2020) which showed that all patients who had been able to apply prone position had raises in SpO_2, although the proportion of improvement diversified vastly, in which two thirds of patients had SpO_2 $\geq$95% after 1 hour of applying prone position. These patients had significantly less potential to need intubation eventually than patients whose SpO_2 stayed under 95% after 1 hour of applying prone position (37% vs. 83%).

Additionally, our findings correspond with the study of González Moreno et al. (2020) which concluded that in patients with refractory hypoxemia secondary to ARDS, the technique of applying prone position for COVID-19 patients has shown good results with hypoxemia improvement.

Also, our study agrees with the findings of Burton-Papp et al. (2020) in oxygenation improvement that assessed by monitoring the changes in P/F ratio in patients who positioning on the prone position in conjunction with NIV in critical care departments. But there is a difference between this study and our study regarding changing in RR and HR, whereas in this study there is no considerable changing in RR and HR, but in our study, there is obvious changes.

Finally, it disagrees with the study of Behesht Aeen et al. (2021) which showed that there is no significant impact of prone position on the respiratory rate.

- **Complication resulting from prone positioning**

The findings indicated that the experimental group a lower percentages and statistically significant differences compared to control group in present apnea at 2 hours & at 4 hours, vomiting at 2 hours & at 4 hours, discomfort at 2 hours & at 4 hours, decubitus ulcers at 0 minute, 2 hours & at 4 hours, facial edema at 0 minute. In contrast, the findings indicated that the experimental group had a statistically considerably elevated percentage compared to control group in present facial edema at 2 hours & at 4 hours. Also, in terms of other complications, there were not statistically significant differences observed between experimental and control group.

The study results match with the studies of Ponnapa Reddy et al. (2021), Dong et al. (2020), Coppo, et al., (2020), Elharrar et al. (2020), Caputo et al. (2020), Ng et al. (2020), and Damarla et al. (2020) which showed that there is no worsening, major or severe adverse events combined with prone position; but they recorded slight side effects, for example back pain, vomiting, nausea, and musculoskeletal discomfort.

- **Hospitalization**

The study results indicated that there are statistically considerably differences were observed between experimental and control groups related to discharged to home (42% vs. 4.0%), transfer to ICU department (8.0% vs. 60.0%) and death (0.0% vs. 8.0%), respectively.

While there is not statistically significantly different was observed between experimental group and control group related to still in the department (50.0% vs

38.0%) and duration of hospitalization (The Mean±SD of duration of hospitalization (days) for experimental group is 7.9±6.5 compared to 8.3±8.1 for control group).

And the Mean±SD of duration of hospitalization (days) for experimental group is 7.9±6.5 compared to 8.3±8.1 for control group.

The study of Singh et al. (2020) agrees with our study and showed that the prone position reduces the rate of intubation.

There is also a concordance between our study and a study of Caputo et al. (2020) in the applying of prone position for awake COVID-19 patients may lead to avoid intubation or delay it.

Additionally, it agrees with study that conducted by Ferrando et al. (2020) which found that patients managed by High-flow nasal oxygen & awake prone position had a trend for delayed intubation compared to patients managed by High-flow nasal oxygen alone and it confirmed that awake prone position had no effect on rate of death.

Also, it matches with a retrospective study that was done by Sun et al. (2020) and showed that a multipronged intervention involving early and aggressive use of HFNC and NIV combined with prone position for awake patients lead to lower mortality rate.

Moreover, it agrees with study of study of Behesht Aeen et al. (2021) which showed that the prone position was linked to reduce mortality and intubation rates.

In addition, it corresponds with study of Burton-Papp et al. (2020) which showed that there were no reported deaths, while it disagrees with the intubation rate and required mechanical ventilation.

Also, it contradicts the findings of Awad et al. (2021) who found no considerable difference between prone positioned awake patients compared to non-prone positioned awake patients regarding intubation rate.

Furthermore, it disagrees with the study of Fazzini et al. (2022) which showed that when applying Prone position, the intubation rate was unchanged.

Also, there is difference between our study and the research of Binda et al. (2021) which revealed that among the 43 patients treated with prone ventilation, 15 patients died in ICU.

Finally, it differs from the results of Coppo et al. (2020) which display that almost a quarter of participants were intubated regardless of whether they had been responders or non-responders

At the end, based on the above, the researcher note that the findings of this research are in great agreement with results from previous studies of PP in non-intubated patients.

We concluded from the current research and available literature that prone posture in non-intubated COVID-19 patients can enhance oxygenation and reduce the need for invasive mechanical ventilation. However, due to pulmonary mechanics, the effectiveness is still debatable in the early stage of the disease.

It is also worth noting that the results of available literature are limited. There are differences of opinion as to whether this enhancement in oxygenation leads to significant outcomes like decreased intubation or death rates.

However, in the context of a pandemic with limited medical resources, this method might be employed as an early intervention in treating patients in the early stages of disease progression. Therefore, further research needs to be done to identify the most suitable strategy to prone posture in COVID-19 patients with hypoxia, as well as to determine techniques to increase prone positioning tolerability and whether it has an effect on clinical results.

4.2 Conclusions

There is no association between experimental group and control group with regard to duration of symptoms (days), suffering from any medical diseases and medications given.

Early PP on non-intubated COVID-19 patients is associated with elevated partial pressure of oxygen "PaO2" (mmHg) at 2 hours, Partial pressure of oxygen "PaO2" (mmHg) at 4 hours, Oxygen saturation "SpO2" at 0-minute, Oxygen saturation "SpO2" at 2 hours, Oxygen saturation "SpO2" at 4 hours & Total number of cycles. While early prone position on non-intubated COVID-19 patients is associated with lowering respiratory rate "RR" (breath per minute) at 4 hours.

Prone positioning of early prone position on non-intubated COVID-19 patients with severe hypoxia associated with lowering apnea at 2 hours, apnea at 4 hours, apnea at 4 hours, vomiting at 2 hours, vomiting at 4 hours, discomfort at 2 hours, discomfort at 4 hours, decubitus ulcers at 0 minute, decubitus ulcers at 2 hours, decubitus ulcers at 4 hours, facial edema at 0 minute, while prone positioning of non-intubated COVID-19 patients with severe hypoxia associated with elevated present facial edema at 2 hours and facial edema at 4 hours.

The effectiveness of prone posture on cardiorespiratory clinical outcomes in non-intubated COVID-19 patients with severe hypoxia is associated with PaCO2, PaO2, SpO2, HR, and RR while not associated with PH and Bicarbonate "HCO3".

The findings point out that the experimental group had a statistically lower percentages and significant differences compared to control group in present apnea, vomiting, discomfort, and decubitus ulcers. In contrast, the experimental group had a statistically elevated percentage compared to control group in present facial edema. In terms of other complications, there were not statistically significant differences observed.

There are statistically considerably significantly differences were observed between experimental group and control group related to discharged to home, transfer to ICU department (8.0% vs. 60%, $P < 0.05$) and death (0.0% vs. 8.0%, $P<0.05$). While there is not a statistically significantly different was observed between experimental group and control group related to still in the department (50.0% vs 38.0%) and duration of hospitalization.

4.3 Strengths points

This study has several strengths including:

- The high quality of the data because the researcher collected it, and it was entered electronically (online) so the possibilities of errors associated with data entry are eliminated.
- The subject of the study enriches and enhances the researcher's ability to deal with non-intubated COVID-19 patients with severe hypoxia and help in delay respiratory deterioration and ease the burden imposed on intensive care facilities.
- It is the first study that conducted in Palestine.
- Clinical outcomes were assessed in this study.
- The researcher adhered to personal protective equipment and infection control measures when dealing with patients.
- Ease of access to information, reports and statistics about the records of COVID-19 patients.
- The relationship of fellowship and mutual respect that existed previously with employees in COVID-19 departments helped the researcher in facilitating data collection.
- The presence of many colleagues in the work environment of the researcher and the researcher benefited from their experiences before and during the start of the research.

4.4 Limitations

The study had several limitations, including:

- Difficulty following patients for prolonged periods.
- It is not possible to infer the reasons for the differences and changes.
- Lack of prior research and recent references relevant to the topic of the study in Palestine.
- Limited number of COVID-19 patients who decided to take part in the research.
- Difficulty in reaching the participants.

- Time constraints.

4.5 Recommendations

Based on the findings of the study, the researcher makes the following recommendations:

- Further future research is needed to determine the best technique of prone positioning for COVID-19 patients with hypoxia, as well as strategies to enhance prone positioning tolerability and see if it affects clinical results.
- Additional studies with a larger sample size, longer duration, and in other hospitals or departments should be conducted. Also, further studies should be done on patients with more severe lung disease to determine efficacy of prone position in improving oxygenation.
- The impact of prone position to patient should be considered and evaluated by health care providers.
- The Ministry of Health should work to provide knowledge on the managing of critical Covid 19 patients in Palestine for nurses and medical teams.
- The researcher recommends that the prone position protocol be adopted and duly incorporated and considered legally binding for all health teams in Palestinian hospitals.

