

Coronavirus Disease 2019 and Bone Marrow Transplantation: A Mini-review

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Abstract

Since the first incidence of coronavirus disease 2019 (COVID-19) was identified in 2019, the illness has rapidly spread, increasing the number of cases, hospital admissions, and fatalities associated with COVID-19. The epidemic is putting an unprecedented amount of stress on the health-care system, including programs that perform both allogeneic and autologous hematopoietic stem cell transplantation (HSCT) and cellular treatment employing T cells. The risk of a severe COVID-19 infection in HSCT patients is widely acknowledged, and the COVID-19 vaccine is strongly advised. This mini-review provides a succinct overview of recent advances in COVID-19 and bone marrow transplantation.

Keywords: Bone marrow, coronavirus disease, transplantation

INTRODUCTION

Since the first appearance of the clinical case with coronavirus disease 2019 (COVID-19), this infection has widespread quickly, resulted in a huge number of COVID-19 infectious cases, hospitalized cases, and mortalities. The health-care system, including programs that undertake allogeneic and autologous hematopoietic stem cell transplantation (HSCT) and cellular therapy using T cells, is under unprecedented strain as a result of this epidemic.^[1] Age and predisposing diseases like cancer are risk factors for serious illness. The interaction between bone marrow transplantation (BMT) and COVID-19 can be complicated and multidimensional. The transplantation of stem cells from a donor to a recipient effectively replaces the recipient's immune system.^[1,2] This procedure weakens the recipient's immune system, rendering them more susceptible to diseases such as COVID-19. Individuals who have had BMT may be at a higher risk of getting serious sickness if they contract COVID-19 due to their impaired immune system.^[1,2] This is due to the fact that their ability to fight off the virus and other diseases may be greatly diminished. COVID-19 may have an impact on the success of a bone marrow transplant. Infection with the virus either before or after the transplant operation can result in issues such as delayed engraftment (when the donated cells begin to grow and make new blood cells), graft failure, and even death.^[1,2]

The exact clinical problem induced by COVID-19 in recipients of stem cell transplants is largely unknown.^[1,3] On the basis of their immunosuppressed condition, HSCT patients are thought to be at a significant risk of having poor outcomes after COVID-19, although information from extensive trials on HSCT recipients is sparse.^[4] According to Sharma *et al.*, COVID-19 patients with autologous and allogeneic HSCT had a poor prognosis for survival.^[4] These findings highlight that it is necessary to have a strict monitoring system and appropriate management in HSCT recipients who experience COVID-19.^[4] However, there are a number of concerns regarding COVID-19 and BMT, for which there is yet insufficient information. In this mini-review, we will provide a brief overview of COVID-19 and BMT.

BONE MARROW TRANSPLANTATION AND TRANSMISSION OF CORONAVIRUS DISEASE 2019

Patients who have received transplants may contract COVID-19, but there is still no information on transmission

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linked to transplantation.^[5] In fact, viruses may exist in internal organs like the lung, and disease transmission may be feasible if the contaminated organ is utilized for transplantation.^[1] Before transplantation, it is advised that patients be screened for potential severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) infection. There is currently a lack of information on this problem; hence, transplantation medicine needs to gather more data on it. According to Lázaro Del Campo *et al.*, the low viral RNA concentration in COVID-19 patient plasma may promote the safety of blood products, including peripheral blood hematopoietic cells.^[6] In light of the COVID-19 pandemic, Lázaro Del Campo *et al.* came to the conclusion that blood products, including hematopoietic stem cells, are safe.^[6] Nevertheless, the safety is still the issue for clinical practice.^[1] There are already some reports confirming that hematopoietic stem cells from asymptomatic SARS-CoV-2-positive donors may be safe in both pediatric and adult case.^[1,5-8]

