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.

(CRP) and d-dimer levels, all of which resolved. Patient characteristics, symptoms defined by Common Terminology Criteria for Adverse Events (CTCAE) 5.0,[3] and outcomes are summarized in Table 1.

Although risk-benefit calculations during the pandemic must consider several variables, including potential survival benefit, possibility of developing COVID-19 hyperinflammation,[4] and patient risk factors and preferences, these data, along with other emerging evidence, suggests that the use of ICIs in the presence of SARS-CoV-2 infection may be safe for patients with mild or asymptomatic COVID-19 who are likely not at risk for developing hyperinflammatory disease. We found that of the 17 patients with concomitant ICI therapy and SARS-CoV-2 infection, only 6 (35%) developed symptoms, all of which were mild, and 15 (88%) resumed therapy. These findings are in line with initial results from the Thoracic Cancers International COVID-19 Collaboration (TERAVOLT) registry, which found that although mortality was high among patients with lung cancers, no evidence was found that COVID-19 outcomes were worse in the small subset of patients receiving ICIs compared with the overall cohort.[5] A subsequent analysis at Memorial Sloan Kettering Cancer Center in New York similarly found that PD-1 blockade was not associated with increased risk of severity of COVID-19.[6] The outcomes we describe are also consistent with other reports of safe ICI therapy in patients with melanoma and COVID-19.[7,8] Larger studies will be needed to definitively establish safety and efficacy. Additionally, it will be important to consider logistical concerns for isolating SARS-CoV-2-infected patients to prevent further spread and the potential for exposing vulnerable individuals, such as those living with cancer, to the virus. The oncology community mobilized and adapted to unprecedented circumstances during the past year, and efforts must continue to provide lifesaving care while minimizing risks for both healthcare workers and patients.

C. Trojaniello, M. G. Vitale & P. A. Ascierto*

Department Melanoma, Cancer Immunotherapy and Development Therapeutics, Istituto Nazionale Tumori IRCCS Fondazione Pascale, Napoli, Italy
(*E-mail: paolo.ascierto@gmail.com).

Available online 16 February 2021

https://doi.org/10.1016/j.annonc.2021.02.008

ACKNOWLEDGEMENTS

The authors thank the patients and their families as well as the frontline workers battling the COVID-19 pandemic. Additionally, the authors acknowledge Sam Million-Weaver, PhD, for editorial assistance.

FUNDING

None declared.

DISCLOSURE

PAA has/had a consultant/advisory role for Bristol-Myers Squibb, Roche-Genentech, Merck Sharp & Dohme, Novartis, Array, Merck Serono, Pierre Fabre, Incyte, MedImmune, AstraZeneca, Syndax, Sun Pharma, Sanofi, Idera, Ultimovacs, Sandoz, ImmunoCore, 4SC, Alkermes, Italfarmaco, Nektar, Boehringer-Ingelheim, Eisai, Regeneron, Daiichi Sankyo, Pfizer, OncoSec, Nouscom, Takis, Lunaphore. He also received research funding from Bristol-Myers Squibb, Roche-Genentech, Array, Sanofi and travel support from MSD. The other authors have declared no conflicts of interest.

REFERENCES

1. Sullivan RJ, Johnson DB, Rini BI, et al. COVID-19 and immune checkpoint inhibitors: initial considerations. *J Immunother Cancer.* 2020;8(1):e000933.
2. Curigliano G, Banerjee S, Cervantes A, et al. Managing cancer patients during the COVID-19 pandemic: an ESMO multidisciplinary expert consensus. *Ann Oncol*. 2020;31(10):1320-1335.
3. US Department of Health and Human Services. CTCAE v5.0. 2017. Available at: https://ctep.cancer.gov/protocoldevelopment/electronic_applications/docs/CTCAE_v5_Quick_Reference_8.5x11.pdf. Accessed November 27, 2017.
4. Manson JJ, Crooks C, Naja M, et al. COVID-19-associated hyperinflammation and escalation of patient care: a retrospective longitudinal cohort study. *Lancet Rheumatol.* 2020;2(10):e594-e602.
5. Garassino MC, Whisenant JG, Huang L-C, et al. COVID-19 in patients with thoracic malignancies (TERAVOLT): first results of an international, registry-based, cohort study. *Lancet Oncol*. 2020;21(7):914-922.
6. Luo J, Rizvi H, Egger JV, Preeshagul IR, Wolchok JD, Hellmann MD. Impact of PD-1 blockade on severity of COVID-19 in patients with lung cancers. *Cancer Discov.* 2020;10(8):1121-1128.
7. Arenbergerova M, Gkalpakiotis S, Arenberger P, Fialova A, Pasek M. COVID-19 in 3 patients treated with immune checkpoint inhibitors for advanced melanoma. *J Dermatolog Treat*. 2020:1-2.
8. Quaglino P, Fava P, Brizio M, et al. Metastatic melanoma treatment with checkpoint inhibitors in the COVID-19 era: experience from an Italian Skin Cancer Unit. *J Eur Acad Dermatol Venereol.* 2020;34(7):1395-1396.

Clinical outcome of SARS-CoV-2 infection in breast and ovarian cancer patients who underwent antiestrogenic therapy

Several studies have reported a higher susceptibility of men to develop severe respiratory disease following severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection when compared with women.[1,2] To explore the implication of hormonal regulation in coronavirus disease-2019 (COVID-19) clinical outcomes, we assessed SARS-CoV-2 infections, hospital admissions, and deaths in women affected by hormone-driven cancers (HDCs) and treated with antiestrogen therapies (AETs).