List of Abbreviations

Abbreviation	Meaning
ANZICS	The Australian and New Zealand Intensive Care Society
ABGs	Arterial Blood Gases
ACE2	Angiotensin Converting Enzyme 2
ALT	Alanine Aminotransferase
ANOVA	Analysis of variance
ANZICS COVID-19	The Australian and New Zealand Intensive Care Society
aPTT	Activated Partial Thromboplastin Time
ARDS	Acute Respiratory Distress Syndrome
AST	Aspartate Aminotransferase
°C	Celsius
CDC	The Centers for Disease Control and Prevention
CoV-19	Coronavirus Disease 2019
COVID-19	Coronavirus Disease 2019
COVID-19 AHRF	Coronavirus Disease 2019 Acute Hypoxemic Respiratory Failure
CPAP	Continuous Positive Airway Pressure
CT	Computerized Tomography
DAMPs	Damage-Associated Molecular Patterns
DIC	Disseminated Intravascular Coagulopathy
DVT	Deep Vein Thrombosis
E	Envelope
ED	Emergency Department
ESR	Erythrocyte Sedimentation Rate
F	Repeated ANOVA measures
FiO2	Boosting Inspired Oxygen
HCO3	Bicarbonate
HFNC	High Flow Nasal Cannula

HFNO	High-flow nasal oxygen
HR	Heart Rate
ICU	Intensive Care Unit
IFNγ	Type II interferon
IL-1β	Interleukin 1 beta
IL-6	Interleukin 6
IMV	Invasive Mechanical Ventilation
IP-10	Interferon Gamma-Induced Protein 10
IRB	Institutional Review Board
LSD	Post hoc
M	Membrane
MCP1	Monocyte Chemoattractant Protein 1
MI	Myocardial Infarction
MIS-C	Multi-inflammatory Syndrome in Children
mmHg	Millimeter of mercury
n	Number of subjects
N	Nucleocapsid
NF-κB	Nuclear factor kappa-light-chain-enhancer of activated B cells
NIV	Non-Invasive Ventilation
NIV/CPAP	Non-Invasive Ventilation/Continuous Positive Airway Pressure
NLR	Nucleotide-Binding Domain Leucine-Rich Repeat
NT-proBNP	NH2-terminal-proB-type natriuretic peptide
P/F	PaO2/ FiO2
PaCO2	Partial Pressure of Carbon Dioxide
PAMPs	pathogen-associated molecular patterns
PaO2	Partial pressure of oxygen
PE	Pulmonary Embolism
PEEP	Positive End-Expiratory Pressure
PH	Power of Hydrogen

PP	prone position
RCT	Randomized Controlled Trial
RR	Respiratory Rate
rRT-PCR	Real-time Reverse-Transcription Polymerase Chain Reaction
RT-LAMP	Reverse Transcription Loop-Mediated Isothermal Amplification
RT-PCR	Reverse-Transcription Polymerase Chain Reaction
S	Spike
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SD	Standard Deviation
SpO2	Oxygen saturation
SPSS	Statistical Package for the Social Sciences
t	Independent t-test
TLRs	Toll-like receptors
TMPRSS2	Transmembrane serine protease 2
VILI	Ventilator-Induced Lung Injury
vs	Versus
WHO	World Health Organization
χ^2	Chi-Square Test

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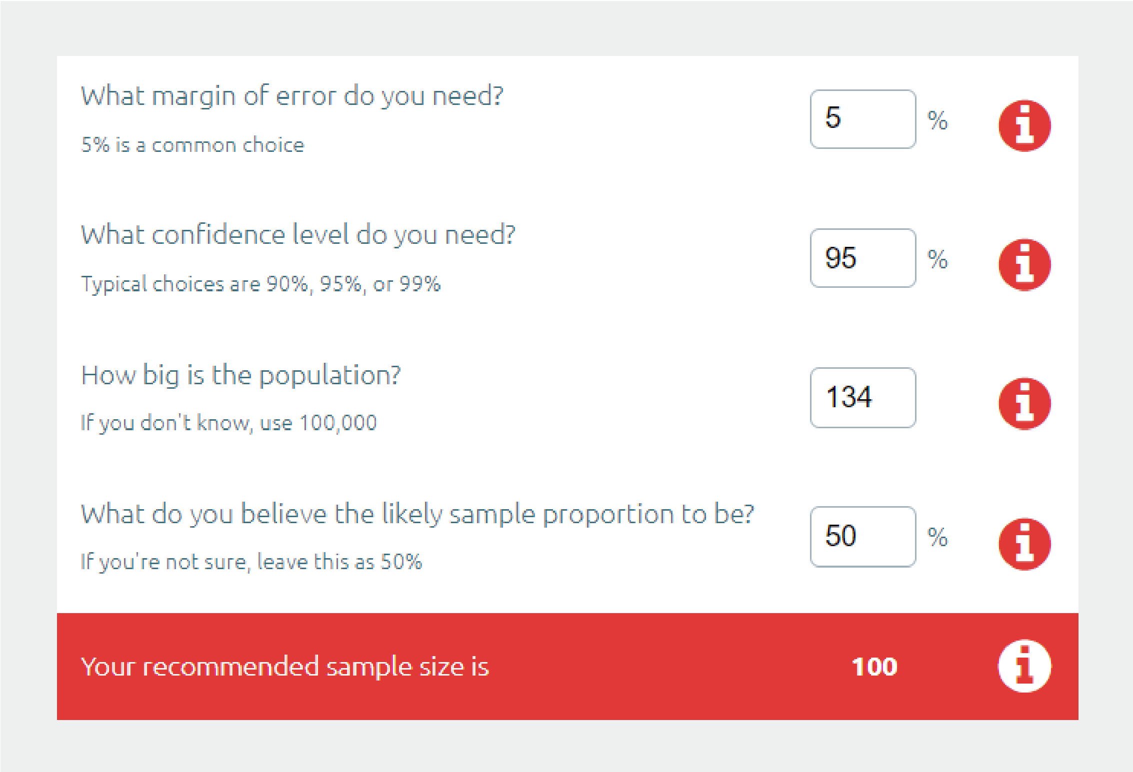
Appendices

Appendix A

Sample size calculator



Appendix B

Checklist

An-Najah National University

Faculty of Graduate Studies

<u>Checklist about:</u>

EARLY PRONE POSITION FOR NON-INTUBATED COVID-19 PATIENTS WITH SEVERE HYPOXIA.

By

Najla Butros Abusahlia

Supervisors

Dr. Hanood Abu Rass

Dr. Mohammad Al-Saleh

Demographic characteristics:

Patient name: ……………………………………………………………...……….

Age: …………………… year.

Gender:

- ☐ Male.
- ☐ Female.

Duration of symptoms: …………………… days.

Suffering from any medical diseases such as DM, heart disease etc.?

- ☐ Yes.
- ☐ No.

If yes, specify: ....

Medications given (It is possible to select more than one option):

- ☐ Antibiotics.
- ☐ Antivirals.
- ☐ Corticosteroids.
- ☐ Other medications: ....

Outcomes

Patient:

- ☐ Experimental group (on prone position).
- ☐ Control group (on another position rather than prone position).
  If the patient on another position rather than prone position; please specify: ……………………………………….

Parameter	At 0 minute	At 2 hours	At 4 hours
pH			
Partial pressure of carbon dioxide "PaCO2" (mmHg)			
Partial pressure of oxygen "PaO2" (mmHg)			
Bicarbonate "HCO3" (mmol/L)			
Oxygen saturation "SpO2"			
Heart rate "HR" (beat per minute)			
Respiratory rate "RR" (breath per minute)			

Prone Characteristics

(If the patient selected as Experimental group)

Total number of cycles: …………………

Duration of each Cycle:

☐ Less than 60 minutes.
☐ From 61–180 minutes.
☐ From 181–360 minutes.
☐ More than 360 minutes.

Total duration on prone position: ……………………..

Complications or risks associated with prone positioning:

Complications	At 0 minute	At 2 hours	At 4 hours
Apnea (stop breathing for 15 seconds)			
Present			
Absent			
Vomiting			
Present			
Absent			
Discomfort			
Present			
Absent			
Decubitus ulcers			
Present			
Absent			
Facial edema			
Present			
Absent			
Another complication: ………………………..			
Present			
Absent			

Hospitalization

Duration of hospitalization: ………………. **days.**

<u>Hospitalization status:</u>

Still in the department:

- ☐ Yes.
- ☐ No.

Discharged to home:

- ☐ Yes.
- ☐ No.

Transfer to ICU department:

- ☐ Yes.
- ☐ No.

Death:

- ☐ Yes.
- ☐ No.

