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.

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First case of persistent pancytopenia associated with SARS-CoV-2 bone marrow infiltration in an immunocompromised patient

A 53-year-old man was referred from an intensive care unit for acute respiratory distress, pancytopenia and cytokine release syndrome. His symptoms had begun 3 weeks earlier with anosmia, ageusia, cough, fever and dyspnea. He had a medical history of mantle-cell lymphoma diagnosed in 2017, and was in complete remission following autologous bone marrow transplant in 2018 and nine-monthly maintenance infusions of anti-CD20 monoclonal antibody (last infusion 42 days before his symptoms appeared). Blood tests showed pancytopenia (hemoglobin 7.9 g/dl, leukocytes 0.8 G/l and platelets 48 G/l) and elevated inflammatory markers (C-reactive protein 235 mg/l, fibrinogen >10 g/l, ferritin 8106 ng/ml and D-dimers 1132 ng/ml). Coronavirus disease 2019 (COVID-19) tests by semiquantitative severe acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2) reverse transcription-PCR (RT-PCR) revealed negative findings in nasopharyngeal swab samples, but positive findings in bronchoalveolar lavage fluid, blood [cycle threshold (*Ct*) value = 30] and bone marrow aspiration samples. Other microbiological examination results were negative. Bone marrow aspiration revealed neither hemophagocytosis features nor viral infection except SARS-CoV-2. Flow cytometry analysis of circulating leukocytes revealed the absence of circulating B lymphocytes, a result of the repeated anti-CD20 antibody infusions, and a low T-lymphocyte count (0.447 G/l). Serum protein electrophoresis revealed gamma globulin level of 3 g/l (versus 4.9 g/l 6 months before). Thoracic CT scan showed bilateral patchy ground-glass opacities. Upon admission, he received two successive infusions of tocilizumab (8 mg/kg) and an infusion of polyvalent immunoglobulins (400 mg/kg). He required respiratory support with noninvasive ventilation and high-flow oxygen therapy for 7 days. Clinical evolution was gradually favorable over 2 weeks, with apyrexia, reduced oxygen requirements and normalized inflammatory biomarker levels. However, at 45 days after admission, SARS-CoV-2 RT-PCR test results remained positive in blood (*Ct* value = 35) and bone marrow. Moreover, SARS-CoV-2 serological testing detected no antiviral immunoglobulin G, while pancytopenia persisted.

If respiratory complications are the most common clinical presentation of severe COVID-19, hematological involvement as described here and persistent viremia are not published in the literature.[1,2] Therefore, SARS-CoV-2 RT-PCR should be performed in blood and bone marrow aspiration in case of pancytopenia associated with typical COVID-19 symptoms, especially in case of secondary humoral immunodeficiency. Among the many therapeutic options under

investigation, including antiviral drugs, we suggest that convalescent plasma could be useful in patients with COVID-19 infection and concurrent persistent B-cell immunodeficiency; we will consider this approach for our patient.[3–5]

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Does androgen deprivation therapy protect against severe complications from COVID-19?

Currently, there is a paucity of effective treatments to address the remarkably high morbidity and mortality associated with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) coronavirus disease-19 (COVID-19). This letter highlights a potential therapeutic strategy based on known biology of SARS-CoV-2 cellular entry and replication.

SARS-CoV-2 relies on surface expression of angiotensin-converting enzyme 2 (ACE2) and transmembrane serine proteases 2 (TMPRSS2) for cellular entry and replication in the respiratory epithelium.[1,2] In *in vitro* and mouse models, TMPRSS2 inhibition limits respiratory cell damage and reduces severity of infection.[1,3] TMPRSS2 is commonly expressed in prostate cancer cells and is known to be regulated by androgens.[4] Hence, androgen deprivation therapy (ADT) may theoretically reduce TMPRSS2 expression limiting SARS-CoV-2 cellular entry and preventing severe complications from COVID-19. In fact, a recent report from Alimonti and colleagues demonstrated a lower rate of infection in prostate cancer patients on ADT, compared with those not on ADT.[5] Herein, we report our observational study of all patients in a single New York City health system with COVID-19 and prostate cancer to determine the impact of ADT on COVID-19 clinical outcomes. To our best knowledge, this is the largest study to report severity of COVID-19 in patients receiving ADT.

This study was approved by the Mount Sinai School of Medicine Institutional Review Board. We identified all Mount Sinai Health System (MSHS) patients with prostate cancer and SARS-CoV-2 viral detection by PCR (based on testing within and outside MSHS) from 1 March 2020 to 4 June 2020. We collected clinical information including demographics, medical history, and medications including ADT use. ADT use was defined as a gonadotropin-releasing hormone (GnRH) analog or antagonist administered within 3 months and/or documented testosterone concentrations $\leq$50 ng/dl within 6 months of COVID-19 diagnosis. We collected COVID-19-related outcomes including death, hospitalization, oxygen utilization, and intubation. We carried out bivariable and multivariable logistic regression models, adjusting for age, cardiac, and pulmonary disease, to evaluate differences in COVID-19-related outcomes between ADT and non-ADT cohorts. All tests were two-sided at a 0.05 level.

We identified 58 patients in our study, 22 and 36 in the ADT and non-ADT cohorts, respectively. Baseline characteristics were similar in both groups, with the exception of prostate cancer clinical disease state and baseline pulmonary disease. Specifically, those in the ADT group had a higher incidence of metastatic disease (64% versus 0%, $P < 0.001$) and higher rates of pulmonary disease (27% versus 6%, $P < 0.02$), compared with the non-ADT group. Median follow-up in the entire cohort was 23 days (range 1—48).

The clinical outcomes between ADT and non-ADT cohorts are listed in Table 1. ADT use, after controlling for age, cardiac disease, and pulmonary disease, was associated with lower rates of hospitalization [odds ratio (OR) 0.23, 95% confidence interval (CI) 0.06—0.79, $P < 0.02$] and supplemental oxygen requirements (OR 0.26, 95% CI 0.07—0.92, $P = 0.036$). ADT use was also associated with a protective effect on need for intubation (OR 0.31, 95% CI 0.05—1.81, $P = 0.192$) and mortality (OR 0.37, 95% CI 0.08—1.80, $P = 0.22$); however, it did not reach statistical significance.

Despite the limitations of a small sample size, our data support the hypothesis that ADT may limit severe complications from COVID-19, based on lower rates of hospitalization and supplemental oxygen requirements for