Out of 51 060 women (median age: 56 years) tested for SARS-CoV-2 infection from 22 February 2020 to 01 April 2020, 2478 had a clinical history of malignancy (4.9%), including 926 breast and 60 ovarian cancers. Women affected by cancers (331/2478) had a significantly higher prevalence of infection versus non-cancer patients (4414/48 582; $P < 0.001$).

Cancer patients developed more severe conditions and required hospitalization in 49.5% of cases versus 26.5% of women without cancer. During the study follow-up, 19.3% of cancer patients versus 7.3% of non-cancer patients died.

Compared with women without cancer, patients affected by breast cancer had a higher risk of hospitalization (RoH) [age- and comorbidity-adjusted prevalence odds ratio (adjPOR) = 1.98; 90% confidence interval (CI): 1.42-2.76] and death (26.6%; adjPOR = 2.53; 90% CI: 1.71-3.74). The presence of respiratory comorbidities increased the RoH (adjPOR = 7.89; 90% CI: 6.76-9.20) and death (adjPOR = 1.72; 90% CI: 1.35-2.19). A total of 90.6% of SARS-CoV-2-positive cancer patients were affected by comorbidity as compared with 47.8% of non-cancer patients. Cardiovascular disease was the most frequent (39.9% of cancer patients and 28.4% of non-cancer patients) together with respiratory disease (33.2% and 19.1%, respectively).

Four hundred and eighty-three patients affected by HDCs were receiving AETs. The prevalence of comorbidity was even higher among women under AET (94.2%). Specifically, 198 patients were treated with selective estrogen receptor modulators, degraders, or down-regulators (SERMs), of which 16 were under ovarian function suppression therapy (OFST). Three hundred and thirty-four women were under aromatase inhibitors (AIs), of which 16 were also under OFST, and 48 women were under luteinizing hormone-releasing hormone agonists (LAs) (16 were also under OFST).

SARS-CoV-2 positivity was found in 14 women under SERM treatment (7.1%), 44 women under AI (13.2%), and 3 women under LA (6.3%). Hospitalization was required by 51.9% of women under AET, and 19.2% died.

No significant association with SARS-CoV-2 infection, hospitalization, or death emerged among all patients with HDCs receiving AET. However, SARS-CoV-2 infection was significantly lower in women aged ≥50 years (adjPOR = 0.66; 90% CI: 0.48-0.91). Considering separately the three categories of AETs, only patients under SERMs had a lower prevalence of SARS-CoV-2 (adjPOR = 0.42; 90% CI: 0.21-0.83) as compared with patients not receiving any AETs. SARS-CoV-2 positivity was significantly higher in patients under AIs than in those under SERMs (adjPOR = 2.07; 90% CI: 1.02-4.19).

Altogether, our data indicate that female cancer patients have an increased risk of SARS-CoV-2 infection and develop more severe forms of COVID-19, in line with recent findings.[3,4] Moreover, ablation of estrogens in these patients reduced the prevalence of COVID-19. Therefore, the use of SERMs in the treatment of COVID-19 patients may represent a possibility. These data need to be further validated in a larger cohort and corrected to multiple variables. Moreover, molecular studies are required to elucidate the molecular bases for the protective effect observed in women under SERM treatment.

The study was approved by the Bioethics Committee of the Veneto Region (protocol no. 245343/2020).

M. Montopoli[1,2,3†], M. Zorzi[4†], V. Cocetta[1], T. Prayer-Galetti[5], S. Guzzinati[4], E. Bovo[4], M. Rugge[4,6*] & A. Calcinotto[3,7*]

[1]*Department of Pharmaceutical and Pharmacological Sciences, Università degli Studi di Padova, Padova;*
[2]*VIMM-Veneto Institute of Molecular Medicine, Fondazione per la Ricerca Biomedica Avanzata, Padova, Italy;*
[3]*Institute of Oncology Research (IOR), Oncology Institute of Southern Switzerland, Bellinzona, Switzerland;*
[4]*Veneto Tumour Registry, Azienda Zero, Padova;*
[5]*Department of Oncological and Gastroenterological Sciences—Urology Unit, Azienda Ospedaliera di Padova, Padova;*
[6]*Department of Medicine, Università degli Studi di Padova, Padova, Italy;*
[7]*Università della Svizzera Italiana, Lugano, Switzerland*
(*E-mail: massimo.rugge@unipd.it or arianna.calcinotto@ior.usi.ch).

†These authors contributed equally to this work.

Available online 29 January 2021

https://doi.org/10.1016/j.annonc.2021.01.069

FUNDING

This work was supported by the Dipartimento di Scienze del Farmaco-Universita degli Studi di Padova [grant number MONT_SID18_01] to MM and Fondazione per l'Istituto Oncologico di Ricerca (IOR) to AC.

DISCLOSURE

The authors have declared no conflicts of interest.

REFERENCES

1. Gebhard C, Regitz-Zagrosek V, Neuhauser HK, Morgan R, Klein SL. Impact of sex and gender on COVID-19 outcomes in Europe. *Biol Sex Diff.* 2020;11(1):29.
2. Montopoli M, Zumerle S, Vettor R, et al. Androgen-deprivation therapies for prostate cancer and risk of infection by SARS-CoV-2: a population-based study (*N* = 4532). *Ann Oncol.* 2020;31(8):1040-1045.
3. Rugge M, Zorzi M, Guzzinati S. SARS-CoV-2 infection in the Italian Veneto region: adverse outcomes in patients with cancer. *Nat Cancer.* 2020;1(8):784-788.
4. Liang W, Guan W, Chen R, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *Lancet Oncol.* 2020;21(3):335-337.