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COVID-19 Impact on Cancer Patients

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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) has spread fast over the world, prompting the proclamation of a pandemic. As the pandemic evolves, scientists are learning more about the virus and how it affects us. According to early studies, elderly patients with various chronic health conditions, such as hypertension, diabetes, and obesity, were more likely to develop severe COVID-19 after contracting SARS-CoV-2. According to growing data, patients with cancer have been demonstrated to be a particularly vulnerable group. Cancer patients have a weaker immune system as a result of traits particular to the development of cancer or even treatment, making them more liable to COVID-19 infections. Due to heightened immunosuppression, patients with haematological malignancies and those having aggressive chemotherapy treatment may be at the greatest risk. As a cancer patient contracts COVID-19, the risk of organ-related problems increases when compared to a healthy person. The establishment of protective strategies should be encouraged for cancer patients, thereby decreasing their exposure to the SARS-CoV-2 virus and thus helping to maintain the public's health.

Objective:The objective is to review the article related to COVID-19 and cancer.

Methodology: For the review article, we gathered the data from various databases like PubMed, ScienceDirect, Google, and other websites involving searches for cancer, COVID-19, risk factors, and chemotherapy.

Result: After reviewing the article, complications and mortality were higher in comparison to cancer free patients.

Conclusion: After reviewing the article, we conclude that cancer patients are more vulnerable to COVID-19 and as a risk factor leads to more complications and greater mortality.

Key words: Cancer, SARS CoV-2, COVID-19, Immunosuppression, Chemotherapy

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INTRODUCTION

Coronavirus is a human and animal-infecting RNA virus. In the previous two decades, the Middle Eastern respiratory syndrome coronavirus (MERS-CoV) and the severe acute respiratory syndrome coronavirus (SARS-CoV) both contagious as well as fatal and have caused thousands of deaths [1]. Although antivirals, corticosteroids, and respiratory support have all been used to treat COVID-19. For this infection there is no specific.1 Early discovery, isolation, quick treatment, and the development of a powerful system for finding contacts are all recognized ways to stop the virus from spreading. The virus is believed to be transferred from human to human via the respiratory tract. During the asymptomatic incubation period, SARS-CoV-2 is thought to be transmitted. The incubation period of the virus is considered to be between 2 - 10 days [2].

COVID-19 sickness, caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV2), was declared a global pandemic by WHO on March 11, 2020 [3]. After the initial discovery of the virus, the spread of SARS CoV-2 globally was very fast, with over 1.7 million confirmed cases all over the world and more than 100,000 deaths as of April 2020 [4]. This condition can range in severity from asymptomatic to ARDS, and depending on that, it may require intensive care or may lead to death.

One of the most common diseases worldwide is cancer. It affects multiple organs and may also harm the immune system due to its inability to control tumour cell proliferation and manage auto reactive reactions.

Furthermore, because the treatment is so aggressive, it can intermittently suppress the immune system, leaving the patient suffering from cancer more vulnerable to infections. In numerous studies, it has been demonstrated that chemotherapy increases the rate of death of carcinoma patients infected with the COVID-19 virus by lowering the immune system's capacity to fight against the virus.

In the midst of this epidemic, providing care to immunocompromised individuals and cancer patients has been incredibly difficult. Furthermore, due to prioritizing and resource constraints, care for chronic diseases, including cancer, was partially interrupted during the pandemic's height. Also, a lack of supplies in outpatient settings, such as medical staff and specialists, has hampered regular patient care [5]. Travel restrictions as well as patients' unwillingness to visit hospitals due to fear of contracting infection have led to the reduction in accessibility to medical facilities. COVID-19 is being treated with the use of healthcare resources that were diverted. Concerns have been raised about probable delays in cancer detection as a result of this resource diversion. This pandemic also has a very significant effect on cancer research around the world. The establishment of protective strategies for cancer patients should be promoted, which may decrease their access to the SARS-CoV-2 virus, thereby helping to maintain the public's health. This COVID-19 outbreak has had some good effects as well. The pandemic's consequences have driven society and governments to recognize the significance of a robust healthcare system.

