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Cancerous Patients Survival Admitted to Oncology Wards Through COVID-19 Pandemic

Conflict of interest: nothing to declare.

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Abstract _____

Introduction. Patients with cancer are considered a high-risk group for viral pneumonia, with an increased probability of fatal outcome. COVID-19 infection has emerged as a pandemic causing severe pneumonia rendering this vulnerable group at risk of adverse outcomes.

Purpose. To highlight the survival of patients with solid malignancy that were admitted to the infectious unit during the outbreak of COVID-19 in 2021.

Materials and methods. A retrospective cross-sectional study that involved 150 patients with malignancy and COVID-19 infection and was conducted in the oncology center for a period of one year. Data were collected from the oncology center data base and from general hospital isolation unite and COVID-19 infectious center at the Child central hospital.

Results. The mean age of the study sample was 58.7 years with male predominance (62%). Lung cancer was the most common malignancy among the study population (31.3%), followed by breast cancer (20.7%) and prostate cancer (16.7%), approximately 45.3% of patients experienced complications, including acute respiratory distress syndrome (22.7%), sepsis and septic shock (17.3%), and thromboembolism (10%).

Conclusions. The risk of severe mortality among patients with cancer is high compared to normal population. Higher risk is noted when cancer is accompanied with other medical comorbidities and with advanced age.

Keywords: COVID-19, cancer, oncology, lung cancer, breast cancer

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Выживаемость онкологических пациентов, поступивших в онкологические отделения в период пандемии COVID-19

Резюме _____

Введение. Пациенты с онкологическими заболеваниями относятся к группе высокого риска вирусной пневмонии с повышенной вероятностью летального исхода. Инфекция COVID-19 стала пандемией, вызывающей тяжелую пневмонию, что подвергает эту уязвимую группу пациентов риску неблагоприятных исходов.

Цель. Изучить выживаемость пациентов с солидными злокачественными опухолями, поступивших в инфекционное отделение во время вспышки COVID-19 в 2021 г.

Материалы и методы. Ретроспективное перекрестное исследование, включавшее 150 пациентов со злокачественными новообразованиями и инфекцией COVID-19, проводилось в онкологическом центре в течение одного года. Данные были получены из базы данных онкологического центра, а также из изолятора больницы общего профиля и центра инфекции COVID-19 при детской центральной больнице.

Результаты. Средний возраст исследуемой выборки составил 58,7 года с преобладанием мужчин (62%). Рак легких был наиболее распространенной злокачественной опухолью среди исследуемых (31,3%), за ним следовали рак молочной железы (20,7%) и рак предстательной железы (16,7%). Примерно у 45,3% пациентов наблюдались осложнения, включая острый респираторный дистресс-синдром (22,7%), сепсис и септический шок (17,3%) и тромбоэмболию (10%).

Выводы. Риск тяжелой смертности среди пациентов с онкологическими заболеваниями высок по сравнению с обычной популяцией. Более высокий риск отмечается, когда рак сопровождается другими сопутствующими заболеваниями, а также в пожилом возрасте.

Ключевые слова: COVID-19, рак, онкология, рак легкого, рак молочной железы

■ INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a contagious disease caused by the virus SARS-CoV-2. The first known case was identified in Wuhan, China, in December 2019 the disease quickly spread worldwide, resulting in the COVID-19 pandemic [1].

The symptoms of COVID-19 are variable but often include fever, cough, headache, fatigue, breathing difficulties, loss of smell, and loss of taste, Symptoms may begin one to fourteen days after exposure to the virus [2].

COVID-19 transmits when infectious particles are breathed in or come into contact with the eyes, nose, or mouth. The risk is highest when people are in close proximity, but small airborne particles containing the virus can remain suspended in the air and travel over longer distances, particularly indoors. Transmission can also occur when people touch their eyes, nose or mouth after touching surfaces or objects that have been contaminated by the virus. People remain contagious for up to 20 days and can spread the virus even if they do not develop symptoms [3].

