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REFERENCES

1. Smeeth L, Cook C, Thomas S, Hall AJ, Hubbard R, Vallance P. Risk of deep vein thrombosis and pulmonary embolism after acute infection in a community setting. *Lancet*. 2006;367(9516):1075-1079. [https://doi.org/10.1016/S0140-6736\(06\)68474-2](https://doi.org/10.1016/S0140-6736(06)68474-2)
2. VAN WISSEN M, KELLER TT, VAN GORP ECM, et al. Acute respiratory tract infection leads to procoagulant changes in human subjects. *J Thromb Haemost*. 2011;9(7):1432-1434. <https://doi.org/10.1111/j.1538-7836.2011.04340.x>
3. Liu Q, Zhou YH, Yang ZQ. The cytokine storm of severe influenza and development of immunomodulatory therapy. *Cell Mol Immunol*. 2016;13(1):3-10. <https://doi.org/10.1038/cmi.2015.74>
4. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497-506. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5)
5. Tan CW, Cheen MHH, Wong WH, et al. Elevated activated partial thromboplastin time-based clot waveform analysis markers have strong positive association with acute venous thromboembolism. *Biochem Med*. 2019;29(2):020710. <https://doi.org/10.11613/BM.2019.020710>
6. Foley JH, Conway EM. Cross Talk Pathways between Coagulation and Inflammation. *Circ Res*. 2016;118(9):1392-1408. <https://doi.org/10.1161/CIRCRESAHA.116.306853>
7. Lawrence Ng CK, Tan CW, Cheen HHM, Wong WH, Chu MHY, Lim SS, Yeo GDD, Morvil G, Joo Ng H. APTT-based clot waveform analysis in various infections. *EHA Library*. 2018;215813:PS1530.

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Blood and blood product use during COVID-19 infection

To the Editor:

The COVID-19 pandemic is worsening in severity globally. Singapore confirmed its first imported case of COVID-19 on 23 Jan 2020. As of 29 March 2020, Singapore had 844 confirmed cases of COVID-19 infection with the majority being treated in the National Centre for Infectious Diseases (NCID). Blood and blood products are precious resources and the World Health Organization (WHO) has released guidelines on the management of blood supply in response to the COVID-19 pandemic.¹ We evaluated the indications and requirements of blood and blood products in patients with COVID-19 infection at the NCID, as well as the monthly blood component usage at HealthCity Novena; a central campus comprising of the NCID, Renci Community Hospital and Tan Tock Seng Hospital, a 1700-bed acute care hospital.

Out of 572 patients with COVID-19 infection, 19 required ICU treatment. Nine out of the 572 cases required transfusions; five were male and four were female, and the median age was 70 years. None

had clinical evidence of hemolysis. Here we present the clinical profiles of the nine patients who required transfusion (Figure 1).

Patient 1 was a 70-year-old male with hypertension and diabetes. He was admitted to the Intensive Care Unit (ICU) for COVID-19 pneumonia complicated by acute respiratory distress syndrome (ARDS). He suffered a non-ST-elevation myocardial infarction, atrial fibrillation, a cardioembolic stroke and acute kidney injury (AKI) requiring continuous renal replacement therapy (CRRT). There was no overt bleeding. Packed red blood cell (PRBC) transfusions were initiated at the ICU physician's discretion due to hemoglobin decreasing to as low as 8.1 g/dL.

Patient 2 was a 39-year-old male with no significant medical history. He was admitted for severe COVID-19 pneumonia complicated by ARDS, septic shock, AKI requiring CRRT and multi-organ failure. He suffered recurrent coffee ground nasogastric tube aspirates and was treated conservatively with intravenous esomeprazole infusions, with plans for endoscopy in the event of massive bleeding. Bone marrow examination performed for evaluation of pancytopenia showed adequate trilineage hematopoiesis. The cause of his anemia was multifactorial and attributed to anemia of inflammation and gastrointestinal bleeding. He required a total of 24 units of PRBC and 1 unit of pooled platelets.

Patient 3 was a 64-year-old male with asthma, hypertension, hyperlipidemia and ischemic heart disease. He was admitted for severe COVID-19 pneumonia with ARDS and AKI requiring CRRT. Veno-venous extracorporeal membrane oxygenation (ECMO) was initiated with no requirements for transfusions but was then abandoned when the patient developed major bleeding. Fresh frozen plasma (FFP) and pooled platelets were transfused but the patient succumbed to multi-organ failure.

Patient 4 was a 74-year-old with hypertension, hyperlipidemia, previous transient ischemic attack and hypertensive nephrosclerosis. He was admitted for severe COVID-19 pneumonia with ARDS and developed ST-elevation myocardial infarction. Coronary angiography revealed triple vessel disease, and he was placed on medical therapy with plans for coronary artery bypass grafting when stable. Dual antiplatelet agents and low molecular weight heparin were started; thereafter he developed a drop in hemoglobin requiring 2 units of PRBC.

