Journal of Communicable Diseases
Volume 58, Issue 2 - 2026, Pg. No. 79-86
Peer Reviewed & Open Access Journal

Research Article

Impact of Previous Covid-19 Infection on Cancer Progression and Occurrence: A Retrospective Study of Different Cancer Types

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DOI: https://doi.org/10.24321/0019.5138.202632

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How to cite this article:
Al-Asadi A B, Hadab M A, Al-Maadhidi J F, Abdulghani M N, Al-Aameri D A, Al-Nuaimi B N. Impact of Previous Covid-19 Infection on Cancer Progression and Occurrence: A Retrospective Study of Different Cancer Types. J Commun Dis. 2026;58(2):79-86.

Date of Submission: 2025-11-01
Date of Acceptance: 2026-06-08

A B S T R A C T

Background: The possibility of the oncogenic effect of the SARS-CoV-2 infection has become a growing concern owing to its prolonged immune and inflammatory effects. The present study had the objective of testing the hypothesis of whether the presence of a previous COVID-19 infection affects cancer incidence, distribution, and stage of diagnosis.

Methods: A retrospective observational study was conducted on 100 cancer patients with documented previous COVID-19 infection. Data on demographics, cancer type and stage, COVID-19 severity, and the interval between infection and cancer diagnosis were analyzed and compared with the Iraqi Cancer Registry (2018). Statistical analysis was performed using SAS software, employing Chi-square, t-test, and ANOVA.

Results: The mean patient age was 52.86 ± 17.45 years; 51% were male and 49% female. Solid tumors constituted 64% of cases, while hematologic malignancies represented 36%. Compared with 2018 national data, leukemia and prostate cancer increased significantly (27% and 14%, respectively; $p < 0.001$). Advanced stages (III–IV) were more frequent in patients with severe COVID-19 ($p = 0.0017$). The mean interval between COVID-19 infection and cancer diagnosis was shorter among advanced-stage patients (1.84 ± 0.92 years) than early-stage ones (2.18 ± 0.84 years; $p = 0.0321$).

Conclusion: Patients with previous COVID-19 infections may be associated with altered cancer distribution and stage at diagnosis, possibly due to immune dysregulation and inflammatory sequelae. These findings emphasize the necessity of vigilant cancer surveillance among post-COVID populations and further research into the molecular mechanisms linking SARS-CoV-2 to oncogenesis.

Keywords: COVID-19, SARS-CoV-2, Cancer, Immune dysregulation, Oncogenesis

Introduction

During the pandemic period, coronavirus disease 2019, caused by a novel coronavirus (SARS-CoV-2), progression of pneumonia-like cases has been typified by a broad range of clinical manifestations, courses, and outcomes. Specifically, the vast majority of patients with severe or critical symptoms had to be rehospitalized. The pre-existing medical conditions and the demographic and clinical features of the patients on admission into the hospital appear to have influenced the clinical outcome.[1,2] The highest 90-day incidence of COVID-19-specific mortality and hospitalizations was found in lung cancer and hematologic malignancies. It counts about 1,572 persons with cancer and confirmed SARS-CoV-2 infection, according to large prospective cohort research.[3] COVID-19 could have more lasting effects on oncogenesis, tumor progression, and the cancer continuum of care. According to the results of a meta-analysis, 16.5 percent of individuals with hematological malignancies had a SARS-CoV-2 infection during the COVID-19 pandemic, linked with a far greater chance of negative consequences.[4] Another comprehensive analysis reported that among 51,544 patients with COVID-19, about 976 patients have cancer, and the highest proportion of death was found in solid cancer (25%), and the lowest proportion of death appeared in the no COVID-19 or no cancer group.[5] There are several different pathophysiological ways that SARS-CoV-2 may affect the advancement of cancer. It may establish an oncogenic microenvironment by exploiting host immunity, stimulating signaling and oncogenic pathways. Such immune dysregulation as lymphopenia, T-cell exhaustion, pro-inflammatory cytokines (cytokine storm), and endothelial damage.[6,7] It has been observed that a cytokine storm is mainly caused by interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-alpha), and interleukin-1 beta (IL-1β). These cytokines chronically stimulate the Janus kinase/signal transducer and activator of transcription 3 (JAK/STAT3) and NF-κB signaling cascades, which are well known to stimulate cellular proliferation, angiogenesis, and apoptotic resistance.[8,9] Moreover, oxidative stress, endothelial dysfunction, and SARS-CoV-2-related microthrombosis result in a chronic low-grade inflammatory disease that predicts tissue remodeling and malignant transformation.[10,11,12]