Testing methods for COVID-19 to detect the virus's nucleic acid include real-time reverse transcription polymerase chain reaction (RT-PCR), transcription-mediated amplification, and reverse transcription loop-mediated isothermal amplification (RT-LAMP) from a nasopharyngeal swab [4, 5]. Complications may include pneumonia, acute respiratory distress syndrome (ARDS), multi-organ failure, septic shock, and death [6].

COVID-19 can provisionally be diagnosed on the basis of symptoms and confirmed using reverse transcription polymerase chain reaction (RT-PCR) or other nucleic acid testing of infected secretions, along with laboratory testing, chest CT scans may be helpful to diagnose COVID-19 in individuals with a high clinical suspicion of infection [7]. Detection of a past infection is possible with serological tests, which detect antibodies produced by the body in response to the infection [8].

Almost 3–4 percent of all COVID-19 victims have cancer and related diseases, and the numbers are terrifying, as the patient is described as "doubly unlucky" to be suffering from cancer as well as being infected with COVID-19. Cancer patients could be at significant risk for COVID-19, and there seems to be an upsurge in the likelihood of serious conditions, such as ICU usage and artificial ventilation, for them as opposed to non-cancer COVID-19 patients [9].

In the United States, cancer-related mortality rose by 3% during the pandemic era, most likely as a result of delayed diagnoses and inefficient patient care that forces hospitals to treat patients at high risk of contracting COVID-19. According to the retrospective research of two institutes, a positive COVID-19 test caused a delay in the length of cancer therapy. The length of the delays varies depending on a number of factors, including time between test results, a string of positive tests, fear of medical treatment and hospitalization, etc. A total of 131 cancer patients who were infected with COVID required hospitalization, of whom 38% required ICU care, and 7% died [10].

The immunocompromised status of patients is almost certainly the reason for this elevated danger to cancer victims with COVID-19. The lethal combination of COVID-19 and cancer is also being blamed on cytokine storms. Patients with cancer and COVID-19 both have inflammatory responses [11].

Many molecular and biological processes are also reported in patients with cancer, such as a cytokine storm, increased angiotensin-converting enzyme 2 (ACE2) and transmembrane protease serine 2 (TMPRSS2) production, in addition to coagulopathy, which is a potential concern observed in a lot of cancer patients [12].

In respiratory system cells, the increased amount of Anexelekto (AXL) is also reported. It plays an important role in cancers and in COVID-19 as a transmembrane protein that promotes cell growth, migration, aggregation, metastasis, and adhesion [13].

Cancer patient receives many treatments, the bulk of which target the immune system those patients have a greater fatality rate and need for intensive care than healthy people do. Immunosuppression in patients limits the use of live vaccines due to an increased risk of infection. However, immunization is necessary to guard against novel variations [14].

If the patient is commencing chemotherapy, they should allow at least 14 days before the immunization. A patient with blood cancer who is receiving chemotherapy should not be vaccinated until the neutrophils achieve homeostasis [15].

The COVID-19 vaccines are considered efficacious against the majority of viral variants, such as the Delta form. Variants may, nevertheless, promote disease in certain vaccinated persons. The Omicron form, for example, is more pathogenic than the Delta variant and may produce recurrent infections in vaccinated patients. Booster dosages are critical in lowering the chance of a reoccurring illness [16, 17].

Aim of study to highlight the outcome of COVID-19 infection on patients with solid malignancy that were admitted to the infectious unit at Al-Sadder teaching hospital during the outbreak in 2021.

■ MATERIALS AND METHODS

Study design

A retrospective cross-sectional study was conducted in the oncology center for a period of one year from February 2023 till February 2024 after approval of the research proposal was gained by the Arab Board of health specializations / Local Council of medicine / Iraq.

Data was collected retrospectively from the oncology center data base and from Al-Sadder general hospital isolation unite and COVID-19 infectious center at the Child central hospital during the year 2021.

Inclusion criteria

1. Adult patients who were diagnosed with malignancy and registered in Missan oncology center.
2. Have received treatment for cancer at the center wither completed or on treatment.
3. Diagnosed with COVID-19 infection and the infection was confirmed with a positive nasopharyngeal swap PCR test.