SARS-CoV-2

Tyrell and Bynoe discovered coronaviruses (CoVs) in individuals with viral-like upper respiratory disease in 1966 [6]. CoVs are single-stranded, enveloped, positive RNA viruses that may infect people and animals. These viruses are spherical, which includes a core protein and consists of glycoprotein that projects outwards from their envelope, giving them the appearance of a crown, as viewed under electron microscopy, hence known as coronavirus. As spike glycoprotein is essential for coronavirus invasion, it is a promising antiviral target. The S protein is made up of two subunits, i.e., S1 and S2. The virus attaches to the binding site on the host cell with the help of S1 subunit. The role of S2 subunit is fusion of the membranes of viruses to the host cells [7]. Certain human CoVs can upper respiratory infections in immunocompromised people and these infections are self-limiting, but other beta-CoVs, like SARS-CoV, MERS-CoV, and SARS-CoV-2 (COVID19), can lead to outbreaks that have higher fatality rates [8].

COVID 19 pathophysiology

A beta coronavirus, termed as SARS-CoV-2, causes COVID-19. The virus has a single-stranded ribonucleic acid (RNA) structure and it belongs to the Coronavirinae subfamily and Coronaviridae family [9]. SARS-CoV has 14 binding sites that come into direct contact with the human angiotensin-converting enzyme 2 (ACE2), whereas SARS-CoV-2 has eight of these amino acids. Although the pathophysiological processes are unclear, the virus's 96.2 percent genetic similarity to SARS-CoV may aid in its pathophysiology [10,11]. SARS-CoV-2 infects the epithelial cells of the respiratory system via ACE2, a presumed receptor that is a membrane-bound aminopeptidase, and reaches the cell via receptor-mediated endocytosis. Once the virus binds to host receptors, it enters the host cells by fusion of membrane and endocytosis. After the release of viral contents into the host cells, viral ribonucleic acid reaches the nucleus where it replicates. Viral proteins are made from viral mRNA. The virus then produces and releases new viral particles. The spike protein on the surface of SARSCoV-2 must be proteolytically cleaved by serine transmembrane protease 2 (TMPRSS2) before interacting with ACE2 receptors in order for the virus to infect cells. Although ACE2 is mostly found in type II alveolar cells of the lung, it is also found throughout the aerodigestive tract, that includes the mucosa of the oral cavity, posing a threat to the immune system [11,12]. ACE2 is involved in lung protection, so viral binding to it disturbs a pulmonary protection pathway, adding to viral infectivity. 11 Immunity is linked to a vulnerability of COVID-19 infections, and an individual suffering from cancer and receiving chemotherapy or radiation may have weakened immune system, making them more easily affected by COVID-19 infection [13].

Cancer and COVID-19

Patients with already existing immune suppression tend to have a higher risk of catastrophic consequences when they contract COVID-19, emphasising the value of a functioning immune system in restraining and reacting to SARS-CoV-2 infection [14]. Cancer is a disease characterised by abnormal cell proliferation with the ability to involve adjacent structures and spread to other organs. Cancer cells grow uncontrollably, resulting in abnormalities that disrupt the cell regulatory mechanism, thereby affecting patients' immune systems. Radiation therapy or chemotherapy damages bone marrow, leading to decreased cell production thereby disrupting body's ability to fight infection. Cancer cells can infiltrate the cells of bone marrow and compete for place and nutrients, causing death of normal cells of bone marrow and thus limits the white blood cells formation that fights infection [15]. The possibility of severe complications is lower in lung carcinoma compared to other cancer types. SARS-CoV-2 stimulates the immune system when it enters the body, triggering cytolytic immune responses, mostly through type I interferons and natural killer cells. Generation of antibodies by T cells and B cells are also responsible for boosting acquired immunity. Some defence cells, such as CD8+ T cells and CD4+ T cells, have been found to be reduced in patients severely ill with COVID 19.

