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**Case Report**

# Navigating the COVID-19 Pandemic with DPLD: Insights from a Case Report for Healthcare Providers

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**Abstract:**

The COVID-19 pandemic brought significant challenges to global healthcare systems, particularly for individuals with underlying health conditions. This article reports a case of a 65-year-old man with a medical history of diabetes mellitus, hypertension, and diffuse parenchymal lung disease (DPLD), who succumbed to severe COVID-19 infection. He presented to the Medicine inpatient of a tertiary care hospital, with fever and extreme lethargy during the second wave of the COVID-19 pandemic early in 2021. Upon presentation, his oxygen saturation ($SPO_2$) was 31%. High-resolution computed tomography (HRCT) chest findings revealed extensive ground glass opacity, and his nasal swabs tested positive for COVID-19 via reverse transcription-polymerase chain reaction (RT-PCR). He was diagnosed with type 1 respiratory failure and was subsequently admitted to the intensive care unit (ICU), where his condition rapidly deteriorated and he passed away.This case highlights the heightened vulnerability of individuals with pre-existing comorbidities to severe COVID-19 complications and thus intensifies the importance of early recognition and intervention in such high-risk populations.

**Key words:** COVID-19 pneumonia, COVID-19 mortality, DPLD, ground glass opacity, type 1 respiratory failure, COVID-19 with comorbidities, ARDS

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## Introduction:

Coronaviruses are a large family of viruses that cause illnesses ranging from the common cold to more severe diseases such as Middle East respiratory syndrome MERS-CoV and severe acute respiratory syndrome SARS-CoV.[1] The outbreak of a novel coronavirus, recognized on December 31, 2019, in Wuhan, China, was declared a pandemic by the World Health Organization (WHO), known as COVID-19, subsequently spreading across 229 countries worldwide and causing more than seven million deaths by April 2024.[2]

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With no prior knowledge about the new virus and the new pandemic, experience sharing has been playing an important source of information for combating this global health-care crisis.

In the first month of the outbreak, China reported at least 44 cases of pneumonia of unknown cause, which were later identified as being caused by SARS-CoV-2, the virus responsible for COVID-19.[3] Healthcare providers quickly began to learn about the clinical presentation and progression of the new disease from these reported cases. The fatality rate among cases exhibited an idiosyncratic disposition. However, from the very early days, it became evident that patients without comorbid conditions fared better than those with one or more comorbid illnesses.[3,4]

This case report underscores the extensive medical history of a 65-year-old man burdened with multiple comorbidities, including a chronic lung condition known as Diffuse Parenchymal Lung Disease (DPLD). While he managed to navigate through the initial year (2020) of the global pandemic relatively well, he tragically succumbed to the virus early in the second year (2021). Remarkably, his admission to the

Medicine inpatient unit at Sylhet Women's Medical College coincided with the onset of the institution's documented second wave of the COVID-19 pandemic, as recorded in hospital documentation.[5.]

The decision to report this case at a later stage is justified by the recent surges in the incidence of the disease, as evidenced by data from WHO dashboards **(Figure-1)**[6] and from local observations. As a result of the implementation of global vaccination campaigns and improvement of the natural immunity among populations, fatalities due to COVID-19 have decreased in recent times.[7] However, it is imperative to remain vigilant regarding comorbid illnesses in affected individuals, as they continue to pose a significant risk.[3]

**Case summary**

A 65-year-old retired gentleman residing in the suburbs of Sylhet city was admitted to the Medicine inpatient department of Sylhet Women's Medical College Hospital (SWMCH) in January 2021, presenting with fever and, severe lethargy persisting for three days. On examination, despite being ambulatory and alert, he exhibited a peripheral capillary oxygen saturation (SPO2) of 31%. He had a blood pressure 130/80mmHg, core temperature 102°F, mild dehydration and, widespread crepitations on both lung fields. He had no pulsus alternans, galloped rhythm suggestive of acute left ventricular failure. His random blood glucose level 140mg/dl and urine ketone body was nil. High-resolution computed tomography (HRCT) of the chest revealed diffuse ground-glass opacities **(Figure 2 and Figure 3)** overlaid on pre-existing shadows of diffuse parenchymal lung disease (DPLD)which he had been diagnosed with for many years. Subsequent nasal swab testing for reverse transcription-polymerase chain reaction (RT-PCR) confirmed COVID-19 infection. Consequently, he was transferred to the COVID-19 isolation facility of the hospital, where standard therapeutic protocols were commenced. However, due to progressive deterioration of oxygen saturation despite maximal intervention, he was moved to the COVID-19 Intensive Care Unit (ICU) within the same facility within 6 hours of admission. His blood test reports, summarized in **Table 1**, showed neutrophilic leukocytosis, raised ESR, CRP and procalcitonin, mildly raised serum creatinine, moderately raised serum ferritin and D-dimer levels. His NT-proBNP was within an acceptable range. His arterial blood gas analysis findings were compatible with type 1 respiratory failure. Treatment in the ICU comprised administration of oxygen therapy with high flow nasal cannula (HFNC), Remdesivir (100mg/day), Dexamethasone (6mg/day), and Enoxaparin (0.5mg/kg 12 hourly) injections. Given his pre-existing vulnerable lung condition, empirical Meropenem injections were initiated for secondary bacterial infection. However, Ivermectin or Hydroxychloroquine doses were not administered either before or during the illness. His posture was changed to prone position as long as he was breathing spontaneously. Despite recommendations for mechanical ventilatory support, the patient's caregivers declined such intervention. Regrettably, his clinical condition continued to decline, culminating in his demise 50 hours following admission to the ICU.