Exclusion criteria

1. Pediatric age group.
2. Patients with hematological malignancies.
3. Incomplete data and loss of follow up.

The study included a sample of 150 patients that were diagnosed with malignancy and signed in the oncology center data base and then encountered COVID-19 infection during the infection era during 2021, while taking treatment for their malignancy or during follow up, the patients with suspected infection were referred to general hospital central laboratory for further investigations, patients without positive swap after crossing the information with PCR results were excluded from the study.

Data collection

After crossing data from the center with the hospital laboratory data the researcher followed the confirmed cases by obtaining information from their related files.Data is transported from each patient file into a prepared paper form (questionnaire) that was prepared by the researcher and included the following:

1. Patients demographic data of Age, Gender, Smoking history and body mass index.
2. Past medical history: history of associated comorbidities including: hypertension, diabetes, ischemic heart disease, CVA, thyroid disease, Asthma, chronic renal failure and others.
3. Type of malignancy and cancer treatment history.
4. Chief complain during COVID-19 infection and associated symptoms.

After that the patient is followed by the hospital record to determine the severity of infection, if the patient is discharged home with suppurative treatment the case is labeled as mild, if there is evidence of viral pneumonia on chest CT scan without the need for hospital admission or oxygen therapy the case is labels as moderate, and if the patient has been admitted to the isolation ward at general hospital or the infectious center at the Child central the case is labeled as sever, and if the patient has developed complication or required intubation and admission to the RCU the case is labeled as critical. Severe and critical cases are followed to determine the final outcome of the infection (improved, died) and the associated complications, confirmation of the final outcome of the infection is done either through future follow up at the oncology center or through phone calls.

Statistical Analysis

Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) for Microsoft Windows® version 27 software was used for the statistical analysis of data. Data were presented in simple measures of frequency, percentage, mean and SD and illustrated as tablets and figures. The significance of difference of different means were tested using Students-t-test, chi-square test was used for the assessment of different categorical data. Statistical significance was considered whenever the P value was <0.05 [18–22].

■ RESULTS

Their mean age was 58.7±20.1 years, ranging from 38 years to 82 years. Males represent 62% of patients, while females represent 38%. Most of the study sample patients are non-smokers (53.4%), 11 patients are still actively smoking (7.3%) and 59 patients had quit smoking (39.3%). The mean study sample BMI was 78.4±23.7 kg/m², 18 patients were underweighting (12%) with a BMI <18.5 kg/m², 72 patients had a normal BMI of 18.5–24 kg/m² (48%), 55 patients (36.7%) were overweight with a BMI of 25–30 kg/m² and 5 patients (3.3%) were obese with a BMI of >30 kg/m² (Table 1).

Lung cancer was the most common type of malignancy among the study sample patients representing 31.3% with 47 patients followed by breast cancer with 31 patients (20.7%), prostate cancer 25 patients (16.7%), colon cancer 16 patients (10.7%), ovarian cancer 10 patients (6.6%), cervix with 9 patients (6%), pancreatic cancer 7 patients (4.7%), osteosarcoma 3 patients (2%) and brain malignancies with two patients (1.3%) (Table 2).

The infection was complicated in 68 patients (45.3%), acute respiratory distress syndrome (ARDS) happened for 34 patients (22.7%), sepsis and septic shock in 26 patients, thromboembolism in 15 patients (10%), multi organ dysfunction in 13 patients (8.7%),

Table 1
Demographic characteristics of the study sample (n=150)

	No.	%
Age (years)		
Mean ± SD	58.7±20.1	
Range	38–82	
Gender		
Males	93	62
Females	57	38
Smoking		
Active	11	7.3
X smoker	59	39.3
Non smoker	80	53.4
BMI (kg/m²)		
Underweight	18	12
Normal	72	48
Overweight	55	36.7
Obese	5	3.3
Mean±SD	78.4±23.7	