Appendix C

IRP Approval Letter

An-Najah National University
Faculty of medicine Sciences Health
Institutional Review Board

جامعة النجاح الوطنية
كلية الطب وعلوم الصحة
لجنة اخلاقيات البحث العلمي

Ref: N.G.S March.*2021/16*

IRB Approval Letter

Study Title:

"Early prone position for non-intubated COVID-19 patients with severe hypoxia. ".

Submitted by:

Najla Butros Abusahlia.

Supervisor:

Hanood aburass , Mohammad Al-Saleh,

Date Approved:

21st March 2021

Your Study Title **"Early prone position for non-intubated COVID-19 patients with severe hypoxia. "** viewed by An-Najah National University IRB committee and was approved on 21th March 2021

Hasan Fitian, MD

IRB Committee Chairman

An-Najah National University

نابلس - ص.ب 7 أو 707 || هاتف 2342902/4/7/8/14 (09) (970) || فاكسميل 2342910 (09) (970)

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An-Najah National University
Faculty of Medicine & Health Sciences
Dean's office

جامعة النجاح الوطنية
كليـــة الطب وعلوم الصـــحة
مكتب العميد

التاريخ : 2021/06/13

ع ط/.666 .13 حزيران/2021

حضرة الدكتور عبد الله القواسمي المحترم
مدير عام التعليم الصحي/ وزارة الصحة

تحية طيبة وبعد،،

الموضوع: تسهيل مهمة

تهديكم جامعة النجاح الوطنية أطيب التحيات، ونرجو موافقتكم على تسهيل مهمة الطالبة: "نجلاء بطرس ابو ساحلية" و هي طالبة في برنامج ماجستير الرعاية الحثيثة في كلية الدراسات العليا وذلك تحت اشراف د. هنود ابو راس، حيث ستقوم بعمل فحص لغازات الدم في عدة اوقات زمنية اثناء وضع المريض في وضعية الانبطاح على البطن "النوم على البطن" و مقارنتها بوضعية النوم على الظهر لمرضى كورونا في نابلس و هي مستشفى الهلال الاحمر و العسكري.

علماً بأن :

1.عنوان البحث :

"وضعية الانبطاح المبكرة لمرضى كوفيد -19 الغير منبوبين المصابين بنقص الاوكسجين الحاد".

2.المعلومات ستستخدم لأغراض البحث العلمي فقط وسيتم المحافظة على السرية التامه للمعلومات.

3.مرفقة لحضرتكم موافقة لجنة أخلاقيات البحث ومختصر البحث .

4.مرفق جدول البحث.

شاكرين لكم حسن تعاونكم ومساعدتكم للعملية التعليمية.

مع وافر الاحترام،،

د.خليل عيسى
عميد كلية الطب وعلوم الصحة

- نسخة: المشرف
- نسخة: الطالب

نابلس- ص.ب 7 او 707 هاتف 2342902/4/7/8/14(09) (970) فاكسميل 2349739(09) (970)
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Appendix D

Consent form

عزيزي/تي المُشارِك/ة:

أنا الطالبة **نجلاء بطرس عوض ابو سحلية،** أدرس ماجستير تمريض العناية المكثفة بكلية الدراسات العليا، في جامعة النجاح الوطنية.

أقوم بإعداد بحث بعنوان:

"وضعية الانبطاح المبكرة لمرضى كوفيد-19 الغير منبوبين المصابين بنقص الأكسجة الحاد".

“Early prone position for non-intubated COVID-19 patients with severe hypoxia”.

باعتباره متطلب للتخرج والحصول على درجة الماجستير، وتم اختيارك بناءً على مطابقتك لشروط العينة.

تهدف الدراسة إلى تقييم تأثير وضعية الانبطاح المبكر على مرضى كوفيد-19 غير المنبوبين المصابين بنقص الأكسجة الحاد. وتقييم التغييرات في النتائج السريرية المرتبطة بوضعية مرضى COVID-19. ثم مقارنة النتائج السريرية بين المرضى الذين تلقوا وضعية الانبطاح المبكر وأولئك الذين تلقوا رعاية اعتيادية فقط. وتحديد المخاطر المرتبطة بوضعية الانبطاح لمرضى كوفيد-19.

أشكر لك مشاركتك في هذه الدراسة، وفي حال أنّ الموعد غير مناسب الرجاء تحديد موعد آخر يناسبكم.

مشاركتك طوعية، ويمكنك رفض المشاركة أو الإجابة عن أي سؤال، وأرغب أنْ أؤكد لك أنّ المعلومات ستكون سرية ولن تستخدم إلا لغرض البحث العلمي، لذا أرجو أن تكون الإجابات دقيقة.

قبل البدء، هل تود/ين الاستفسار حول أي شيء عن الدراسة وهل من الممكن أن نبدأ المقابلة؟

(   ) نعم

(   ) لا

توقيع المشارك:

أشكرك على حسن تعاونك

Appendix E

Tables of the study

Table E.1

Comparison between experimental and control groups among non-intubated COVID-19 patients with severe hypoxia regarding demographic and clinical characteristics.

	Groups (n=100) n (%)			Statistical analysis	
	Total	Experimental (n=50)	Control (n=50)	χ^2	P-value
Gender:					
Male	50 (50.0)	25 (50.0)	25 (50.0)	0.000	1.000
Female	50 (50.0)	25 (50.0)	25 (50.0)		
Duration of symptoms (days) groups					
5 or less	17 (17.0)	9 (18.0)	8 (16.0)	2.941	0.401
6-10	34 (34.0)	13 (26.0)	21 (42.0)		
11-15	21 (21.0)	12 (24.0)	9 (18.0)		
More than 15	28 (28.0)	16 (32.0)	12 (24.0)		
Suffering from any medical diseases such as DM, heart disease etc.					
Yes	66 (66.0)	29 (58.0)	37 (74.0)	2.852	0.091
No	34 (34.0)	21 (42.0)	13 (26.0)		
If yes, Specify					
HTN					
Yes	53 (53.0)	26 (52.0)	27 (54.0)	0.040	0.841
No	47 (47.0)	24 (48.0)	23 (46.0)		
DM					
Yes	48 (48.0)	22 (44.0)	26 (52.0)	0.641	0.423
No	52 (52.0)	28 (56.0)	24 (48.0)		
Cardiac disease					

Yes	10 (10.0)	3 (6.0)	7 (14.0)	1.778	0.182
No	90 (90.0)	47 (94.0)	43 (86.0)		
kidney disease					
Yes	8 (8.0)	5 (10.0)	3 (6.0)	0.543	0.461
No	92 (92.0)	45 (90.0)	47 (94.0)		
Rheumatoid arthritis					
Yes	3 (3.0)	1 (2.0)	2 (4.0)	0.344	0.558
No	97 (97.0)	49 (98.0)	48 (96.0)		
BPH					
Yes	1 (1.0)	0 (.0)	1 (2.0)	1.010	0.315
No	99 (99.0)	50 (100.0)	49 (98.0)		
Hyperlipidemia					
Yes	6 (6.0)	1 (2.0)	5 (10.0)	2.837	0.092
No	94 (94.0)	49 (98.0)	45 (90.0)		
Allergy					
Yes	2 (2.0)	2 (4.0)	0 (.0)	2.041	0.153
No	98 (98.0)	48 (96.0)	50 (100.0)		
SLE					
Yes	1 (1.0)	1 (2.0)	0 (.0)	1.010	0.315
No	99 (99.0)	49 (98.0)	50 (100.0)		
Asthma					
Yes	3 (3.0)	1 (2.0)	2 (4.0)	0.344	0.558
No	97 (97.0)	49 (98.0)	48 (96.0)		
Breast cancer					
Yes	1 (1.0)	0 (.0)	1 (2.0)	1.010	0.315
No	99 (99.0)	50 (100.0)	49 (98.0)		
Medications given					
Antibiotics					
Yes	79 (79.0)	41 (82.0)	38 (76.0)	0.542	0.461
No	21 (21.0)	9 (18.0)	12 (24.0)		
Anticoagulant					
Yes	54 (54.0)	25 (50.0)	29 (58.0)	0.644	0.422
No	46 (46.0)	25 (50.0)	21 (42.0)		
Corticosteroids					

Yes	67 (67.0)	35 (70.0)	32 (64.0)	0.407	0.523
No	33 (33.0)	15 (30.0)	18 (36.0)		
Antifungals					
Yes	2 (2.0)	1 (2.0)	1 (2.0)	0.000	1.000
No	98 (98.0)	49 (98.0)	49 (98.0)		
Immunosuppressive drug					
Yes	3 (3.0)	2 (4.0)	1 (2.0)	0.344	0.558
No	97 (97.0)	48 (96.0)	49 (98.0)		
NSAID					
Yes	3 (3.0)	3 (6.0)	0 (.0)	3.093	0.079
No	97 (97.0)	47 (94.0)	50 (100.0)		
Mucolytic					
Yes	1 (1.0)	1 (2.0)	0 (.0)	1.010	0.315
No	99 (99.0)	49 (98.0)	50 (100.0)		
Analgesics and antipyretics					
Yes	2 (2.0)	2 (4.0)	0 (.0)	2.041	0.153
No	98 (98.0)	48 (96.0)	50 (100.0)		
	Groups (n=100) Mean±SD			Statistical analysis	
	Total	Experimental (n=50)	Control (n=50)	T	P-value
Age (years)	47.1±12.6 (17-83)	43.8±12.9 (17-79)	50.3±11.6 (19-83)	-2.637	0.010
Duration of symptoms (days):	12.7±8.2 (1-43)	13.2±8.5 (1-40)	12.2±8 (3-43)	0.629	0.531

Note. Significant at P≤0.05; P>0 05: Not significant; n: number of subjects; SD: standard deviation; t: independent t-test & χ^2: chi-square test.