As reported by Liang et al carcinoma patients are at greater risk of serious infections and an increased requirement for ventilation and ICU admission in comparison to cancer free patients [16]. The possibility

of severe complications is lower in lung carcinoma compared to other cancer types.16 Wang and Zhang stated that the risk for carcinoma patients is the restricted availability of critical health care and that required health services are not available in a timely manner, particularly in epidemic areas with higher risk [17].

Clinical aspect of a cancer patient

A retrospective analysis found that the most typical symptoms at presentation for COVID-19 infected patients with cancer were fever, dry cough, and exhaustion [18]. When infected with COVID-19, both carcinoma patients and patients free of cancer have comparable clinical symptoms, but the cancer patient has more tiredness and dyspnea symptoms. In patients diagnosed with lung carcinoma, when compared to other cancerous and non-cancerous patients' dyspnea occurred much earlier from the onset of COVID-19 diagnosis [19].

Carcinoma patients probably infected with COVID 19 may have a number of adverse effects in addition to respiratory problems. 16 Acute respiratory distress syndrome (ARDS) was the most prevalent consequence and cause of mortality in these patients (28.6%), followed by septic shock (3.6%), pulmonary embolism (7.1%), acute myocardial infarction (AMI) (3.6 %) [18].

Effect of chemotherapy on the immune system of carcinoma patient

Cells that divide quickly are targeted by chemotherapy, which is common in cancerous cells but is not exclusively limited to cancerous cell. Because normal cells in the blood, hair, mouth, vagina, digestive system, nails, and nose divide rapidly, antineoplastic chemotherapy has the most impact on them. These substances have no effect on cancer cells [20]. Some chemotherapeutic agents harm bone marrow cells, causing a decrease in formation of platelets, white blood cells, and red blood cells. White blood cells have the biggest impact, increasing the susceptibility of a patient to infection. According to the study by Liang et al. [16], individuals receiving chemotherapy, immunotherapy, or undergoing surgery are more likely to acquire significant COVID-19 infections. Incident, and the danger was significantly higher among the elderly when compared to cancer-free patients. To prevent the negative effects of chemotherapy on the individual immune system, it is vital to do research about the chemotherapy drug combinations that would be utilized and choose the one that has the least negative influence on the immune system of the patient. They must also eat a nutritious diet, decrease stress, exercise, and should get enough sleep to maintain immunity. Chemotherapy can be less damaging to the immune system if these elements are present [21]. Major role is played by inflammation in SARS-CoV-2-related damage. Elevated IL-6, raised D-dimer, reduced albumin, lymphopenia development, greater prothrombin time, and increased neutrophil count that occur due to various inflammatory mechanisms have been identified as deteriorating these patients' clinical state. Immunotherapy, a conventional treatment for a variety of tumors, tries to restore immunological function against cancer cells.

Carcinoma patients at risk from COVID-19 infection

SARS-CoV-2 stimulates the immune system when it enters the body, causing cytolytic immunological responses, mostly through natural killer cells and type 1 interferons. Acquired immunity is also boosted, with B cells and T cells generating antibodies to combat the virus. Some defensive cells, such as natural killer cells, CD8+ T cells, and CD4+ T cells, are reduced in COVID-19 patients, but pro-inflammatory cells are increased. The number of T cells that produce IL-17 and cytotoxic T cells is increasing, which might have negative consequences. The lungs suffer from significant immunological damage [22]. The continuous immune response might result in excessive levels of inflammatory cytokines and may also lead to tissue destruction in the host. This cytokine storm is a very important contributor to the development of progress and mortality of COVID-19.