At the same time, the pandemic led to global interruptions in the screening, diagnostics, and treatment of cancer. Indicatively, due to screening interruptions, the number of late-stage diagnoses of particular cancers increased.[13] The incidence and stage of cancer diagnosis varied during the pandemic, according to a number of registry-based analyses. Due to statistics from the Surveillance, Epidemiology, and End Results (SEER-22) registries, the number of new cancer diagnoses in the US in 2020 was 9.4% fewer than anticipated.[14]

In addition to these evolving insights, little research has been done on the relationship between the time of COVID-19 infection and the subsequent diagnosis of cancer, the relative prevalence of different types of cancer in the post-COVID period, and whether or not previous COVID-19 alters the stage of cancer at diagnosis or cancer-specific characteristics. Based on this, the current study intends to determine whether the severity of COVID-19 infection is related to cancer progression, type, and stage of cancer. Also, to ascertain the time between COVID-19 infection and cancer diagnosis in patient subgroups and to compose the distribution of cancer type and stage before and after a reported previous COVID-19 infection.

Materials and Methods

This retrospective observational study was performed during the period from April 2023 to the end of December 2024. Data were collected and reviewed at Madenat El-Elem University using records obtained from national oncology centers and collaborating hospitals in Iraq. The study uses data collected from national oncology centers and hospital records. The dataset included 100 patients diagnosed with various types of malignant tumors who also had a documented history of COVID-19 infection confirmed by PCR during the pandemic period (2020–2022). This study was designed as an exploratory retrospective analysis intended to identify potential patterns rather than establish population-level incidence estimates. Fifty-one of them are male and forty-nine are female. Cases of cancer in the post-COVID period were compared to the national cancer registry data in the Iraqi Ministry of Health (2018) in order to evaluate the possible changes in the patterns of cancer incidence.[15] The institutional ethics committee gave its approval to the study protocol in compliance with the Declaration of Helsinki (2013).

The study parameters underwent analysis by using Statistical Analysis System-SAS (2018). It was measured with both the *T-test* and the least significant difference (*LSD*) to evaluate means. *ANOVA* one way investigate the differences in means among 3 or more groups. *Chi-square* used to analyze correlations among categorical variables. Statistical significance was determined at probability (0.05 and 0.01)

Results

The mean age of patients in the current study was 52.86 ± 17.45, ranging from 17 to 93; 51% (n=51) of the cases were male and 49% (n=49) were female. The majority of patients (57%) were aged between 41 and 70 years. Regarding COVID-19 severity, 58% of patients had moderate infections,

ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202632

19% mild, and 23% severe. Solid tumors constituted 64% of all cases, whereas hematologic malignancies represented 36%. According to the stage distribution, 62% of cancers were classified as Stage I–II, and 38% as Stage III–IV (Table 1).

A comparison of cancer type distribution after COVID-19 infection with the Iraqi Cancer Registry 2018 showed that the proportion of leukemia was 27% and of prostate cancer was 14%. There were increases significantly ($p < 0.001$) compared to 2018 data (6.03% and 3.25%, respectively), while other types of cancers decreased significantly ($p < 0.001$) from 42.87% to 11% (Table 2).

Regarding the relation between severity of COVID-19 and malignancy type, solid tumors were more frequent among moderate and severe cases (60.9% and 281%, respectively), whereas hematologic malignancies predominated in mild infections (33.3%). This association was statistically significant ($p = 0.0199$) (Table 3).

Although the mean interval between COVID-19 infection and cancer diagnosis varied according to tumor type, there were no significant differences in the severity of COVID-19 on it (Table 4).

Analysis of COVID-19 severity and cancer stage showed that advanced stages (III–IV) were more common in patients with severe infection, while early stages (I–II) predominated among mild and moderate cases. The disparity was statistically significant ($p = 0.0017$) (Table 5).

The interval between COVID-19 infection and cancer diagnosis was longer among patients with early cancer stage (I–II) (2.18 ± 0.84 years) compared with those in advanced stage (III–IV) (1.84 ± 0.92 years), showing a significant difference ($p = 0.0321$) (Table 6).

