Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

American Journal of Emergency Medicine 47 (2021) 324.e1–324.e3

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

A coronavirus disease-2019 induced pancytopenia

Rachel E. Bridwell, MD *, Brannon L. Inman, MD, Sara Birdsong, MD, Sarah Goss, MD, Brit Long, MD

Department of Emergency Medicine, San Antonio Uniformed Services Health Education Consortium, 3551 Roger Brooke Dr, Fort Sam Houston, TX 78234, United States

ARTICLE INFO

Article history:
Received 30 January 2021
Accepted 18 February 2021

Keywords:
COVID-19
Pancytopenia
Thrombocytopenia
Lymphopenia
Anemia
SARS-CoV2

ABSTRACT

As the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2) pandemic progresses, various hematologic complications have emerged, often centered around the hypercoagulable state. However, pancytopenia represents a rare but serious complication from SARS-CoV2 infection. While lymphopenia is a common finding, concomitant acute anemia and thrombocytopenia are not commonly reported. We describe a novel case of SARS-CoV2 pancytopenia in a 40-year-old male without active risk factors for cell line derangements but subsequent critical illness.

Published by Elsevier Inc.

1. Introduction

Defined as the simultaneous decrease in all three cell lines, pancytopenia can arise from nutritional deficiencies, hypersplenism, immunosuppressive medications, radiation, chemotherapy, megaloblastic anemia, and infection [1]. A variety of viruses can cause pancytopenia, including Epstein-Barr virus and Human Immunodeficiency Virus; Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2) is postulated to cause pancytopenia via a massive cytokine storm and bone marrow infiltration [2]. Lymphopenia has become a hallmark of SARS-CoV2 infection, while pancytopenia is a rare complication not commonly seen in immunocompetent patients [3]. We present a novel case of coronavirus disease 2019 (COVID-19) pancytopenia in a previously immunocompetent patient who developed multi-organ failure.

2. Case presentation

A 40-year-old male with past medical history of hypertension presented to the emergency department (ED) with 3 days of progressive shortness of breath and dyspnea on exertion in the setting of previously confirmed COVID-19. He endorsed anosmia, anorexia, productive cough with pink tinged sputum, malaise, and fever of 103 °F the morning of presentation. He denied recent travel, animal exposure, known sick contacts, or immunocompromising states.

The patient's initial vital signs were blood pressure of 186/133 mmHg, heart rate 98 beats per minute, respiratory rate 20 breaths per minute, oxygen saturation 96% on room air, and a temperature of 100.8 degrees Fahrenheit. Physical examination was notable for mild respiratory distress, tachypnea, and rhonchi in all lung fields. Laboratory evaluation demonstrated lymphopenia (white blood cell count of 2.4×10^3 cells/μL, lymphocytes 6.4%, absolute lymphocyte count 154 cells/mm^3), normocytic anemia (hemoglobin of 12.0 g/dL), thrombocytopenia (platelets of 44×10^3 cells/μL), acute kidney injury with a creatinine of 2.3 mg/dL (baseline of 1.2 mg/dL), and a glomerular filtration rate (GFR) of 34 mL/min. SARS-CoV-2 infection was confirmed via a second nasopharyngeal polymerase chain reaction (PCR). Chest radiograph and computed tomography showed bibasilar interstitial infiltrate and ground glass opacities without pulmonary embolism (Figs. 1-2). The patient was admitted to the hospital and quickly upgraded to the intensive care unit (ICU) with a hematology consultation where all cell lines continued to downtrend. He required multiple platelet transfusions and intermittent red blood cell transfusions. The hospital course was complicated by acute hypoxic respiratory failure with subsequent pulseless electrical activity (PEA) arrest requiring cardiopulmonary resuscitation and mechanical ventilation, as well as acute renal failure requiring continuous renal replacement therapy (CRRT) and catheter associated sepsis secondary to a urinary source (Fig. 3).

3. Discussion

With the development of the SARS-CoV2 pandemic, several hematologic complications have been characterized, often representing harbingers of coagulopathic complications or critical illness [4]. Lymphopenia remains a common feature of this disease and is a marker for more severe illness, though notably thrombocytopenia is rare [3-6]. Akin to the proposed pulmonary virulence mechanism, the etiology of

* Corresponding author at: 3551 Roger Brooke Dr., JBSA Fort Sam Houston, TX 78234-6200, United States.
E-mail address: r.e.bridwell@gmail.com (R.E. Bridwell).