REACTIVATION OF CORONAVIRUS DISEASE 2019 AFTER BONE MARROW TRANSPLANTATION

SARS-CoV-2 reactivation or reinfection cases are well documented, although there is little proof that reactivation occurs in immunocompromised patients.^[1] The possibility of SARS-CoV-2 reactivation raises concerns about the dangers of reactivation among patients who have received stem cell transplants and other immunocompromised individuals.^[9] As a result, having a solid strategy of preparedness and prevention is essential. According to a recent study, selected individuals with a history of COVID-19 infection can safely undergo autologous and allogeneic HCT with proper patient preparation.^[10]

CORONAVIRUS DISEASE 2019 VACCINATION AND IMMUNE RESPONSE IN BONE MARROW TRANSPLANTATION CASE

In instances involving BMT, Matkowska-Kocjan *et al.* assessed the tolerance and immunogenicity of the COVID-19 mRNA vaccine.^[11] Young people who have undergone HSCT tolerate the COVID-19 mRNA vaccination well and have an immune response, according to Matkowska-Kocjan *et al.*^[11] The report from the Seattle also highlighted the need for COVID-19 vaccination for the case with HSCT.^[2] In another study by Ram *et al.*,^[12] patients who have received allogeneic HCT or CART show excellent immunogenicity to the BNT162b2 mRNA COVID-19 vaccination. Patients should be constantly monitored since adverse events were usually minor and short-lived, although some serious hematologic problems were also noted.^[13]

Many people have insufficient vaccination while using immunosuppressive medications; this is typically fixed with a third dose. This is brought on by the immunity's quick decline. The data show that two-dose vaccination methods in HSCT patients have limited immunogenicity, supporting the

case for additional booster shots and/or alternate prophylactic measures in this population.^[13] Patients who have undergone allogeneic hematopoietic cell transplantation may not have the same immunological response to the COVID-19 vaccine as the general healthy population.^[2] The impact of the asymptomatic COVID-19 is a significant area of concern. The impact of the asymptomatic COVID-19 is a significant area of concern. There is no explicit methodology to exclude prevaccination and postvaccination asymptomatic COVID-19 among study transplant patients, despite the fact that this condition is widespread. It would be interesting to know if asymptomatic COVID19 confounded the reported immunological parameter.^[14]

BREAKTHROUGH CORONAVIRUS DISEASE IN BONE MARROW TRANSPLANT RECIPIENT

No COVID-19 vaccination can elicit 100% protection rate. Similar to other populations, bone marrow transplant recipients may experience a COVID breakthrough.^[15] People who had had vaccinations generally had a significantly lower chance of developing new diseases. However, among those who had received vaccinations, drugs with significant immunosuppressive effects and bone marrow transplants were substantially linked to a higher probability of a breakthrough.^[16] After administering the COVID-19 breakthrough infection vaccine in the US, Sun *et al.* came at the following conclusion.^[17]

CONCLUSION

It is conceivable for the recipient of a bone marrow transplant to contract COVID-19, which could cause a serious infection. There is still no proof that COVID-19 transfer can occur due to transplantation. For recipients of bone marrow transplants, the usual COVID-19 immunization continues to be effective. As a recommendation, the COVID-19 vaccine is strongly suggested due to the potential of a serious COVID-19 infection in HSCT patients.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Ljungman P, Mikulska M, de la Camara R, Basak GW, Chabannon C, Corbacioglu S, *et al.* The challenge of COVID-19 and hematopoietic cell transplantation; EBMT recommendations for management of hematopoietic cell transplant recipients, their donors, and patients undergoing CAR T-cell therapy. *Bone Marrow Transplant* 2020;55:2071-6.
2. Ueda Oshima M, Sandmaier BM, Petersdorf E, Flowers ME, Hill GR, Lee SJ, *et al.* Blood and marrow transplantation during the emerging COVID-19 pandemic: The Seattle approach. *Bone Marrow Transplant* 2021;56:305-13.
3. Mansour RO, El-Ashwah S, Denewer M. The impact of COVID-19 on acute myeloid leukemia patients undergoing allogeneic stem cell transplantation: A concise review. *Blood Res* 2023;58:13-9.