Table 1.Demographic and Clinical Characteristics of Cancer Patients with Previous COVID-19 Infection

Variable	Category	n (%)	Mean ± SD	p-value
Age (years)	--	--	52.86 ± 17.45	--
Age groups	<40	22 (22%)	--	0.1919 NS
	40-59	35 (35%)	--	
	≥60	43 (43%)	--	
Sex	male	51 (51%)	--	0.8875 NS
	female	49 (49%)	--	
Type of Cancer	Hematologic	36 (36%)	--	0.04554 *
	Solid tumors	64 (64%)	--	
Cancer Stage	I–II	62 (62%)	--	0.0873 NS
	III–IV	38 (38%)	--	
COVID-19 severity	Mild	19 (19%)		0.0016 **
	Moderate	58 (58%)		
	Severe	23 (23%)		
Interval between Covid-19 and cancer diagnosis (years)			2.07 ± 0.88	

** (P≤0.01), * (P≤0.05), NS: Non-significant

Table 2.Distribution of Cancer Types Before and After COVID-19 Infection

Cancer type	MOH 2018 (%)	After COVID (%)	Difference %	P-value
Breast	19.7	20	0.3	0.9400 NS
Bronchus & Lung	8.19	5	-3.19	0.2452 NS
Colorectal	6.15	7	0.85	0.7236 NS
Leukemia	6.03	27	20.97	0.0001 **
Urinary Bladder	4.89	7	2.11	0.2846 NS
Brain & CNS tumor	4.89	2	-2.89	0.1807 NS
Lymphoma	4.03	7	2.97	0.1323 NS
Prostate	3.25	14	10.75	0.0013 **

ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202632

Other	42.87	11	-31.87	0.0001 **
Total	100	100	--	--

** (P≤0.01), NS: Non-significant

Table 3.Association between Severity of COVID-19 and Malignancy Type

COVID-19 Severity	Hematologic n (%)	Solid tumor n (%)	P-value
Mild	12 (33.3)	7 (10.9)	0.0199 *
Moderate	18 (50.0)	39 (60.9)	
Severe	6 (16.7)	18 (28.1)	

* (P≤0.05)

Table 4.Time Interval between COVID-19 and Cancer Diagnosis by Severity

COVID-19 Severity	Mean Interval (years)	P-value
Mild	2.2105	0.1167 NS
Moderate	2.1552	
Severe	1.7391	

NS: Non-significant

Table 5.COVID severity vs cancer stage

COVID-19 Severity	Stage I–II n (%)	Stage III–IV n (%)	P-value
Mild	13 (21)	6 (15.8)	0.0017 **
Moderate	42 (67.7)	16 (42.1)	
Severe	7 (11.3)	16 (42.1)	

** (P≤0.01)

Table 6.Comparison of mean COVID–Cancer interval according to cancer stage

Cancer stage	Mean Interval (years) ± SD	P-value
Stage I–II	2.18 ± 0.84	0.0321 *
Stage III–IV	1.84 ± 0.92	

*(P≤0.05)

Discussion

The current study explored potential link between previous SARS-CoV-2 infection and later oncologic characteristics exists. The findings suggest that the pattern and stage of cancer presentation in this group of people may reflect a combination of biological effects, delayed diagnosis, disrupted screening programs, and reduced healthcare access during the pandemic. These results are consistent with global publications demonstrating that immunological sequelae and SARS-CoV-2 infection may modify tumor biology, delay diagnosis, or disrupt host inflammatory responses implicated in carcinogenesis. Therefore, observed differences in the distribution and stage of cancer after COVID-19 could be biologically driven as well as healthcare-related impacts of the pandemic. The observed increase in advanced-stage cancers may partly be explained by delayed cancer screening and interruptions in routine medical services during the COVID-19 pandemic.

