



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 4, April 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

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Helmet Delivered Non-Invasive Ventilation System for Covid-19 Patients

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ABSTRACT: COSMIC Medical, a Vancouver-based open-source volunteer initiative, has designed associate degree accessible, affordable, and aerosol confining non-invasive positive pressure ventilator (NIPPV) device, called the COSMIC Bubble Helmet (CBH). This device is meant for COVID-19 patients with mild-to-moderate acute metabolism distress syndrome. CBH consists of thermoplastic polymer, that creates a versatile neck seal and clear hood. This device is often connected to wall O, NIPPVs as well as Continuous Positive Airway Pressure and Bi-level Positive Airway Pressure, and mechanical ventilators. CBH has implications among and outdoors of the pandemic, as an alternate to invasive mechanical ventilation strategies. we've got through an experiment verified that CBH is effective in minimizing aerosolization risks and performs at specified clinical needs.

KEYWORDS: NIPPV-Non-Invasive Positive Pressure Ventilator, CBH-Cosmic Bubble Helmet.

I. INTRODUCTION

AS COVID-19 continues to unfold globally, the combined threat to patients that have developed acute metabolism distress disorder (ARDS), and also the potential for transmission mechanism of extremely contagious SAR-CoV-2 coronavirus remains a central concern among the health profession the quality-of-care treatment for COVID-19 connected white lung includes both invasive mechanical ventilation and non-invasive positive pressure ventilation (NIPPV). In patients laid low with milder cases of hypoxemia or white lung, NIPPV has been proposed because the best technique of natural action to stabilize this subset of patients. These values, if less, might represent the proportion of patients that may avoid invasive ventilation due to devices like CBH. These values emphasize the doable advantages of NIPPV treatment as invasive ventilation strategies might contribute to ventilator induced respiratory organ injury in fragile respiratory organ tissues, thus amplifying the risks related to mechanical ventilation. Helmet styles are higher tolerated by patients because of raised comfort compared to ancient NIPPV modalities, and supply the patient with clearer, unimpeded views compared to full-face mask styles. CBH may additionally play a job in optimizing crucial care resources by preclude the need for invasive ventilation in some cases, liberating social unit equipment for patients in sudden metabolism distress.

The Paper is organized as follows. Section II describes the literature survey for the paper.

Finally, Section III presents the conclusion.

II. LITERATURE REVIEW

G. Merritt (2020) presented a system for helmet delivered non-invasive pressure support ventilation for covid-19 patients. The world is severely affected by the covid-19 pandemic that can be transmitted to humans and cause significant respiratory disease. This helmet will provide adequate and good respiratory support in the moderately ill patient in the earlier stages of the disease. With the use of the helmet, the need for rapid early intubation often can be delayed safely while a patient is observed carefully for any improvement in disease or deterioration in condition. This may enable endotracheal intubation to be avoided in a subset of patients. This helmet allows the patient to see, read, talk, and interact more easily than do other NIV respiratory devices. This helmet could be a low-cost addition to the ventilator options for COVID-19 patients.

Stanley Chidzik (2020) presented a system for multi-patient respiratory monitoring system for helmet ventilation during covid-19 pandemic. The evolving role of Inexpensive multi-patient respiratory monitoring system for helmet

ventilation during COVID-19 pandemic. Helmet noninvasive ventilation (NIV) is a form of continuous positive applied pressure that has emerged as a useful therapy for COVID-19 patients who require respiratory support but may not require invasive ventilation. Helmet NIV is a low-cost, readily available, and provides viral filters between the patient and clinician. It may also provide better patient outcomes by delaying or eliminating the need for invasive ventilation. -invasive ventilation systems, such as continuous positive application of pressure (CPAP) and high flow nasal cannula, have emerged as important tools for treating Coronavirus disease 2019 (COVID-19) patients who need respiratory support but not intubation.

Matias Ramos (2021) presented a system for the increased demand for mechanical ventilation caused by SARS-CoV-2 could generate a critical situation where patients may lose access to mechanical ventilators. Combined ventilation, in which two patients are connected to a single ventilator has been proposed as a bridge while waiting for new ventilators availability. DuplicAR is a new device that allows individualization of ventilatory parameters in combined ventilation models. Acute respiratory distress syndrome caused by SARS-CoV-2 increased the demand for mechanical ventilation worldwide. An imbalance between supply and demand for mechanical ventilators could pose a critical scenario in which it would be necessary to decide which patients should be assigned to these devices. DuplicAR is a medical device that functions as a complementary adapter to the mechanical ventilator and has the ability to offer adequate and independent pressurization of the system for the two subjects.