Table E.2

The comparison between experimental and control group regarding studied parameters.

	Groups (n=100) Mean±SD (Min-Max)			Statistical analysis	
	Total	Experimental (n=50)	Control (n=50)	T	P-value
PH at 0 minute	7.4±0.1 (7-7.6)	7.4±0.1 (7-7.5)	7.4±0.1 (7-7.6)	1.173	0.243
PH at 2 hours	7.4±0.1 (7.2-7.5)	7.4±0.1 (7-7.6)	7.4±0.1 (7.2-7.5)	0.135	0.893
PH at 4 hours	7.4±0.1 (6.9-7.6)	7.4±0 (7.3-7.6)	7.4±0.1 (6.9-7.6)	-0.388	0.699
Partial pressure of carbon dioxide "PaCO2" (mmHg) at 0 minute	43.2±16.9 (7.4-111)	43.2±14.7 (23-107)	43.1±19.1 (7.4-111)	0.013	0.989
Partial pressure of carbon dioxide "PaCO2" (mmHg) at 2 hours	41.7±13.4 (19-85)	41.1±11.5 (23-85)	42.2±15.1 (19-85)	-0.399	0.691
Partial pressure of carbon dioxide "PaCO2" (mmHg) at 4 hours	40.3±11.3 (17-84)	39.9±9.4 (24-74.2)	40.7±13 (17-84)	-0.333	0.740
Partial pressure of oxygen "PaO2" (mmHg) at 0 minute	66.4±14.9 (33-123)	68.9±17.2 (34-123)	64±11.8 (33-90)	1.667	0.099
Partial pressure of oxygen "PaO2" (mmHg) at 2 hours	73.7±16.2 (43-139)	79.6±17.6 (43-139)	67.9±12.3 (50-110)	3.870	0.000*
Partial pressure of oxygen "PaO2" (mmHg) at 4 hours	77±19.5 (44-145)	87±19 (51-145)	66.9±14.3 (44-116)	5.969	0.000*
Bicarbonate "HCO3" (mmol/L) at 0 minute	24.3±4.6 (13.2-46)	24.7±3.6 (18.2-34.2)	24±5.4 (13.2-46)	0.823	0.413
Bicarbonate "HCO3" (mmol/L) at 2 hours	24.3±4.2 (11.8-45.6)	24.8±3 (19.4-33.7)	23.9±5.1 (11.8-45.6)	1.043	0.299
Bicarbonate "HCO3" (mmol/L) at 4 hours	24.5±4.3 (9.5-45.3)	24.8±3 (19-33.1)	24.2±5.3 (9.5-45.3)	0.716	0.476
Oxygen saturation "SpO2" at 0 minute	82.7±9.3 (49-98)	84.9±7.6 (55-98)	80.5±10.3 (49-96)	2.426	0.017*

Oxygen saturation "SpO2" at 2 hours	87.3±8.5 (60-99)	91.3±6.2 (71-99)	83.4±8.7 (60-98)	5.202	0.000*
Oxygen saturation "SpO2" at 4 hours	88.8±10 (54-99)	94.7±5.8 (73-99)	82.8±9.7 (54-98)	7.390	0.000*
Heart rate "HR" (beat per minute) at 0 minute	93.4±18.1 (59-140)	91.5±16 (60-135)	95.4±20 (59-140)	-1.062	0.291
Heart rate "HR" (beat per minute) at 2 hours	91.1±17.4 (51-145)	88.5±11.9 (60-121)	93.6±21.4 (51-145)	-1.468	0.145
Heart rate "HR" (beat per minute) at 4 hours	90.4±17.1 (44-147)	87±12.6 (66-122)	93.7±20.2 (44-147)	-1.978	0.051
Respiratory rate "RR" (breath per minute) at 0 minute	28.2±8.1 (16-80)	27.7±9.5 (16-80)	28.6±6.4 (18-47)	-0.554	0.581
Respiratory rate "RR" (breath per minute) at 2 hours	24.9±5.5 (17-41)	22.7±4.4 (17-37)	27±5.6 (19-41)	-4.271	0.000*
Respiratory rate "RR" (breath per minute) at 4 hours	23.7±5.9 (12-45)	20.5±4.3 (12-32)	26.9±5.6 (20-45)	-6.472	0.000*
Total number of cycles:	7.2±10.4 (0-43)	13.9±10.8 (0-43)	0.4±3.1 (0-22)	8.440	0.000*

Note. Significant at P≤0.05; P>0 05: Not significant; n: number of subjects; SD: standard deviation & t: independent t-test .

Table E.3

The relation between complications and studied groups among non-intubated COVID-19 patients with severe hypoxia.

	Groups (n=100) n (%)			Statistical analysis	
	Total	Experimental (n=50)	Control (n=50)	χ^2	P-value
Apnea at 0 minute					
Present	95 (95.0)	49 (98.0)	46 (92.0)	1.895	0.169
Absent	5 (5.0)	1 (2.0)	4 (8.0)		
Apnea at 2 hours					
Present	52 (52.0)	8 (16.0)	44 (88.0)	51.923	0.000*
Absent	48 (48.0)	42 (84.0)	6 (12.0)		
Apnea at 4 hours					
Present	49 (49.0)	5 (10.0)	44 (88.0)	60.864	0.000*
Absent	51 (51.0)	45 (90.0)	6 (12.0)		
Vomiting at 0 minute					
Present	55 (55.0)	25 (50.0)	30 (60.0)	1.010	0.315
Absent	45 (45.0)	25 (50.0)	20 (40.0)		
Vomiting at 2 hours					
Present	34 (34.0)	6 (12.0)	28 (56.0)	21.569	0.000*
Absent	66 (66.0)	44 (88.0)	22 (44.0)		
Vomiting at 4 hours					
Present	35 (35.0)	6 (12.0)	29 (58.0)	23.253	0.000*
Absent	65 (65.0)	44 (88.0)	21 (42.0)		
Discomfort at 0 minute					
Present	99 (99.0)	49 (98.0)	50 (100.0)	1.010	0.315
Absent	1 (1.0)	1 (2.0)	0 (.0)		
Discomfort at 2 hours					
Present	71 (71.0)	22 (44.0)	49 (98.0)	35.406	0.000*
Absent	29 (29.0)	28 (56.0)	1 (2.0)		
Discomfort at 4 hours					
Present	62 (62.0)	14 (28.0)	48 (96.0)	49.066	0.000*
Absent	38 (38.0)	36 (72.0)	2 (4.0)		
Decubitus ulcers at 0 minute					
Present	8 (8.0)	0 (.0)	8 (16.0)	8.696	0.003*
Absent	92 (92.0)	50 (100.0)	42 (84.0)		
Decubitus ulcers at 2 hours					

Present	7 (7.0)	0 (.0)	7 (14.0)	7.527	0.006*
Absent	93 (93.0)	50 (100.0)	43 (86.0)		
Decubitus ulcers at 4 hours					
Present	9 (9.0)	0 (.0)	9 (18.0)	9.890	0.002*
Absent	91 (91.0)	50 (100.0)	41 (82.0)		
Decubitus ulcers at 4 hours					
Present	9 (9.0)	0 (.0)	9 (18.0)	9.890	0.002*
Absent	91 (91.0)	50 (100.0)	41 (82.0)		
Facial edema at 0 minute					
Present	9 (9.0)	1 (2.0)	8 (16.0)	5.983	0.014*
Absent	91 (91.0)	49 (98.0)	42 (84.0)		
Facial edema at 2 hours					
Present	29 (29.0)	19 (38.0)	10 (20.0)	3.934	0.047*
Absent	71 (71.0)	31 (62.0)	40 (80.0)		
Facial edema at 4 hours					
Present	39 (39.0)	29 (58.0)	10 (20.0)	15.174	0.000*
Absent	61 (61.0)	21 (42.0)	40 (80.0)		

Note. Significant at $P \leq 0.05$; P>0 05: Not significant; n: number of subjects; & χ^2: chi-square test.