The patient had a medical history encompassing diabetes managed through mixed insulin therapy, hypertension treated with Losartan potassium (100mg) and Cilnidipine (10mg), alongside chronic Diffuse Parenchymal Lung Disease (DPLD) spanning at least fifteen years. Respiratory symptoms were effectively controlled using a maintenance regimen consisting of oral methyl-prednisolone (16mg/day) and metered dose inhalers containing salbutamol, ipratropium, and salmeterol-fluticasone combination. While the patient had a history of smoking during youth, they ceased smoking at the age of 25. Regular outpatient follow-ups occurred at SWMC. Observations of weight gain, facial swelling **(Figure 4)**, elevated blood glucose, and poorly managed blood pressure prompted concern for steroid-induced Cushing's syndrome. Subsequent investigation revealed elevated serum glucocorticoid levels and low ACTH levels, confirming the diagnosis. Owing to reluctance to pursue biological agent therapies, the patient's steroid maintenance dosage was reduced to 8mg/day. The patient required two

inpatient admissions in the Medicine department, firstly in 2012 for diabetes management and later in 2014 for acute exacerbation of DPLD, with successful recovery from both instances. In 2018, he reported generalized body pain, prompting Bone Mineral Densitometry evaluation, which identified osteoporotic levels **(Figure 5)** in the spine and forearms. Symptoms gradually alleviated with annual Zolendronicacid injections and daily oral calcium-vitamin D supplements.

Despite enduring many ailments, throughout his long history of clinical problems, he ultimately succumbed to the latest onslaught of the novel SARS-CoV2 virus, COVID-19.