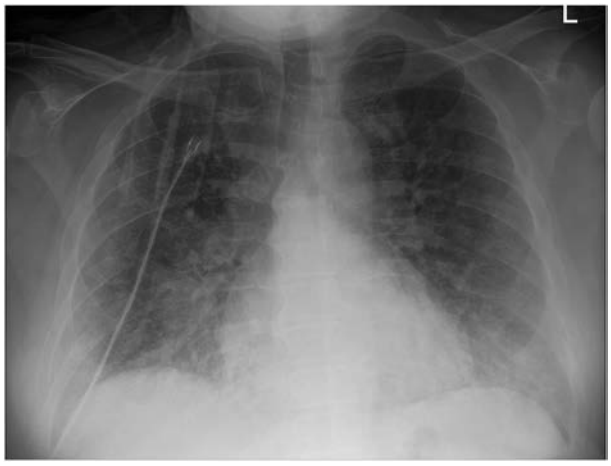

Fig. 1. Anteroposterior chest radiograph demonstrating bilateral interstitial infiltrates without consolidation.

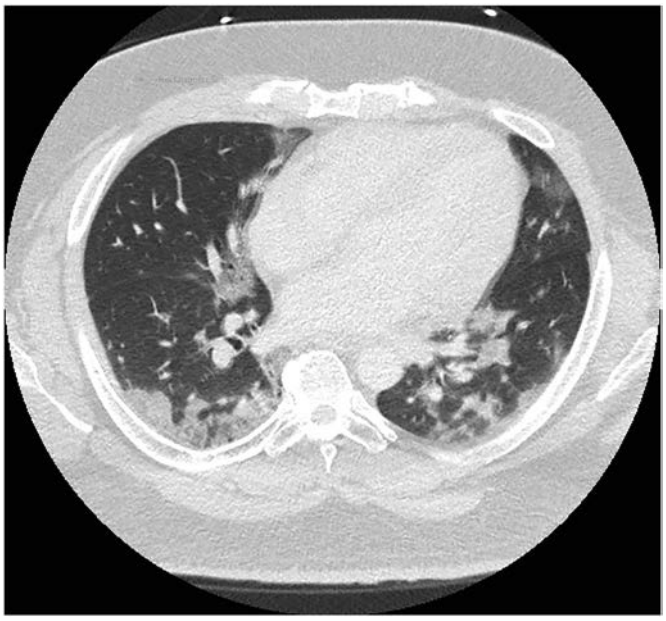

Fig. 2. Non-contrasted computed tomography with axial slice showing bilateral ground glass opacities consistent with SARS-CoV2 infection.

pancytopenia is also linked to the angiotensin converting enzyme 2 receptor, which is present in bone marrow in lower levels [7]. Additionally, autoantibody production may occur after antigenic epitopes located on myelocytes are exposed as well as immune complex deposition on platelet surfaces, resulting in destruction of all cell lines [3,8].

While other cases of SARS-CoV2 induced pancytopenia have been reported, they occurred in those with prior or functionally immunocompromised states. The initial case from the COVID-19 literature occurred in patient with mantle-cell lymphoma status post recent autologous bone marrow transplant, and a report detailed a pancytopenic COVID-19 patient with follicular lymphoma and recent bone marrow transplant [9,10]. An additional COVID-19 associated pancytopenia was complicated by neutropenic enterocolitis, highlighting the functionally immunocompromised stated secondary to SARS-CoV2 infection [11]. Our patient was young and had relatively few risk factors with a mild ED presentation; his pancytopenia likely was an indication of his impending critical illness, stressing the importance of this case.