Table E.4

Effectiveness of prone position on cardiorespiratory clinical outcomes among the non-intubated COVID-19 patients with severe hypoxia.

	Groups (n=100) Mean±SD			Statistical analysis			
	Experimental (n=50)	Control (n=50)	Mean Different	F	P-value	Post hock	Effect size
PH at							
0 minute	7.43±0.08	7.41±0.13	0.020 [a]	0.831	0.437	0.319 [a]	0.008
2 hours	7.42±0.05	7.42±0.12	0.00 [b]			0.337 [b]	
4 hours	7.41±0.05	7.42±0.13	-0.01 [c]			0.649 [c]	
Partial pressure of carbon dioxide "PaCO2" (mmHg) at							
0 minute	43.17±14.68	43.13±19.05	0.04 [a]	4.219	0.016	0.048 [a]	0.041
2 hours	41.12±11.55	42.19±15.06	-1.07 [b]			0.029 [b]	
4 hours	39.91±9.44	40.67±13.05	-0.76 [c]			0.101 [c]	
Partial pressure of oxygen "PaO2" (mmHg) at							
0 minute	68.88±17.19	63.96±11.84	4.92 [a]	38.647	0.000	0.000 [a]	0.283
2 hours	79.61±17.58	67.86±12.33	11.75 [b]			0.000 [b]	
4 hours	87.01±18.99	66.93±14.34	20.08 [c]			0.000 [c]	
Bicarbonate "HCO3" (mmol/L) at							
0 minute	24.71±3.56	23.95±5.41	0.76 [a]	0.470	0.626	0.985 [a]	0.005
2 hours	24.76±3.05	23.89±5.1	0.87 [b]			0.441 [b]	
4 hours	24.83±3.02	24.21±5.28	0.62 [c]			0.244 [c]	
Oxygen saturation "SpO2" at							
0 minute	84.87±7.63	80.48±10.27	4.39 [a]	61.251	0.000	0.000 [a]	0.385
2 hours	91.26±6.22	83.4±8.69	7.86 [b]			0.000 [b]	
4 hours	94.68±5.81	82.83±9.74	11.85 [c]			0.000 [c]	
Heart rate "HR" (beat per minute) at							
0 minute	91.52±15.98	95.36±19.95	-3.84 [a]	7.127	0.001	0.015 [a]	0.068

2 hours	88.52±11.87	93.6±21.4	-5.08 [b]			0.001 [b]	
4 hours	87.02±12.62	93.68±20.18	-6.66 [c]			0.279 [c]	
Respiratory rate "RR" (breath per minute) at							
0 minute	27.74±9.51	28.64±6.45	-0.90 [a]	30.486	0.000	0.000 [a]	0.237
2 hours	22.74±4.44	27.04±5.57	-4.3 [b]			0.000 [b]	
4 hours	20.48±4.27	26.94±5.62	-6.46 [c]			0.003 [c]	

Note. Significant at P≤0.05; P>0 05: Not significant; n: number of subjects; SD: standard deviation; F: repeated ANOVA measures; χ^2: chi-square test; Post hoc (LSD) [a]: 0 minute *vs.* 2 hour: [b]: 0 minute *vs.* 4 hours; [c]: 2 hour *vs.* 4 hours & Effect Size calculated by Partial Eta Squared.

Table E.5

The relation between complications and studied groups among non-intubated COVID-19 patients with severe hypoxia.

	Experimental n (%) (n=50)				P-value	Control (n=50)				P-value
	2 hours		4 hours			2 hours		4 hours		
	Present	Absent	Present	Absent		Present	Absent	Present	Absent	
Apnea at 0 minute										
Present	8 (16.0)	41 (82.0)	5 (10.0)	44 (88.0)	0.840 [a]	44 (88.0)	2 (4.0)	44 (88.0)	2 (4.0)	0.000 [a]
Absent	0 (.0)	1 (2.0)	0 (.0)	1 (2.0)	0.900 [b]	0 (.0)	4 (8.0)	0 (.0)	4 (8.0)	0.000 [b]
2 hours					0.000 [c]					0.000 [c]
Present			5 (10.0)	3 (6.0)				44 (88.0)	0 (.0)	
Absent			0 (.0)	42 (84.0)				0 (.0)	6 (12.0)	
Vomiting At 0 minute										
Present	6 (12.0)	19 (38.0)	6 (12.0)	19 (38.0)	0.011 [b]	28 (56.0)	2 (4.0)	28 (56.0)	2 (4.0)	0.000 [a]
Absent	0 (.0)	25 (50.0)	0 (.0)	25 (50.0)	0.011 [b]	0 (.0)	20 (40.0)	1 (2.0)	19 (38.0)	0.000 [b]
2 hours					0.000 [c]					0.000 [c]
Present			6 (12.0)	0 (.0)				28 (56.0)	0 (.0)	
Absent			0 (.0)	44 (88.0)				1 (2.0)	21 (42.0)	
Discomfort At 0 minute										
Present	22 (44.0)	27 (54.0)	14 (28.0)	35 (70.0)	0.560 [a]	1 (2.0)	49 (98.0)	48 (96.0)	2 (4.0)	-
Absent	0 (.0)	1 (2.0)	0 (.0)	1 (2.0)	0.720 [b]	-	-	-	-	-
2 hours					0.000 [c]					0.000 [c]
Present			13 (26.0)	9 (18.0)				48 (96.0)	1 (2.0)	
Absent			1 (2.0)	27 (54.0)				0 (.0)	1 (2.0)	
Decubitus ulcers at 0 minute										
Present	0 (.0)	0 (.0)	0 (.0)	0 (.0)	-	7 (14.0)	1 (2.0)	8 (16.0)	0 (.0)	0.000 [a]
Absent	0 (.0)	50 (0.0)	0 (.0)	50 (0.0)	-	0 (.0)	42 (84.0)	1 (2.0)	41 (82.0)	0.000 [b]
2 hours					-					0.000 [c]
Present			0 (.0)	0 (.0)				7 (14.0)	0 (.0)	

Absent			0 (.0)	50 (0.0)				2 (4.0)	41 (82.0)	
Facial edema										
0 minute										
Present	1 (2.0)	0 (.0)	1 (2.0)	0 (.0)	0.380 [a]	8 (16.0)	0 (.0)	8 (16.0)	0 (.0)	0.000 [a]
Absent	18 (36.0)	31 (62.0)	28 (56.0)	21 (42.0)	0.580 [b]	2 (4.0)	40 (80.0)	2 (4.0)	40 (80.0)	0.000 [b]
2 hours					0.000 [c]					0.000 [c]
Present			18 (36.0)	11 (22.0)				10 (20.0)	0 (.0)	
Absent			1 (2.0)	20 (40.0)				0 (.0)	40 (80.0)	

Note. Significant at P≤0.05; P>0 05: Not significant (McNemar test); n: number of subjects; [a]: 0 minute *vs*. 1 hour; [b]: 0 minute *vs*. 2 hours &[c]: 1 hour *vs*. 2 hours.

Table E.6

Comparison between experimental and control groups among non-intubated COVID-19 patients with severe hypoxia regarding complications.

	Groups (n=100) n (%)			Statistical analysis	
	Total	Experimental (n=50)	Control (n=50)	χ^2	P-value
Lung fibrosis					
Yes	1 (1.0)	0 (.0)	1 (2.0)	1.010	0.315
No	99 (99.0)	50 (100.0)	49 (98.0)		
Loss of consciousness					
Yes	1 (1.0)	0 (.0)	1 (2.0)	1.010	0.315
No	99 (99.0)	50 (100.0)	49 (98.0)		
Insomnia					
Yes	2 (2.0)	0 (.0)	2 (4.0)	2.041	0.153
No	98 (98.0)	50 (100.0)	48 (96.0)		
Hyperkalemia					
Yes	1 (1.0)	1 (2.0)	0 (.0)	1.010	0.315
No	99 (99.0)	49 (98.0)	50 (100.0)		
ESRD					
Yes	1 (1.0)	0 (.0)	1 (2.0)	1.010	0.315
No	99 (99.0)	50 (100.0)	49 (98.0)		
Edema					
Yes	1 (1.0)	0 (.0)	1 (2.0)	1.010	0.315
No	99 (99.0)	50 (100.0)	49 (98.0)		
Dyspnea					
Yes	1 (1.0)	1 (2.0)	0 (.0)	1.010	0.315
No	99 (99.0)	49 (98.0)	50 (100.0)		
Acute kidney injury (AKI)					
Yes	3 (3.0)	0 (.0)	3 (6.0)	1.5255	0.234
No	97 (97.0)	50 (100.0)	47 (94.0)		
Still in the department:					
Yes	44 (44.0)	25 (50.0)	19 (38.0)	1.461	0.227

