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Platypnea-Orthodeoxia Syndrome in SARS COVID-19: A Mini Review

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Abstract

POS is an uncommon condition marked by respiratory distress and/or hypoxia that worsens in the sitting/standing position but improves in the lying position. Cardiovascular, pulmonary, and non-cardiopulmonary illnesses all contribute to it. COVID-19 can cause a variety of respiratory symptoms, including acute respiratory distress syndrome (ARDS) and pulmonary fibrosis with sequelae. In patients with COVID-19, POS has only been documented on a few occasions. Intra cardiac shunt closure can be curative when Platypnea-Orthodeoxia syndrome is caused by intra cardiac shunting without pulmonary hypertension. Platypnea-Orthodeoxia syndrome is an uncommon illness characterized by dyspnea and de oxygenation brought on by standing and alleviated by lying down. Shunting through a patent foramen oval and pulmonary Arterio venous malformations are two common causes. Shunting should be assessed in both the recumbent and upright postures in individuals with unexplained or transitory hypoxemia who are suspected of having a cardiac etiology. Significant right-to-left shunting does not need increased right atrial pressure in this condition. If possible, percutaneous closure is the initial line of treatment for these patients. Micro thrombi and vasculoplegia along with mainly the basal distribution of the consolidative changes which occurs in severe infection of COVID-19 disease. Platypnea orthodoxies syndrome develops as a result of increased basal physiological shunting and upper zone dead space ventilation due to gravity redistribution of pulmonary blood flow. Platypnea orthodoxies syndrome responds comparatively in a good way to chest physiotherapy and steroids along with oxygen therapy medication. It is understood that POS may mainly affects the posterior and lower zones of lung parenchyma in COVID 19 affected patients.

Keywords: Platypnea orthodoxies syndrome; Corona virus disease; Hypoxia; Pulmonary blood flow; Oxygen therapy; Oxygen saturation

Introduction

SARS-Cov-2 that is severe acute respiratory syndrome coronavirus 2 is the causative organism of acute respiratory infection which is coronavirus disease 2019. It has caused an explosive catastrophic pandemic that affected almost all part of the world, and produced significant loss of lives and the worst financial crisis recorded ever, since World War II. SARS-CoV-2 began in China and spread aggressively around the world over a span of 3-4 months, making it one of the fastest spreading infectious diseases in humans [1]. It was first identified in December 2019 in Wuhan, China, which produced a large cluster of pneumonia cases- hence; the virus was initially called as the 'Wuhan Virus'. Subsequently it was named as the 2019-novel coronavirus (2019-nCoV. Further research work revealed that it is a B-Coronavirus with a genome that is almost identical (96 percent homology) to the SARS-like bat coronavirus which is indicating that bats are the natural host. The epidemic was labeled a "Public Health Emergency of International Concern (PHEIC)" on January 30, 2020, as the number of cases remained high. WHO announced the official name to the newly emerging virus as 'COVID-19' on 11th February 2020. The virus was also renamed as SARS-Cov-2 due to its close structural similarity to the previously found SARS-Cov. According to the reports which are available till now it is indicated that the newly found corona virus disease infection 2019 (COVID-19) affects the respiratory system. The exacerbations of this particular syndrome can lead to catastrophic consequences like renal failure, sever acute respiratory syndrome (SARS), cardiac arrhythmia, pneumonia which may progress to multiple organ failure, and also could prove fatal [2]. Corona virus infection is seen transferred by respiratory and extra pulmonary pathways, which may explain its rapid spread leading to the worldwide pandemic as on 11 March, 2020, World Health Organization (WHO) labelled this new coronavirus (COVID-19) spread worldwide as a pandemic. As on July 14, 2021, there have been 187,519,798 confirmed COVID-19 cases worldwide, including 36,196,974 in Southeast Asia and 30,946,074 in India. Situation in India (As of August 2020: India was one among those countries where the COVID-19 pandemic had a slower growth curve to reach its peak. The first report was from Kerala in January 2020. It was the first cluster reported in India. 15 Italian visitors were detected to be positive at Jaipur, in March 2020. Following the Tablighi Jamaat (TJ), a religious gathering held in Delhi's. Nizamuddin Markaz Mosque in early March 2020, an explosive epidemic of COVID-19 occurred, resulting in over 4,000 cases.

The SARS-Cov-2 virus contains nucleocapsid and it is seen that this virus is covered by an envelope. Virus is of 120 mm in its size and has a helical type of symmetrical structure. Virus is composed of 4 major proteins they are [N, S, M, E].There are several other proteins and 16 non-structural proteins are present in the virus. Nucleocapsid protein [N] is the nucleon capsid which is surrounded by virus. The nucleocapsid contains the positive sense single stranded RNA with the 30 kb genomic size. The envelope is lipoprotein in nature; the lipid part is host-derived into which a number of proteins are embedded such as, Spike protein (S): Helps in the attachment to the host cells. Neutralizing antibodies are produced against S protein are protective in nature. It has two subunits. The receptor-binding domain (RBD)

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of the S1 subunit interacts to a particular receptor on the host cell surface, S2 subunit facilitates virus-cell membrane fusion. The most commonly present structural proteins that are membrane glycoprotein [M] which provides shape to the virus. Envelope protein (E) is a Tran's membrane protein having ion channel function that is only present in trace amounts. Non-structural proteins: They include several enzymes J which help in replication of the virus, e.g. RNA-dependent RNA polymerase (RdRp), helicase, etc.