Table 2
Distribution of malignancies among the study sample patients

Cancer type	No.	%
Lung	47	31.3
Breast	31	20.7
Prostate	25	16.7
Colon	16	10.7
Ovarian	10	6.6
Cervical	9	6
Pancreatic	7	4.7
Osteosarcoma	3	2
Brain	2	1.3

Table 3
COVID-19 infection associated complication

Complications	No.	%
No	82	54.7
Yes	68	45.3
Acute respiratory distress syndrome	34	22.7
Sepsis and septic shock	26	17.3
Thromboembolism	15	10
Multiple organ dysfunction syndrome	13	8.7
Myocardial injury	6	4
Renal insufficiency	4	2.7
Liver injury	2	1.3

Note: * a patient may have one or more complication.

Table 4
Correlations between the patients' medical and oncological history with COVID-19 infection outcome

Variable		Total	Improved	Died	P value
Cancer type	Lung	47	35 (74.5)	12(25.5)	0.177
	Breast	31	24 (77.4)	7 (22.6)	
	Prostate	25	20 (80)	5 (20)	
	Colon	16	13 (81.2)	3 (18.8)	
	Ovarian	10	8 (80)	2 (20)	
	Cervical	9	7 (77.8)	2 (22.2)	
	Pancreatic	7	6 (85.7)	1 (14.3)	
	Osteosarcoma	3	3 (100)	0	
	Brain	2	2 (100)	0	
	No	56	47 (83.9)	9 (16.1)	
Comorbidities	Yes	94	71 (75.5)	23 24.5)	0.017

acute myocardial infarction in 6 patients (4%), acute renal failure in 4 patients (2.7%) and acute hepatic injury in 2 patients (1.3%). 82 patients (54.7%) passed the infection without significant complications (Table 3).

There was no statistical correlation between the type of malignancy and COVID-19 infection mortality at the alpha level of 0.05 (P=0.177), while the mortality rate raises from (16.1%) to (24.5%) if the patient has an associated chronic illness beside malignancy with significant correlation (P=0.017) (Table 4).

■ DISCUSSION

The current study involved 150 patients with malignancy and COVID-19 infection, the results show that their mean age was 58.7±20.1 years, Males represent 62% of the study sample with 93 patients, while females represent 38% with 57 patients, Studies have shown variations in age distribution, with some reporting similar mean ages to the provided study (around late 50s to early 60s), while others may have different age ranges or mean ages. Gender distribution may also vary across studies, with some showing a higher proportion of male patients, while others may have a more balanced distribution.

A study by Liang et al. in China 2020 collected the data of 1590 COVID-19 cases with a history of cancer and concluded that patients with cancer were observed to have a higher risk of severe events and higher mortality, older age was the only risk factor for severe events (OR 1,43, 95% CI 0,97–2,12; p=0,072), the study by Liang et al. observed a similar mean age among cancer patients with COVID-19 (mean age = 53.3), with a range comparable to the current study results. Additionally, the gender distribution in both studies aligns closely, with a slightly higher proportion of male patients [23].

The current study results show that lung cancer was the most common type of malignancy followed by breast cancer, prostate cancer, colon cancer, ovarian cancer, carcinoma of the cervix, pancreatic cancer, osteosarcoma and brain malignancies. Comparing the distribution of malignancies across studies may reveal variations in the prevalence of different cancer types. For example, some studies might show lung cancer as the most common, while others might highlight different types such as breast or prostate cancer.

Miyashita et al. study in (2020) analyzed the data of A total of 5688 patients had COVID-19, and there were 334 patients (6%) with cancer among them, lung cancer was the most common type followed by breast cancer, they also reported higher complications rate including ARDS, sepsis, and thromboembolism among patients with solid malignancies and COVID-19, offering insights that can be compared with the complications of the current study [24].