No	56 (56.0)	25 (50.0)	31 (62.0)		
Discharged to home					
Yes	23 (23.0)	21 (42.0)	2 (4.0)	20.384	0.000*
No	77 (77.0)	29 (58.0)	48 (96.0)		
Transfer to ICU department					
Present	34 (34.0)	4 (8.0)	30 (60.0)	30.125	0.000*
Absent	66 (66.0)	46 (92.0)	20 (40.0)		
Death					
Present	4 (4.0)	0 (.0)	4 (8.0)	4.167	0.041*
Absent	96 (96.0)	50 (100.0)	46 (92.0)		

	Groups (n=100) Mean±SD			Statistical analysis	
	Total	Experimental (n=50)	Control (n=50)	T	P-value
Duration of hospitalization (days)	8.1±7.3 (1-38)	7.9±6.5 (1-30)	8.3±8.1 (1-38)	-0.260	0.796

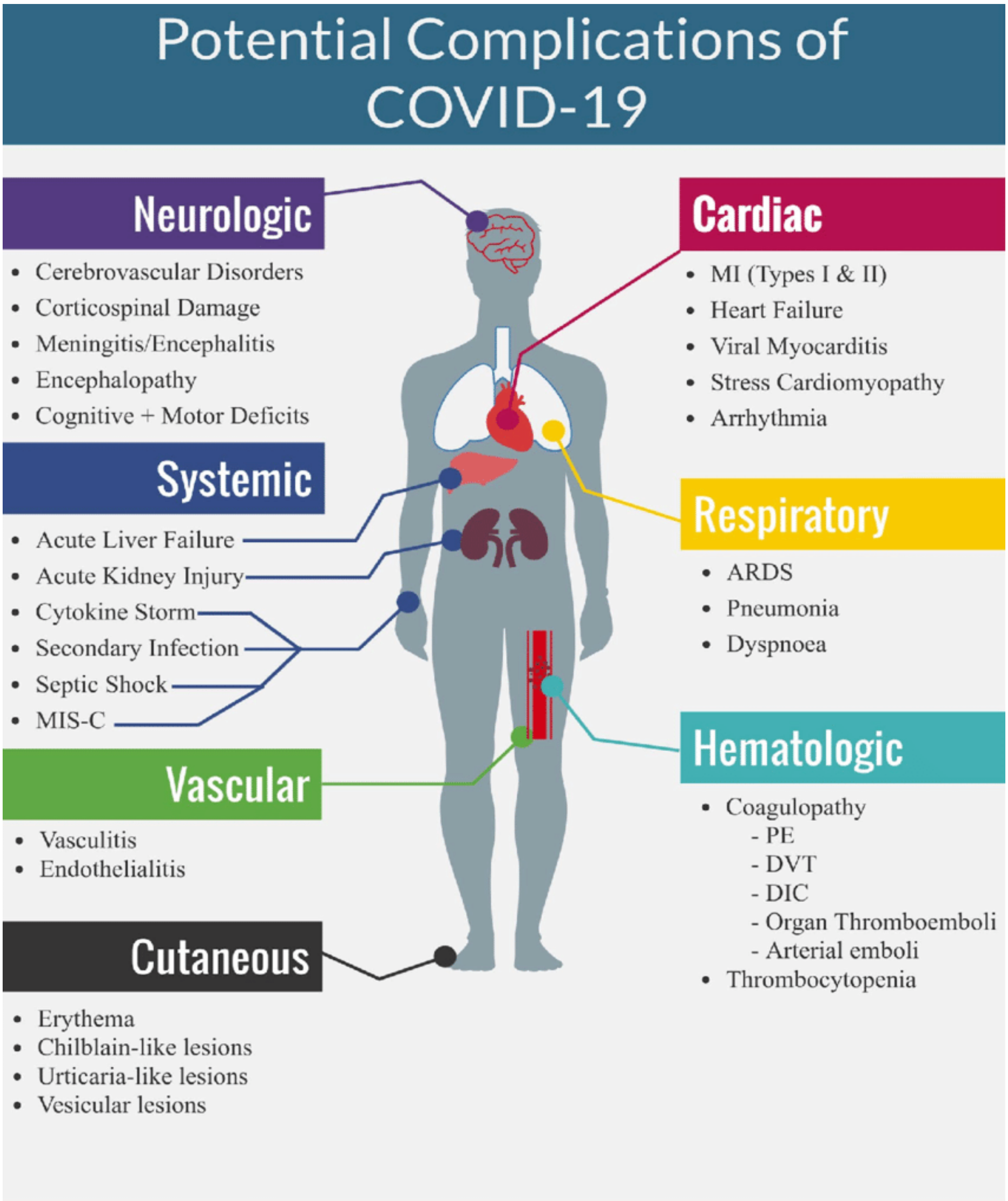
Note. Significant at P≤0.05; P>0 05: Not significant; n: number of subjects; SD: standard deviation; t: independent t-test & $\chi 2$: chi-square test.

Appendix F

Figures of the study

Figure F.1

Complications reported to be potentially associated with COVID-19 (Mallah et al., 2021).



Note. **ARDS**: Acute Respiratory Distress Syndrome; **DIC**: Disseminated Intravascular Coagulopathy; **DVT**: Deep Vein Thrombosis; **MI:** Myocardial Infarction; **MIS-C:** Multi-inflammatory Syndrome in Children; **PE:** Pulmonary Embolism.

Figure F.2

The relation between PH and studied groups among the non-intubated COVID-19 patients with severe hypoxia.

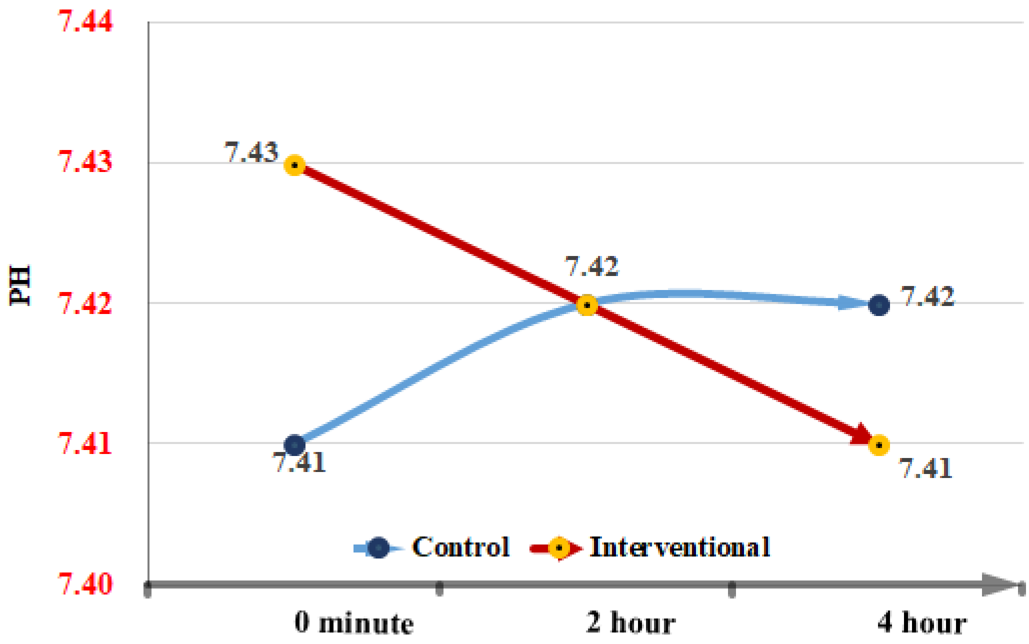


Figure F.3

The relation between partial pressure of carbon dioxide "PaCO2" (mmHg) and studied groups among the non-intubated COVID-19 patients with severe hypoxia.