COVID-19 virus is typically spread by respiratory droplets and direct touch. Droplet Transmission: when COVID-19 infected person comes in contact with the non-infected person within 1 meter of area then there is a high chance of droplet infection. Sneezing, coughing and a close contact results in transmission of droplets. Droplets can be expelled from nose, mouth or conjunctiva. Mask can protect from the droplet transmission. Contact Transmission: COVID19 virus transmission occurs either directly or indirectly through direct contact with infected persons or contaminated surfaces in the surrounding environment., objects used on or by the infected person or fomites (inanimate objects) in the surrounding environment around the infected person's (e.g. infected clothes, utensils, furniture). The virus may only be transferred by touching the contaminated hand to a person's mouth, nose, or conjunctiva after contact (direct or indirect). Frequent hand hygiene following potential contact exposure is crucial to prevent this type of transmission [3]. Aerosol Transmission: Aerosol transmission (spread of the infected droplet nuclei beyond one meter) is not documented yet, although active research is on-going in this regard In particular situations where aerosol-generating procedures such as endotracheal intubation are undertaken, aerosol. COVID-19 disease shows incubation period of 5-6 but sometimes it may show up to 14 days. It shows the symptoms which are as follows: Common features: Fever, cough with expectoration, fatigue, shortness of breath, myalgia, rhinorrhea, sore throat, and diarrhea. Before the onset of respiratory infection there may be loss of taste and smell. Atypical symptoms: Particularly seen in older people and immune-suppressed patients such as loss of appetite, delirium fatigue, reduced alertness, diarrhea, and absence of fever. Throat swab and nasal swabs are preferred specimens. Dacron or polyester flocked swabs are used, dipped in viral transport media (VTM) after collection. Alternate specimens included: nasopharyngeal swabs, broncho alveolar lavage (BAL) or endotracheal POS is a uncommonly found disease which is marked by orthostatic oxygen desaturation and positional dyspnea when the patient moves from supine to upright." Dyspnea (difficulty in breathing) is the third most frequent symptom reported by COVID 19 affected patients. Platypnea is a type of shortness of breath that happens when the patient is standing. Orthodoxies are defined as the oxygen deficiency in a supine posture. It's been seen in diseases involving blood shunting. It is characterized as a diminution in peripheral oxygen saturation ($SpO2 > 5\%$) in sitting position compared to the supine position, which is accompanied by dyspnea in the sitting/standing position. POS can be elicited bedside by measuring SpO2 in the sitting as well as in supine position during a patient's clinical evaluation. To capture changes in oxygen saturation when shifting positions, we need a pulse oximeter. Pulse oximeter is now the fifth vital sign to look for during a clinical evaluation. It is observed that patients with COVID-19 might exhibit postural variation of respiratory distress which is utilized in the wake proning approach therapy of COVID-19 ARDS. Pulmonary fibrosis and (ARDS) acute respiratory distress syndrome and are two respiratory symptoms of COVID-19. In cases of COVID-19, POS has only been documented con on a few occasions. Micro thrombi and vasculoplegia along with mainly the basal distribution of the consolidative changes which occurs in severe infection of COVID-19 disease [4]. Platypnea orthodoxies syndrome develops as a result of enhanced basal physiological shunting and higher zone dead space ventilation as a result of gravitational redistribution of pulmonary blood flow. Platypnea orthodoxies syndrome responds comparatively in a good way to chest physiotherapy and steroids along with oxygen therapy medication.

Methodology

This review paper which was submitted to Jawaharlal Nehru Medical College, DMIMS (DU) SAWANGI WARDHA for publication. The objective of this review was on how the Platypnea orthodoxies syndrome (POS) manifested in COVID 19 infections.

The Observational studies which we referred in this study included literature on articles such as cohort, case report, and case control research, were included in the study. We also added review papers that give further information on Platypnea orthodoxies syndrome (POS). The studies that were analyzed and focused on those linked with corona virus infection.

We did a thorough literature search on the platforms of PubMed in advanced setting for the terms covid19, covid-19, corona 3virus, n-cov, ncov, ncov-2019, sars-cov and sarscov2. On the basis of these terms we got 75,309 free articles then we searched for the term Platyponea-orthodeoxia syndrome we got 58 free articles .the search for the articles was done from 1 January 2020 to 20 July 2021 on PubMed. This all searches done on 20th July 2021. We selected articles and screened them for the topic. Reference used in article is mostly taken from the relevant screened article.