4. Sharma A, Bhatt NS, St Martin A, Abid MB, Bloomquist J, Chemaly RF, *et al.* Clinical characteristics and outcomes of COVID-19 in haematopoietic stem-cell transplantation recipients: An observational cohort study. *Lancet Haematol* 2021;8:e185-93.
5. Wiwanitkit V. Atypical modes of COVID-19 transmission: How likely are they? *Epidemiol Health* 2020;42:e2020059.
6. Lázaro Del Campo P, de Paz Arias R, Ramírez López A, de la Cruz Benito B, Humala Barbier K, Sánchez Vadillo I, *et al.* No transmission of SARS-CoV-2 in a patient undergoing allogeneic hematopoietic cell transplantation from a matched-related donor with unknown COVID-19. *Transfus Apher Sci* 2020;59:102921.
7. Koç A, Doğru Ö, Eker N, Tufan Taş B, Şenay RE. Hematopoietic stem cell transplantation to a patient with acute myeloid leukemia from a sibling donor positive for SARS-CoV-2 by RT-PCR test. *Turk J Haematol* 2022;39:150-1.
8. Anurathapan U, Apiwattanakul N, Pakakasama S, Pongphitcha P, Thitithanyanont A, Pasomsub E, *et al.* Hematopoietic stem cell transplantation from an infected SARS-CoV2 donor sibling. *Bone Marrow Transplant* 2020;55:2359-60.
9. Dalla Via V, von Rotz M, Bättig V, Leuzinger K, Hirsch HH, Passweg J, *et al.* Possible reactivation of SARS-CoV-2 in a patient with acute myeloid leukemia undergoing allogeneic hematopoietic stem cell transplantation: A case report. *SN Compr Clin Med* 2021;3:2011-5.
10. Shah N, Dahi PB, Ponce DM, Sauter CS, Shaffer BC, Chung DJ, *et al.* Hematopoietic cell transplantation is feasible in patients with prior COVID-19 infection. *Transplant Cell Ther* 2022;28:55.e1-e5.
11. Matkowska-Kocjan A, Owoc-Lempach J, Chruszcz J, Kuźnik E, Szenborn F, Jurczenko L, *et al.* The COVID-19 mRNA BNT163b2 vaccine was well tolerated and highly immunogenic in young adults in long follow-up after haematopoietic stem cell transplantation. *Vaccines (Basel)* 2021;9:1209.
12. Ram R, Hagin D, Kikozashvili N, Freund T, Amit O, Bar-On Y, *et al.* Safety and immunogenicity of the BNT162b2 mRNA COVID-19 vaccine in patients after allogeneic HCT or CD19-based CART therapy-a single-center prospective cohort study. *Transplant Cell Ther* 2021;27:788-94.
13. Murray SM, Barbanti M, Campbell C, Brown A, Chen L, Dhanapal J, *et al.* Impaired humoral and cellular response to primary COVID-19 vaccination in patients less than 2 years after allogeneic bone marrow transplant. *Br J Haematol* 2022;198:668-79.
14. Mungmunpuntipantip R, Wiwanitki V. Comment on: mRNA SARS-CoV-2 vaccination in patients after allogeneic hematopoietic cell transplantation. *Transpl Infect Dis* 2022;24:e13839.
15. Pagano L, Salmanton-García J, Marchesi F, Blennow O, Gomes da Silva M, Glenthøj A, *et al.* Breakthrough COVID-19 in vaccinated patients with hematologic malignancies: Results from the EPICOVIDEHA survey. *Blood* 2022;140:2773-87.
16. Song Q, Bates B, Shao YR, Hsu FC, Liu F, Madhira V, *et al.* Risk and outcome of breakthrough COVID-19 infections in vaccinated patients with cancer: Real-world evidence from the national COVID cohort collaborative. *J Clin Oncol* 2022;40:1414-27.
17. Sun J, Zheng Q, Madhira V, Olex AL, Anzalone AJ, Vinson A, *et al.* Association between immune dysfunction and COVID-19 breakthrough infection after SARS-CoV-2 vaccination in the US. *JAMA Intern Med* 2022;182:153-62.