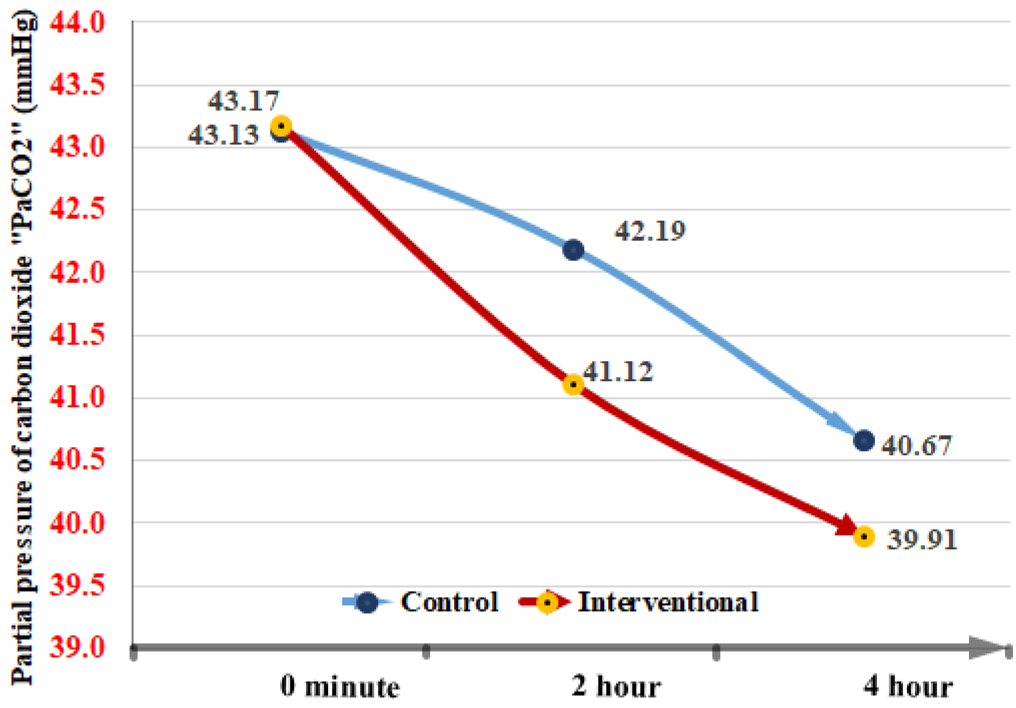


Figure F.4

The relation between partial pressure of oxygen "PaO2" (mmHg) and studied groups among the non-intubated COVID-19 patients with severe hypoxia.

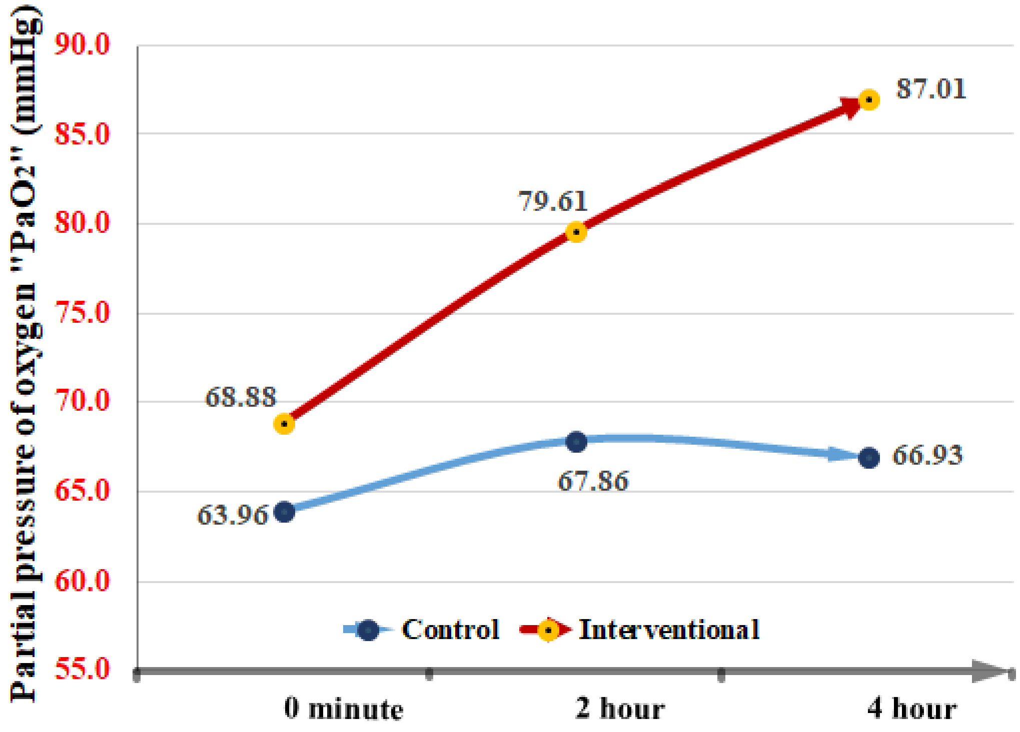


Figure F.5

The relation between Bicarbonate "HCO3" (mmol/L) and studied groups among the non-intubated COVID-19 patients with severe hypoxia.

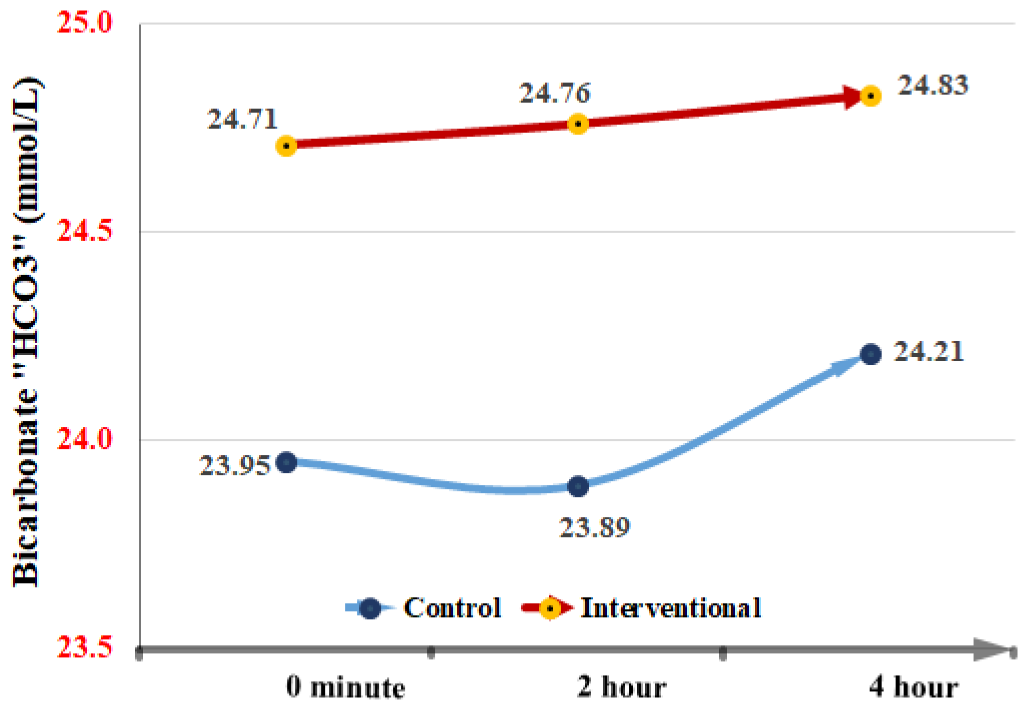


Figure F.6

The relation between Oxygen saturation "SpO2" and studied groups among the non-intubated COVID-19 patients with severe hypoxia.

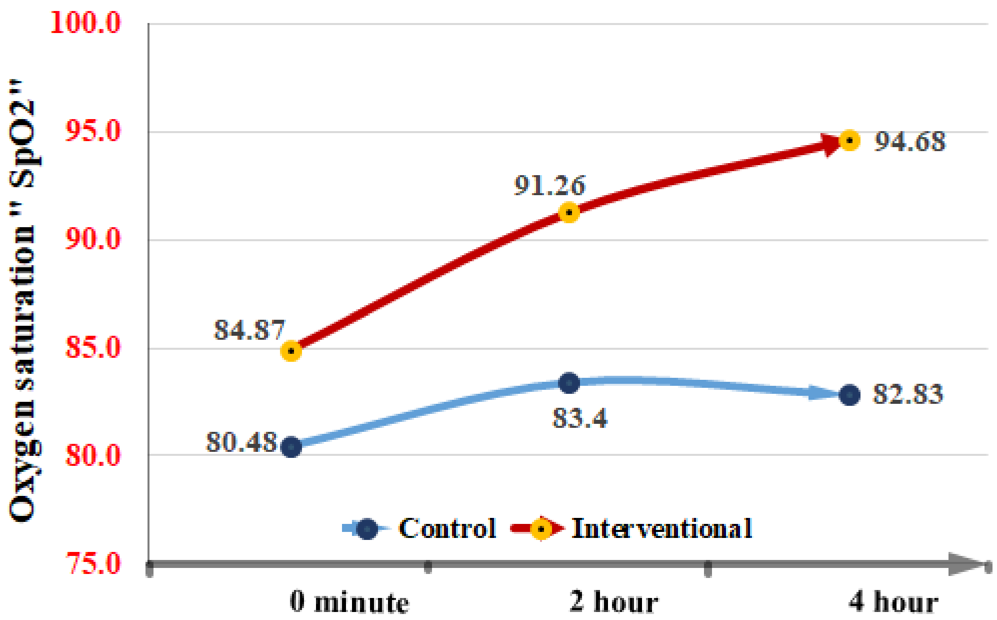


Figure F.7

The relation between Heart rate "HR" (beat per minute) and studied groups among the non-intubated COVID-19 patients with severe hypoxia.