According to a number of studies, the median age of post-COVID-19 malignancies was between 50 and 60 years old, suggesting that infection did not significantly alter the beginning of age-related malignancy.[16,17] The nearly equal male-to-female ratio is consistent with estimates from around the world; however, sex-specific fluctuations in certain cancer types were noted, likely reflecting differences in healthcare access and screening patterns rather than true biological variations.[18]

The rise in leukemia and prostate cancer after COVID-19 compared to baseline levels in 2018 is consistent with recent findings by Chatterji et al. (2024) and Lu et al. (2025), who documented a disproportionate rise in hematologic and genitourinary malignancies among patients previously infected with COVID-19.[5,19] Theoretically, endothelial dysfunction, elevated IL-6 and TNF-α, and prolonged immunological activation may produce a pro-oncogenic environment that promotes clonal hematopoiesis and

ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202632

proliferative signaling in prostate tissue.[20,21] The pandemic's reduction in cancer screening probably caused detection to change to instances that were more advanced and symptomatic.[22]

Hematologic cancers were more prevalent in mild infections, whereas solid tumors predominated in moderate and severe COVID-19 patients. This is somewhat different from global data that indicate hematologic malignancies frequently correspond with more severe infection outcomes.[23,24] The difference could be attributed to the time of cancer initiation in relation to infection; patients who acquire hematologic malignancies later might have had milder initial disease because of immune modulation brought on by treatment or incomplete immunological adaptation.

The variation observed in the time between COVID-19 infection and cancer diagnosis may reflect not the acute severity of the infection but rather other underlying immunological and inflammatory processes.[25,26] Prolonged immune dysregulation following SARS-CoV-2 infection, including chronic cytokine elevation, T-cell exhaustion, and oxidative stress, can create a tumor-promoting environment that favors delayed carcinogenic events.[27,28] Comparable mechanisms have been described with respect to other post-viral conditions, such as hepatitis and Epstein–Barr virus infections, in which chronic immune activation contributes to malignant transformation.[29,30] Recent reviews also emphasize that post-COVID-19 immune remodeling and metabolic reprogramming may sustain low-grade inflammation and genomic instability long after viral clearance.[31]

Individuals with severe COVID-19 were substantially more likely to be in advanced stages (III–IV). This correlation might be a result of both biological aggression brought on by inflammatory cytokines that persist and delays in diagnosis during lockdowns.[32] Similar to this, a Japanese multicenter study showed that the pandemic increased the number of late-stage presentations.[33] Through the ongoing activation of the NF-κB and STAT3 pathways, which are both connected to angiogenesis and metastasis, severe infection may hasten the progression of tumors.[34,35]

The average time between getting COVID-19 and being diagnosed with cancer was shorter in people with advanced-stage illness than in those with early-stage illness ($p = 0.0321$). This suggests that an immune imbalance caused by SARS-CoV-2 may speed up the growth of tumors.[36] Common mechanisms linking coronavirus to tumor include cytokine storms, persistent hyperinflammation, viral entry through ACE2/TMPRSS2, and activation of signaling pathways such as IFN-I, androgen receptors, and immune checkpoints.[37] According to experimental evidence, sustained IL-6/STAT3 signaling during infection enhances tumor cell survival and DNA damage tolerance.[38] Therefore, the interval length could reflect the cumulative effect of inflammatory priming and surveillance escape.

Limitations

This study has several constraints, notably the comparatively small sample size and the retrospective observational design. Consequently, the results should be approached with caution and regarded as exploratory rather than evidence of a causal relationship between previous COVID-19 infection and cancer development or progression. Furthermore, The comparison with the Iraqi Cancer Registry was used as a reference framework and should not be interpreted as a direct epidemiological comparison. The observed associations should not be interpreted as evidence that SARS-CoV-2 directly causes de novo cancer development.

Conclusion

This study suggests that previous COVID-19 infection may be associated with differences in cancer progression and presentation patterns. The observed rise in leukemia and prostate cancer among post-COVID-19 cases, together with the association between severe infection and advanced cancer stages, supports the hypothesis that SARS-CoV-2–related immune imbalance, chronic inflammation, and healthcare-related factors may influence cancer presentation and progression. The shorter interval between infection and diagnosis among patients with advanced-stage disease further indicates a possible association between COVID-19 history and cancer characteristics. Continuous monitoring of post-COVID-19 patients, integration of immune and molecular markers into future studies, and maintenance of uninterrupted cancer screening programs are essential to clarify the long-term oncologic implications of SARS-CoV-2.

Authors controbution: M.A. Hadab and J. F. Al-Maadhidi: Conceptualization, Methodology, Investigation. A. B. Al-Asadi: Project administration, Writing – original draft. B.N Al-Nuaimi and M.N. Adbdulghani: Investigation, Validation and Supervision. D. A. Al-Aameri: Writing – review & editing.

Conflict of Interest: None

Source of Funding: None

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ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202632

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