Luigi Battista (2016) presented a system for patients who have acute respiratory failure and who have not responded to other treatment options can benefit from using a treatment, called Home Mechanical Ventilation. In order to allow the remote patient monitoring, in the last few years several tele-monitoring systems have been introduced, but most of them usually do not allow real-time services, are based on a wired connection, have their own proprietary serial communication protocol implemented and some ventilation parameters are not always measured. In order to reduce the above quoted drawbacks, in this work we report the development of a novel wireless remote monitoring system for long-term home-based ventilation therapy. The proposed system is based on the real-time monitoring of the main physical quantities involved during home-care ventilation and is developed in order to allow observation of different remote therapy units everywhere located in different places of a city, region or country. The developed remote patient monitoring system has been successfully tested by means of spirometric trials and, especially, by means of experimental tests carried out with pulmonary ventilators typically used to support sick patients.

VionaricaGusti (2020) presented a system for COSMIC Medical, a Vancouver-based opensource volunteer initiative, has designed an accessible, affordable, and aerosol-confining non-invasive positive-pressure ventilator (NIPPV) device, known as the COSMIC Bubble Helmet (CBH). This device is intended for COVID-19 patients with mild-to-moderate acute respiratory distress syndrome. System Design: CBH is composed of thermoplastic polyurethane, which creates a flexible neck seal and transparent hood. This device can be connected to wall oxygen, NIPPVs including Continuous Positive Airway Pressure and Bilevel Positive Airway Pressure, and mechanical ventilators. Discussion: Justification of CBH design components relied on several factors, predominantly the safety and comfort of patients and healthcare providers. CBH has implications within and outside of the pandemic, as an alternative to invasive mechanical ventilation methods. We have experimentally verified that CBH is effective in minimizing aerosolization risks and performs at specified clinical requirements.

A R Mitra (2020) presented a system for Pandemic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is associated with high intensive care unit (ICU) mortality. We aimed to describe the clinical characteristics and outcomes of critically ill patients with coronavirus disease 2019 (COVID-19) in a Canadian setting. We conducted a retrospective case series of critically ill patients with laboratory-confirmed SARS-CoV-2 infection consecutively admitted to 1 of 6 ICUs in Metro Vancouver, British Columbia, Canada, between Feb. 21 and Apr. 14, 2020. Demographic, management and outcome data were collected by review of patient charts and electronic medical records.

W. Alhazzani (2019) The novel severe acute respiratory syndrome coronavirus 2 (SARSCoV2) is the cause of a rapidly spreading illness, Coronavirus Disease 2019 (COVID-19), affecting thousands of people around the world. Urgent guidance for clinicians caring for the sickest of these patients is needed. They formed a panel of 36 experts from 12 countries. All panel members completed the World Health Organization conflict of interest disclosure form. The panel proposed 53 questions that are relevant to the management of COVID-19 in the ICU. We searched the literature for direct and indirect evidence on the management of COVID-19 in critically ill patients in the ICU. We identified relevant and recent systematic reviews on most questions relating to supportive care. We assessed the certainty in the evidence using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach, then generated recommendations based on the balance between benefit and harm, resource and cost implications, equity, and feasibility. Recommendations were either strong or weak, or in the form of best practice recommendations.

L. Meng (2020) presented a system for the COVID-19 outbreak has led to 80,409 diagnosed cases and 3,012 deaths in mainland China based on the data released on March 4, 2020. Approximately 3.2% of patients with COVID-19

required intubation and invasive ventilation at some point in the disease course. Providing best practices regarding intubation and ventilation for an overwhelming number of patients with COVID-19 amid an enhanced risk of cross-infection is a daunting undertaking. The authors presented the experience of caring for the critically ill patients with COVID-19 in Wuhan. It is extremely important to follow strict self-protection precautions. Timely, but not premature, intubation is crucial to counter a progressively enlarging oxygen debt despite high-flow oxygen therapy and bilevel positive airway pressure ventilation. Thorough preparation, satisfactory preoxygenation, modified rapid sequence induction, and rapid intubation using a video laryngoscope are widely used intubation strategies in Wuhan. Lung-protective ventilation, prone position ventilation, and adequate sedation and analgesia are essential components of ventilation management

III. CONCLUSION

The CBH is a NIPPV system designed as a low-cost treatment method that can be used in emergency situations to support patients in respiratory distress from COVID-19 and other disease states, as well as help to mitigate ventilator shortages in low resource environments. Major design considerations were given to adequate respiratory support, aerosol containment, patient positioning for ARDS, and an easily reproducible, affordable design CBH has undergone usability testing and has been shown to perform equivalently to the CaStar CPAP hood in minimizing aerosolization risks and meeting the specified clinical treatment requirements. In future, we intend to test for the device's ability to produce bi-level positive airway pressure in order to determine its full efficacy within clinical settings.

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