Patient 5 was a 77-year-old female with hypertension, hyperlipidemia, ischemic heart disease and pan-atrophic gastritis confirmed on endoscopy in 2019. She was admitted for severe COVID-19 pneumonia with ARDS, AKI requiring CRRT, melena secondary to severe gastritis on endoscopy and right sided colitis. She also developed limb gangrene and a distal limb deep vein thrombosis. She required 9 units of PRBC and unfortunately succumbed to COVID-19 pneumonia with multiorgan failure.

Patient 6 was an 86-year-old female with hypertension. She was admitted for severe COVID-19 pneumonia complicated by ARDS, acute liver and kidney injury. She had worsening anemia attributed to the severe infection and developed bleeding from a central line site, requiring 2 units of PRBC.

Patient 7 was a 71-year-old male with type 2 diabetes mellitus. He was admitted for severe COVID-19 pneumonia with ARDS complicated by right upper limb deep vein thrombosis secondary to a right

The total number of blood products transfused at the HealthCity Novena campus was lower in February 2020 and March 2020 as compared to the preceding 12 months. A mean of 1270 PRBC units/month in 2019 was transfused, as compared to 1063 PRBC units/month (16% decrease) in February and March 2020. There was also a reduction in FFP from 245 to 193 units/month (21.2% decrease) and platelet products from 197 to 166 units/month (15.7% decrease). While Tan Tock Seng Hospital still admits non COVID-19 patients, the postponing of elective surgeries and lower bed occupancy rates during February and March 2020 has resulted in decreased demand for blood products. This was also observed from March 2003 to May 2003 during the height of the Severe Acute Respiratory Syndrome (SARS) epidemic, where Tan Tock Seng Hospital was then the designated public hospital in Singapore to manage only patients with suspected and confirmed SARS. The blood transfusion requirements during that period showed a 66.5% decline from a mean 941 monthly red cell units transfused in 2002, to 315 monthly red cell units transfused, and a corresponding decline in mean monthly usage of FFP and platelet transfusions from 500 units FFP and 289 platelet products in 2002, to 211 units FFP (57.8% decrease) and 155 platelet products (46.3% decrease).

The challenges faced by blood banks during an infectious pandemic are securing and protecting the blood supply.⁴ While the demand for blood and blood products may decrease during a pandemic due to postponement of elective surgeries, measures such as physical distancing and a complete lockdown of cities, provinces or countries in an attempt to curb the spread of infection may result in a larger decline in blood supply and an overall shortage of blood products. This was observed in April 2003 to July 2003 in Beijing, China during the SARS outbreak where it was necessary to import blood and blood products from other Chinese provinces to ensure availability for clinical use in patients.⁵ Hospitals should have in place an emergency blood management plan in preparedness planning for sustainability and safety of blood supply.


In summary, most patients with mild COVID-19 infection do not require blood transfusions. A subset of critically ill patients with severe COVID-19 infection in the ICU, especially those with overt gastrointestinal bleeding, requires mostly PRBC transfusion, with lesser requirements for FFP and platelet products.

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1 | CONFLICT OF INTEREST

All authors declare no competing interests. This study was approved by the National Healthcare Group Domain Specific Review Board (DSRB).

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REFERENCES

1. Maintaining a safe and adequate blood supply during the pandemic outbreak of coronavirus disease (COVID-19) WHO Interim guidance, March 2020. [https://www.who.int/publications-detail/maintaining-a-safe-and-adequate-blood-supply-during-the-pandemic-outbreak-of-coronavirus-disease-\(covid-19\)](https://www.who.int/publications-detail/maintaining-a-safe-and-adequate-blood-supply-during-the-pandemic-outbreak-of-coronavirus-disease-(covid-19)).
2. Xiao F, Tang M, Zheng X, Liu Y, Li X, Shan H. Evidence for gastrointestinal infection of SARS-CoV-2. *Gastroenterology*. 2020;158(6):1831-1833.e3.
3. Thachil J, Tang N, Gando S, et al. ISTH interim guidance on recognition and management of coagulopathy in COVID-19. *J Thromb Haemostasis*. 2020;18(5):1023-1026.
4. Gschwender AN, Gillard L. Disaster preparedness in the blood bank. *Am Soc Clin Lab Sci*. 2017;30(4):250-257. <https://doi.org/10.29074/ascls.30.4.250>.
5. Shan H, Zhang P. Viral attacks on the blood supply: the impact of severe acute respiratory syndrome in Beijing. *Transfusion*. 2004;44:467-469. <https://doi.org/10.1111/j.0041-1132.2004.04401.x>.

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Incentive spirometry to prevent acute chest syndrome in adults with sickle cell disease; a randomized controlled trial

To the Editor:

Acute chest syndrome (ACS) is a major complication in patients with sickle cell disease (SCD), attributing to up to 25% of mortality.¹ The pneumonia-like complication frequently coincides with hospitalization for vaso-occlusive crisis (VOC) and occurs in approximately 50% of SCD