COVID-19 is an opportunistic illness that preys on patients with compromised immune systems. Due to a compromised immune system, an individual is more liable to contract a COVID-19 infection. One with weak immune systems are inclined more to be admitted to the hospital, placed on artificial ventilation, or possibly die because their immune systems are unable to fight infection. These cancer patients are unable to obtain vaccinations and must rely on community-wide immunization to protect them. For the time being, the only solutions for cancer patients at risk are social isolation and better hygiene practices for their family and healthcare providers. Time is valuable for patients with carcinoma who cannot be denied prompt therapy. As the virus is spreading worldwide, the dangers of contracting infections are also increasing, especially in individuals with weaker immunity. The biggest concern for cancer patients in this outbreak is the difficulty of receiving critical medical services. Further, delay in treatment may lead to carcinoma progression, and further, the outcome may be very poor. Patients need to undergo chemo and radiotherapy at frequent intervals, and if the duration between two cycles is prolonged, studies have shown that their therapeutic effect decreases. SARS-CoV-2 spread can be slowed without jeopardising cancer therapy, and this is only possible because of careful monitoring of patients exposed to the virus and also due to the measures taken to decrease the danger of infection. Among the deaths due to COVID-19, 19.4% were related to patients with carcinoma [16].

Care of cancer patients in pandemic

Cancer sufferers are among those who should be cautious about respiratory problems. Those receiving intense therapy for leukaemia or lymphoma, as well as those patients who have undergone bone marrow transplantation, are most susceptible to pneumonia, especially viral pneumonia, because of their weak immune systems due to tumours or the therapy they undergo [23]. Patients with lung carcinoma are at threat

because the virus has a strong affinity for the respiratory tract, and infection can cause severe lung damage, including oedema, localised reactive pneumocyte hyperplasia with irregular inflammatory cell infiltration, protein exudate, and mortality.

As reported in studies from the M.D. Anderson Cancer Center, many "elective" procedures and almost all non-emergency procedures have been postponed in communities where COVID-19 instances are at their highest [24]. In scenarios where surgery is indicated, appropriate COVID 19 preoperative protocols must be developed to increase the safety and quality of care. Cancer-directed therapy with the potential to cure or significantly improve quality of life should not be postponed. Because oral chemotherapy and hormonal therapy can often be monitored from anywhere and require fewer lab tests and less frequent in-person visits, treatments prescribed for survivorship and surveillance patients are likely to be continued. One of the most important pillars in cancer care, radiation therapy, has also been affected by the pandemic. Cancer patients who are having radiotherapy or chemotherapy are at risk of infection, including SARS-CoV-2, due to the cytotoxic effect of treatment of carcinoma on the haematological and immune systems, which results in a decrease in neutrophil count and immunological capacity [25].

A recurring issue was the interruption of cancer screening and diagnosis. A cross sectional survey stated that there were delays in appointments and scans. Cancellation of routine follow-up was also reported. There is postponement of many elective surgeries and procedures that are not life threatening, decision for this is made on the basis of individual cases in order to protect the patient suffering from cancer from getting infection and to make sure that healthcare workers have enough supplies that they need to treat an individual who becomes severely ill with COVID-19.

Certain measures should be taken for individuals receiving antineoplastic treatment. In the case of surgery, implementation of preoperative as well as postoperative measures to reduce the risk of getting infected It is critical to encourage people to isolate themselves and reduce the number of hospital visits in the case of patients who require intravenous chemotherapy. Reduce patient flow and develop a workflow plan [16,26]. According to Yu et al, patients suffering from cancer, who are at the heart of the pandemic, are at greater danger of getting SARS-CoV-2 infection than the general public [27].

CONCLUSION

COVID-19 has impacted people of all ages and socioeconomic backgrounds. Carcinoma patients are a high-risk population for morbidity and mortality in the COVID-19 pandemic around the world. Cancer patients are known to have a weaker immune system, making them more liable to infections. COVID-19 positive cancer patients have been shown in studies to have a worsening of their clinical status and are more likely to die. An individual suffering from lung carcinoma may have their clinical state worsened due to the SARS-CoV2 virus's propensity for lung cells. Leukemia, multiple myeloma, and lymphoma are malignancies that directly influence the immune system. Social distancing and the reinforcement of enhanced hygiene practices, such as hand washing, are the best ways to prevent it.

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