**Figure 1:WHO reports: recent (left) and total (right) COVID-19 cases in the world[6]**

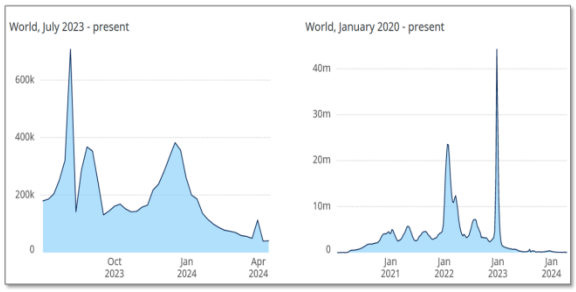



**Figure 2: HRCT chest showing ground glass opacity of DPLD before COVID-19**

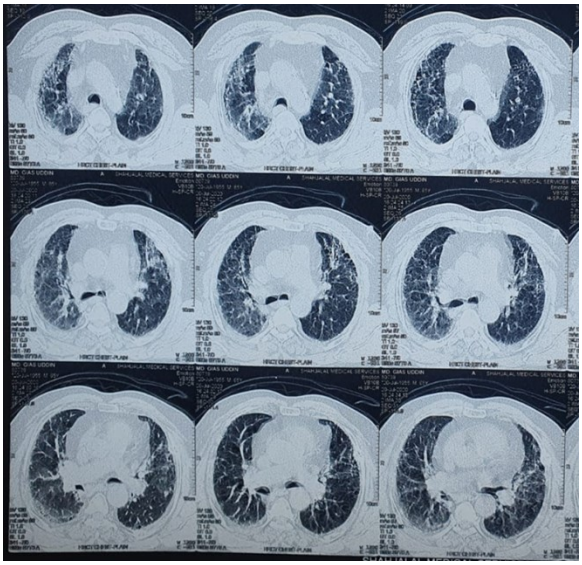


**Figure 3: HRCT chest showing superimposed shadows of COVID-19 pneumonia**

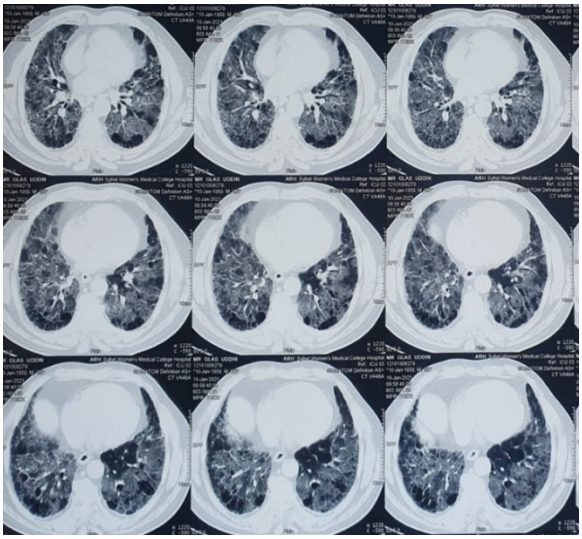


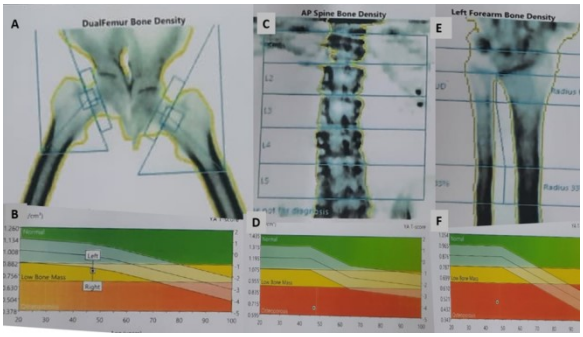
**Table 1: Hematological and biochemical parameters at presentation and at 48 hours of admission**

| | Test parameter | At presentation | At 48 hours |
|---|---|---|---|
| 1 | **Hemoglobin** | 13.5 gm/dl | 12.7gm/dl |
| 2 | **ESR** | 51mm | 60mm |
| 3 | **Total count of WBC** | 12,000/cu-mm | 11800/cu-mm |
| 4 | **Differential count of WBC** | N-80%, L- 15%, M-4%, E-1%, B-0% | N-84%, L- 12%, M-3%, E-0.9%, B-0.1% |
| 5 | **Platelet count** | 1,10,000/cu-mm | 67,000/cu-mm |
| 6 | **CRP** | 129 ng/ml | 203 ng/ml |
| 7 | **Procalcitonin** | 1.1ng/ml | - |
| 8 | **Creatinine** | 1.51 mg/ml | 2.0 mg/ml |
| 9 | **Electrolytes** | Na- 136 mmol/L<br>K- 4.3 momol/L<br>Cl- 112 mmol/L<br>HCO3-20 mmol/L | Na- 136 mmol/L<br>K- 4.3 momol/L<br>Cl- 112 mmol/L<br>HCO3-20 mmol/L |
| 10 | **Ferritin** | 973 ng/ml | - |
| 11 | **D-dimer** | 2.1 µg FEU/ml | 3 micro-gram/L |
| 12 | **$SPO_2$** | 31% (without oxygen) | 80-85 (with oxygen therapy) |
| 13 | **ABG** | PH- 7.33<br>PaO2-45mmHg<br>CO2-30mmHg<br>HCO3-20mmol/L | PH-7.30<br>PaO2-40mmHg<br>CO2- 35mmHg<br>HCO3- 22mmol/L |
| 14 | **NT-proBNP** | 730 pg/ml | - |
| 15 | **Urine ketone body** | nil | - |

*ESR-Erythrocyte Sedimentation Rate, WBC-White Blood Corpuscle, CRP-C-Reactive Protein, ABG-Arterial Blood Gas, NT-ProBNP-N-terminal pro b-type natriuretic peptide*

**Figure 4:Cushingoid face due to prolonged corticosteroid therapy**

**Figure 5: Osteoporotic Bone Mineral Densitometry: AB- pelvis and femurs, CD- vertebral column, EF- left radius and ulna**




**Discussion**

The WHO-China Joint Mission on COVID-19 identified fever, cough, and fatigue as the three most prevalent symptoms of COVID-19 pneumonia.[8]The index case initially presented with fever and fatigue. Despite registering a low oxygen saturation level (31%), he did not exhibit obvious dyspnea, a typical hallmark of COVID-19 infection.[9]Patients with COVID-19-related Acute Respiratory Distress Syndrome (ARDS) characteristically present with severe hypoxemia, often disproportionate to the degree of respiratory distress observed.[10] The patient nearly refused admission to the hospital due to a mistaken sense of not experiencing any distress. High-resolution chest imaging often reveals bilateral infiltrates consistent with diffuse alveolar damage, which served as a guide for diagnosis in this particular case. Though the patient already had pulmonary shadows due to his pre-existing DPLD, there were obvious superimposed bilateral ground glass opacities, indicating ARDS. Since RT-PCR tests take time for results, quick identification and treatment of ARDS, vital for improving outcomes in COVID-19 patients, can be facilitated through chest images.[11]