Result

On evaluation, the primary mechanisms of this condition in individuals with severe coronavirus infection may be divided into three categories: extra cardiac abnormalities, intra cardiac etiology, and miscellaneous etiology. The most common kind of POS is the intracardic connection between the two atria. Predominant location of an intra-cardiac shunt was Patent Foramen Ovale (PFO). Aside from PFO, Atrial Septal Aneurysm or Atrial septal defect (ASD) has been linked to intracardiac shunt and POS. Most the individuals with POS had a concurrent pulmonary, cardiac, or any different extracardiac abnormality that may result to intra-cardiac shunting through ASD, ASA, or PFO, in addition to an isolated intracardiac defect. A subsequent anatomic or functional abnormality was found in the majority of individuals having an intracardiac shunt [5]. The hypotheses have been proposed to elaborate the feature of orthodoxies in the presence of any secondary cardio-pulmonary variables, and they have all been well addressed. Anatomic alteration of aorta (aneurysm, distortion or dilatation) which causes compression of right atria was the most prevalent secondary component. Other secondary causes that have been documented include a chronic Eustachian valve, pneumonectomy, and diaphragmatic paralysis. UNG parenchymal disorders and Intra-pulmonary arteriovenous malformations (AVM) and l were among the extracardiac causes of POS. There are a very few case reports in respect to POS induced by diseases whose mechanisms are still debated and are detailed in the sub – section.

Discussion

On doing the thorough literature search a profound link was found in between Platypnea orthodoxies syndrome and COVID 19 diseases, which in itself is a very rare presentation. The underlying

pathophysiology of the POS is likely to be more complicated, especially in the setting of severe coronavirus infection. Alveolar hypoventilation is important, for example, by improving the amount of 'wasted' breathing (zone 1 phenomenon), which would be increased by lower cardiac function and an unbalanced load-capacity resulting from decreased lung compliance and critical illness myopathy. Burchell and Wood described 1st incidence of Platypnea orthodoxies syndrome (POS) in a patient with post-traumatic intrathoracic AV shunts in 1949.

The terminology "orthodoxies" and "Platyponea" were introduced by Altman and Robin, respectively" The merging of oxygenated arterial blood with deoxygenated venous blood is the primary mechanism of arterial desaturation. The Platyponea orthodoxies syndrome (POS) is a shunting condition which involves both structural and functional abnormalities [6]. The shunting is enhanced in the upright posture. This pathophysiology is the main reason for the majority of cardiovascular causes of POS, such as atrial septal defect, patent foramen ovale and atrial septal aneurysm" Shunting occurs outside the heart in POS owing to lung-related reasons, such as pulmonary AVM (atriovenous malformation). The POS in upright position is improved because of increased shunting via the pulmonary AVM. The shunting is improved as a result of gravity related blood supply to the most dependent parts of lung. Shunting is reduced in the supine position, leading in improved oxygenation. In severe cirrhosis with hepatopulmonary syndrome, this mechanism is also evident. POS, on the other hand, is seen in parenchymal lung diseases such as consolidation, ILD, and emphysema affecting primarily the base of lung, resulting in a significant V/Q (ventilation–perfusion) mismatch in standing position due to gravity driven preferred flow of blood towards the bases.

It is understood that POS may mainly affects the posterior and lower zones of lung parenchyma in COVID 19 affected patients. Related studies on Platypnea and COVID 19 were reviewed. Substantial V/Q mismatch caused by poorly ventilated posterior and lower section because of gravitational shunting of blood. In the presence of pulmonary micro angioplasty as well as micro thrombosis, as reported in severely infected COVID patients, wasted ventilation is likely to be worsened.

Conclusion

Our study observes that Platypnea-Orthodeoxia is a common presentation of moderate COVID19 requiring oxygen supplementation therapy. The oxygen saturation in sitting position correlates with requirement of oxygen supplementation in patients of moderate COVID-19. Patients of moderate COVID 19 who require oxygen supplementation have a greater difference in positional oxygen saturation and a larger drop in oxygen saturation on assuming sitting from supine position as compared to patients who do not require oxygen supplementation. It is prudent to monitor the oxygen saturation in sitting position in all patients as hypoxia may be missed if oxygen saturation is documented only in the supine position, which is how patients are often examined. ARDS i.e. acute respiratory distress syndrome is undervalued condition in the COVID- 19.sever COVID-19 is the direct clinical indication towards the Platyponea orthodoxies syndrome. The incidence of the Platyponea orthodoxies syndrome should be made known to medical practitioners, we conclude (POS). COVID-19 Intensive Care Units in Severe Cases. In resource-constrained or overstretched hospital setting, we recommend direct supervision with bedside (SpO2) oxygen saturation level assessment following postural changes, with a concentration on patients who are old aged and have more serious disease. Recognizing the Platyponea orthodoxies syndrome (POS) can help to reduce incidence, avoid unnecessary panic, enhance healthcare outcomes, and allow for therapeutic changes. According to our findings there is need of more and more observational studies related to intermediate and long-term clinical status in the corona infected patients and the study must include patients with Platypnea orthodoxies syndrome and without the presentation of this syndrome.

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