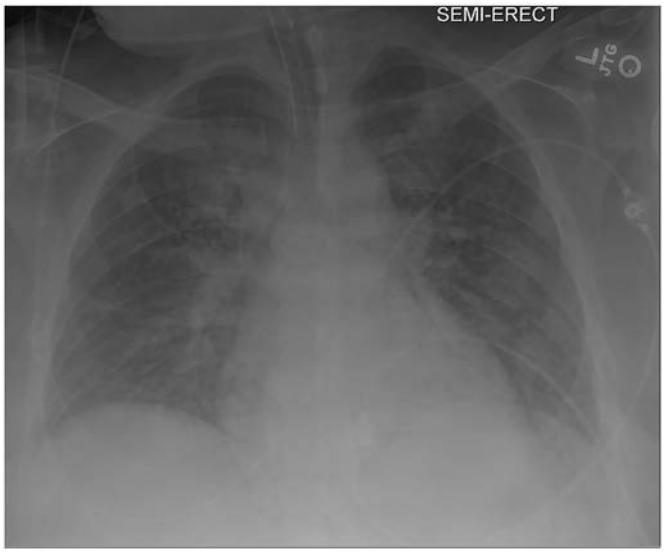

Fig. 3. Anteroposterior chest radiograph demonstrating worsening bilateral interstitial infiltrates after endotracheal intubation.

4. Conclusion

As the SARS-CoV2 pandemic continues, further hematologic complications emerge and should be characterized for the emergency physician. Global cell line suppression is far more rare than isolated lymphopenia, though early identification of this finding may represent a marker of critical illness.

Funding

None.

Acknowledgements

Disclaimer: The view(s) expressed herein are those of the author (s) and do not reflect the official policy or position of Brooke Army Medical Center, the U.S. Army Medical Department, the U.S. Army Office of the Surgeon General, the Department of the Army, the Department of the Air Force and Department of Defense or the U.S. Government.

References

[1] Jain A, Naniwadekar M. An etiological reappraisal of pancytopenia - largest series reported to date from a single tertiary care teaching hospital. BMC Hematol. 2013;13(1):10. https://doi.org/10.1186/2052-1839-13-10.
[2] Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497–506. https://doi.org/10.1016/S0140-6736(20)30183-5.
[3] Zhao Y, He J, Wang J, et al. Development of pancytopenia in a patient with COVID-19. J Med Virol. 2020. https://doi.org/10.1002/jmv.26566.
[4] Al-Samkari H, Karp Leaf RS, Dzik WH, et al. COVID-19 and coagulation: bleeding and thrombotic manifestations of SARS-CoV-2 infection. Blood. 2020;136(4):489–500. https://doi.org/10.1182/BLOOD.2020006520.
[5] Kasinathan G, Sathar J. Haematological manifestations, mechanisms of thrombosis and anti-coagulation in COVID-19 disease: a review. Ann Med Surg. 2020;56:173–7. https://doi.org/10.1016/j.amsu.2020.06.035.
[6] Huang I, Pranata R. Lymphopenia in severe coronavirus disease-2019 (COVID-19): systematic review and meta-analysis. J Intensive Care. 2020;8(1):36. https://doi.org/10.1186/s40560-020-00453-4.
[7] Li MY, Li L, Zhang Y, Wang XS. Expression of the SARS-CoV-2 cell receptor gene ACE2 in a wide variety of human tissues. Infect Dis Pov. 2020;9(1). https://doi.org/10.1186/s40249-020-00662-x.
[8] Xu P, Zhou Q, Xu J. Mechanism of thrombocytopenia in COVID-19 patients. Ann Hematol. 2020;99(6):1205–8. https://doi.org/10.1007/s00277-020-04019-0.

[9] Hersby DS, Do TH, Gang AO, Nielsen TH. COVID-19-associated pancytopenia can be self-limiting and does not necessarily warrant bone marrow biopsy for the purposes of SARS-CoV-2 diagnostics. Ann Oncol. 2021;32(1):121–3. https://doi.org/10.1016/j.annonc.2020.09.020.

[10] Issa N, Lacassin F, Camou F. First case of persistent pancytopenia associated with SARS-CoV-2 bone marrow infiltration in an immunocompromised patient. Ann Oncol. 2020;31(10):1418–9. https://doi.org/10.1016/j.annonc.2020.06.016.

[11] Ufuk F, Bulgurcu E, Sari T. COVID-19-associated pancytopenia and typhlitis. Am J Emerg Med. 2021. https://doi.org/10.1016/j.ajem.2020.12.049.