Complications such as acute respiratory distress syndrome (ARDS), sepsis, thromboembolism, and multi-organ dysfunction syndrome (MODS) are frequently observed among patients with malignancy and COVID-19. However, the frequencies of these complications may vary among different patient populations, a study by Gupta K et al. which examined the frequencies of complications such as acute respiratory distress syndrome (ARDS), sepsis, and thromboembolism among patients with cancers and COVID-19 also showed similar results to the current study results [25].

By comparing the mortality rates reported in the provided results with those from Lee et al. (2020) and Dai et al. (2020), we can observe variations in mortality rates among cancer patients with COVID-19 across different studies. The current study results indicate that there was no statistically significant correlation between the type of malignancy and COVID-19 infection mortality (P=0.177). This suggests that the specific type of cancer did not independently predict mortality in cancer patients with COVID-19 in the studied population.

Comparison with Other Studies Moon SS al. also investigated the relationship between cancer type and mortality in their multicenter cohort study. Their findings may have similarly shown that cancer type is not a significant predictor of mortality in cancer patients with COVID-19 [26].

Additional studies, such as those by Garassino et al. [27] and Dai et al. [9], have also explored this relationship and found no independent association between cancer type and COVID-19 mortality.

The lack of association between cancer type and mortality suggests that clinicians should not prioritize specific cancer types over others when assessing mortality risk in cancer patients with COVID-19.

Several studies conducted by authors in Iraq discussed epidemiology of different cancer types like breast, colon, rectum and sarcoma [28–35] and not dealt with COVID-19.

■ CONCLUSIONS

Lung cancer is the most common malignancy among the study population, followed by breast cancer and prostate cancer. Approximately half of patients experienced complications, including acute respiratory distress syndrome, sepsis and septic shock and thromboembolism. There are no statistical correlation between the type of malignancy and COVID-19 infection mortality.

■ REFERENCES

1. Page J, Hinshaw D, McKay B. In Hunt for COVID-19 Origin, Patient Zero Points to Second Wuhan Market. WSJ. The Wall Street Journal. Retrieved 27 February 2021.
2. Agyeman AA, Chin KL, Landersdorfer CB, et al. Smell and taste dysfunction in patients with COVID-19: a systematic review and meta-analysis. *InMayo Clinic Proceedings.* 2020 Aug 1;95(8):1621–1631. Elsevier.
3. Coronavirus disease (COVID-19): How is it transmitted? www.who.int. Retrieved 13 April 2023.

4. Overview of Testing for SARS-CoV-2, the virus that causes COVID-19. U.S. Centers for Disease Control and Prevention (CDC). 11 February 2020. Retrieved 31 July 2022.

5. Filchakova O, Dossym D, Ilyas A., et al. Review of COVID-19 testing and diagnostic methods. *Talanta*. 2022 Jul 1;244:123409.

6. Heymann DL, Shindo N. COVID-19: what is next for public health? *The Lancet*. 2020 Feb 22;395(10224):542–5.

7. Ai T, Yang Z, Hou H, et al. Correlation of chest CT and RT-PCR testing for coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. *Radiology*. 2020 Aug;296(2):E32–40.

8. Li C, Zhao C, Bao J, et al. Laboratory diagnosis of coronavirus disease-2019 (COVID-19). *Clinica Chimica Acta*. 2020 Nov 1;510:35–46.

9. Dai M, Liu D, Liu M, et al. Patients with cancer appear more vulnerable to SARS-CoV-2: a multicenter study during the COVID-19 outbreak. *Cancer discovery*. 2020 Jun 1;10(6):783–91.

10. Wu JT, Kwon DH, Glover MJ, et al. Changes in cancer management due to COVID-19 illness in patients with cancer in Northern California. *JCO Oncology Practice*. 2021 Mar;17(3):e377–85.

11. Saptarshi S, Kundu CN. Cancer and COVID-19: Why are cancer patients more susceptible to COVID-19? *Medical Oncology*. 2021 Sep 1;38(9).

12. Farahani M, Niknam Z, Amirabad LM, et al. Molecular pathways involved in COVID-19 and potential pathway-based therapeutic targets. *Biomedicine & Pharmacotherapy*. 2022 Jan 1;145:112420.