The emergence of ARDS as a consequence of COVID-19 infection presents a substantial hurdle in the treatment of severe cases. This complication is marked by diffuse alveolar damage, resulting in severe hypoxemia and respiratory failure. The pathophysiology of COVID-19-induced ARDS entails a intricate interaction of direct viral damage, dysregulated immune reactions, endothelial dysfunction, and micro thrombosis. Among severely affected patients, the primary cause of mortality often arises from the rapid deterioration of hypoxemia, culminating in respiratory failure and the onset of ARDS.[12]

In the initial stages of the pandemic, the criteria for commencing mechanical ventilation and the rationale for maintaining lung-protective measures in cases of COVID-19-related ARDS were inadequately established. However, findings from a multicenter trial involving 742 subjects adjoined to mechanical ventilation according to Berlin criteria demonstrated comparable 28-day mortality rates to those observed in non-COVID ARDS cases. Furthermore, mortality rates were correlated with the severity of ARDS.[13]

All treatment protocols for COVID-19-associated ARDS prioritize the implementation of effective oxygen therapy for patients. Utilizing mechanical ventilation with lung-protective strategies, adopting prone positioning, and employing conservative fluid management are fundamental interventions aimed at ameliorating hypoxemia. Additional therapies involving antivirals, antibiotics and immuno-modulators like Baricitinib, Tocilizumaband, Bevacizumab have shown some efficacy in reducing mortality rates among critically ill patients.[14]

It is still uncertain whether the implementation of non-invasive or mechanical ventilation would have positively influenced the patient's outcome. However, based on a broad observation derived from the ICU data of the institution, it was noted that patients necessitating such interventions typically exhibited severe illness and experienced unfavorable outcomes.[15]

Prone positioning offers numerous advantages in the management of ARDS, including improved ventilation-perfusion matching, decreased lung injury, enhanced secretion drainage, and relief from ventral lung compression.[16]This technique has been widely embraced by clinicians, particularly during the COVID-19 pandemic, for patients experiencing severe ARDS with spontaneous respiration. It has been associated with improved mortality rates in a significant portion of patients.[17] However, it did not yield favorable results in the index case. The ABG parameters of PaO2, PaCO2, and A-a gradient carry prognostic significance for COVID-19 ARDS patients. In the index case, the A-a gradient was not calculated, but both PaO2 (40-45) and PaCO2 (30-35) levels were indicative of poor prognosis.[18]

Despite advancements in supportive care and therapeutics, the mortality rate remains elevated among COVID-19 patients who develop ARDS,[19] a condition more prevalent among those with comorbidities. Such comorbidities have consistently been identified as negative prognostic factors for patients with COVID-19 pneumonia.[20,21] The case highlighted in this article presented with multiple comorbid conditions, potentially categorizing him into a vulnerable group. Although he managed well throughout the initial year of the pandemic, he contracted the virus early in its second year. Notably, the patient not only suffered from diabetes and hypertension but also had a history of chronic DPLD. This type of pre-existing lung fibrosis has been recognized as an independent predictor of poor prognosis.[22,23,24] Furthermore, all of this occurred before the introduction of national vaccination campaigns against COVID-19 in the country.

In summary, several adverse factors, such as advanced age, comorbidities, pre-existing DPLD,prior immunosuppressive treatment with steroids, suboptimal arterial blood gas profile,and reluctance to undergo non-invasive or mechanical ventilation, collectively contributed to the fatal outcome of the index case.

With the introduction of preventive measures such as vaccines, COVID-19 infection fatalities have diminished. However, further research is imperative to delineate optimal management strategies and uncover novel therapeutic targets aimed at enhancing outcomes within vulnerable populations. Moreover, endeavors to bolster COVID-19 transmission prevention via vaccination campaigns and reinforced public health measures should be intensified.In a recent study, human bone marrow-derived mesenchymal stem cell was safely transfused to a critically ill patient with COVID-19 pneumonia.[25] However, its therapeutic benefits require larger-scale randomized controlled trials before a recommendation can be made.

**Conclusion**

This case emphasizes the critical importance of identifying and prioritizing individuals with pre-existing comorbidities for early intervention and aggressive management in the context of the COVID-19 pandemic. Heightened vigilance and tailored approaches to care are essential in mitigating the impact of the disease in high-risk populations. As the pandemic continues to evolve, though at a faded extent, efforts to protect and support vulnerable individuals remain paramount in combating the global health crisis posed by COVID-19.

**Limitations:** Owing to restrictions of the pandemic situation, detailed and close clinical follow-up of the case could not be instituted.

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