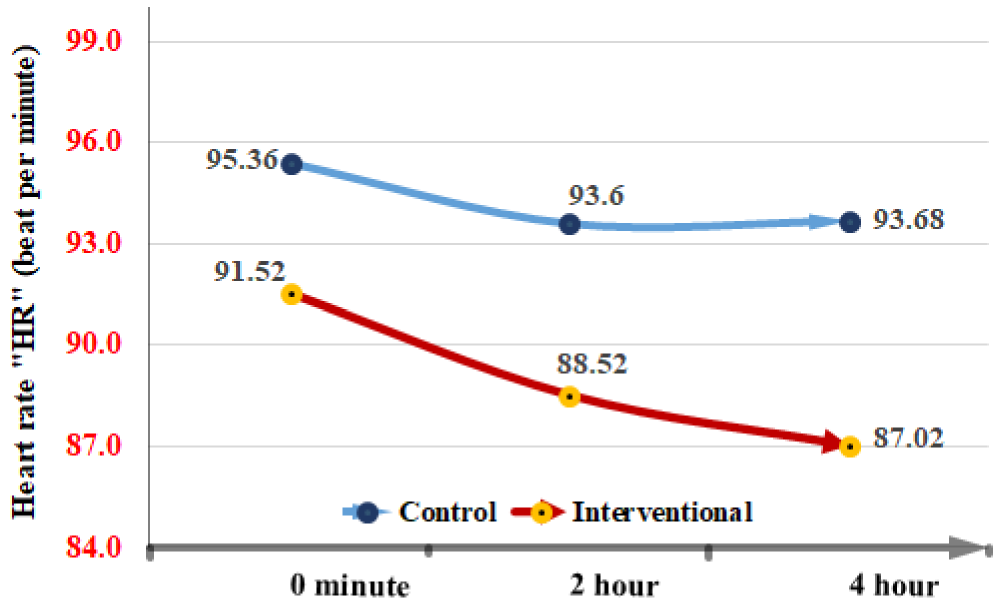
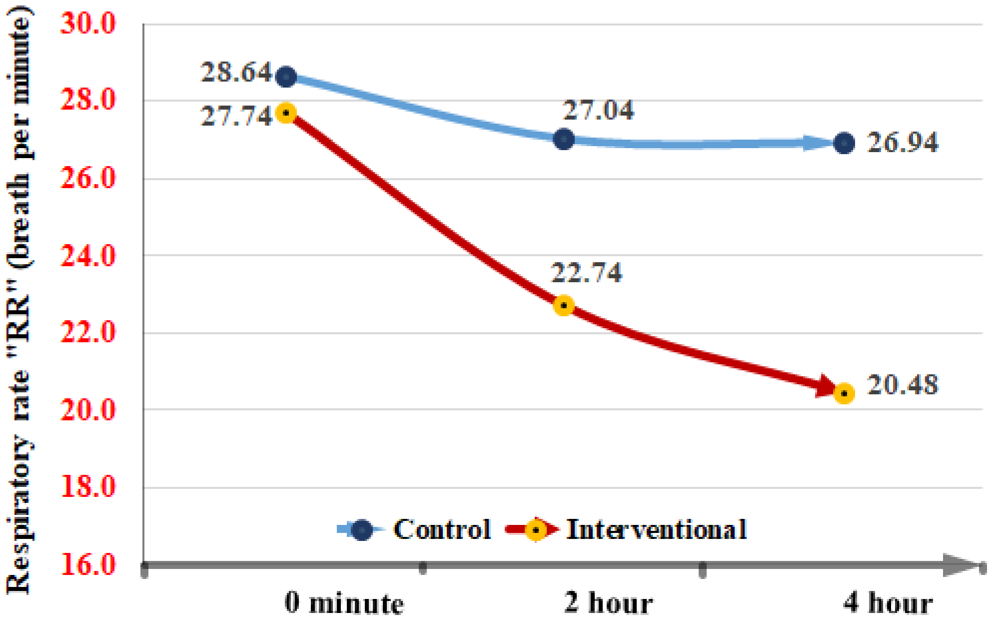


Figure F.8

The relation between respiratory rate "RR" (breath per minute) and studied groups among the non-intubated COVID-19 patients with severe hypoxia.



جــامعـــــة النجاح الوطنية
كليـــة الدراســـــات العليـــا

وضعية الانبطاح المبكرة لمرضى كوفيد-19 الغير منبوبين المصابين بنقص الأكسجة الحاد

إعداد
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إشراف
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قدمت هذه الأطروحة استكمالا لمتطلبات الحصول على درجة الماجستير في تمريض العناية المكثفة، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس- فلسطين.

2023

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الملخص

الخلفية: COVID-19 هو مرض معدي ناشئ تم التعرف عليه لأول مرة في ووهان، الصين، ثم انتشر بسرعة في جميع أنحاء العالم. حوالي 29 بالمائة من مرضى COVID-19 قد يصابون بمتلازمة الضائقة التنفسية الحادة. أشارت الأبحاث السابقة إلى أنه يمكن زيادة متوسط نسبة توتر الأكسجين الشرياني إلى جزء الأكسجين المستوحى (PaO2 / FiO2) عن طريق وضع الانبطاح ويمكن تقليل معدل الوفيات في متلازمة الضائقة التنفسية الحادة المتوسطة إلى الشديدة.

الهدف: تهدف الدراسة إلى تقييم تأثير وضعية الانبطاح المبكر على مرضى COVID-19 غير المنبوبين المصابين بنقص الأكسجة الحاد.

المنهجية: تم استخدام تصميم التجربة العشوائية المنتظمة (RCT) في هذه الدراسة. كان مجتمع الدراسة هو مرضى COVID-19 الذين تتراوح أعمارهم بين 18 عامًا أو أكثر، ويعانون من نقص الأكسجة الحاد. كانت طريقة أخذ العينات عبارة عن عينات عشوائية بسيطة. تم استخدام قائمة المراجعة والتحقق لجمع البيانات.

النتائج: تمت مطابقة الجنس بين المجموعة التجريبية والضابطة (25 (50٪) والإناث (25 (50٪)). ارتفع متوسط المجموعة التجريبية بشكل ملحوظ عن المجموعة الضابطة للضغط الجزئي للأكسجين "PaO2" (مم زئبق) عند ساعتين (79.6 ± 17.6 مقابل 67.9 ± 12.3، $t = 3.87$ & $P <0.001$)،

الضغط الجزئي للأكسجين "PaO2" (مم زئبق) عند 4 ساعات (87 ± 19 مقابل 66.9 ± 14.3، t = 5.969 & P <0.001)، تشبع الأكسجين "SpO2" عند 0 دقيقة (84.9 ± 7.6 مقابل 80.5 ± 10.3 ، t = 2.426 & P <0.001)، تشبع الأكسجين "SpO2" عند ساعتين (91.3 ± 6.2 مقابل 83.4 ± 8.7 ، t = 5.202 & P <0.001)، تشبع الأكسجين "SpO2" عند 4 ساعات (94.7 ± 5.8 مقابل 82.8 ± 9.7 ، t = 7.39 & P <0.001) وإجمالي عدد الدورات: (13.9 ± 10.8 مقابل 0.4 ± 3.1 ، t = 8.44 & P <0.001). يرتبط وضع الانبطاح المبكر عند مرضى COVID-19 غير المنبوبين الذين يعانون من نقص الأكسجة الحاد بمضاعفات منخفضة وهناك اختلاف كبير إحصائيًا بين المجموعة التجريبية والمجموعة الضابطة فيما يتعلق بالخروج من المستشفى، والانتقال إلى قسم العناية المركزة (60٪ مقابل 8.0٪، P <0.05) والوفاة (0.0٪ مقابل 8.0٪، P <0.05). بينما لا يوجد اختلاف إحصائي كبير في المضاعفات الأخرى الناتجة عن وضع الانبطاح المبكر لمرضى COVID-19 غير المنبوبين المصابين بنقص الأكسجة الحاد.

الاستنتاج: يرتبط وضع الانبطاح المبكر عند مرضى COVID-19 غير المنبوبين بارتفاع الضغط الجزئي للأكسجين "PaO2" (مم زئبق) عند ساعتين، والضغط الجزئي للأكسجين "PaO2" (مم زئبق) عند 4 ساعات، وتشبع الأكسجين "SpO2" عند 0 دقيقة، تشبع الأكسجين "SpO2" عند ساعتين، تشبع الأكسجين "SpO2" عند 4 ساعات وإجمالي عدد الدورات. وكذلك يرتبط بانخفاض معدل التنفس "RR" عند 4 ساعات. أيضا، يرتبط وضع الانبطاح المبكر عند مرضى COVID-19 غير المنبوبين بمضاعفات منخفضة.

الكلمات المفتاحية: وضعية الانبطاح، عدم التنبيب، COVID-19، نقص الأكسجة، فلسطين.