13. Zhang WN, Li XP, Wang PF, et al. Comprehensive analysis of the novel omicron receptor AXL in cancers. *Computational and Structural Biotechnology Journal*. 2022 Jan 1;20:3304–12.

14. Chavda VP, Ping FF, Chen ZS. An impact of COVID-19 on cancer care: an update. *Vaccines*. 2022 Dec 4;10(12):2072.

15. Gundavda MK, Gundavda KK. Cancer or COVID-19? A review of recommendations for COVID-19 vaccination in cancer patients. *Current Treatment Options in Oncology*. 2021 Oct;22:1–9.

16. Chavda VP, Apostolopoulos V. Is booster dose strategy sufficient for omicron variant of SARS-CoV-2? *Vaccines*. 2022 Feb 26;10(3):367.

17. Chavda VP, Apostolopoulos V. Global impact of delta plus variant and vaccination. *Expert Review of Vaccines*. 2022 May 4;21(5):597–600.

18. Radi IA, Al-Hashimi O, Ameen NA, et al. Phytochemical effects of soy isoflavones consumption on urinary estrogen levels in premenopausal and postmenopausal women with breast cancer. *Romanian Journal of Diabetes, Nutrition and Metabolic Diseases*. 2023;30(2):222–230.

19. Jabber IA, Abdullah AS, Alhilfi HSQ. Phytochemical effects of soy isoflavones consumption on vitamin D and calcium levels in pre and postmenopausal women with hormone positive HER2 neu negative breast cancer. *Oncology and Radiotherapy*, 2022;16(9):1–7.

20. Alhilfi HSQ. Misanian Men, are or aren't a Prostatic Adenocarcinoma? *ASM Science Journal*. 2021;14:1–4.

21. Al-Yassiry MM, Aloraibi FK, Alhilfi HSQ. Teaching-learning styles & aids student's preferences among first year undergraduate medical students in the college of medicine, university of Missan, Iraq. *Indian Journal of Forensic Medicine and Toxicology*. 2021;15(1):1346–1353.

22. Alhilfi HSQ, Almohammadawi KOM, Alsaad RKA, et al. Colorectal cancer epidemiology and clinical study in Misan. *J Coloproctol (RIO J)*. 2019;9:159–62.

23. Liang W, Guan W, Chen R, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *The Lancet Oncology*. 2020 Mar 1;21(3):335–7.

24. Miyashita H, Mikami T, Chopra N, et al. Do patients with cancer have a poorer prognosis of COVID-19? An experience in New York City. *Annals of Oncology*. 2020 Aug 1;31(8):1088–9.

25. Gupta K, Gandhi S, Mebane III A, et al. Cancer patients and COVID-19: Mortality, serious complications, biomarkers, and ways forward. *Cancer Treatment and Research Communications*. 2021 Jan 1;26:100285.

26. Moon SS, Lee K, Park J, et al. Clinical characteristics and mortality predictors of COVID-19 patients hospitalized at nationally- designated treatment hospitals. *Journal of Korean Medical Science*. 2020 Sep 9;35(36).

27. Garassino MC, Whisenant JG, Huang LC, et al. COVID-19 in patients with thoracic malignancies (TERAVOLT): first results of an international, registry-based, cohort study. *The Lancet Oncology*. 2020 Jul 1;21(7):914–22.

28. Alshewered AS, Al-Naqqash MA. Rectal cancer and chemoradiation in Iraq: systematic review and meta-analysis. *Journal of Coloproctology*. 2019;39(4):309–318.

29. Lazim QJ, Al-Bdaer EK, Mohammed HH, et al. Diagnosis of merkel cell carcinoma at chronic venous ulcer: Case report. *Oncology and Radiotherapy*. 2020;14(2):1–4.

30. Alwan AF, Al-Naqqash MA, Al-Nuami HSA, et al. Assessment of dose-volume histogram statistics using three-dimensional conformal techniques in breast cancer adjuvant radiotherapy treatment. *Precision Radiation Oncology*. 2022;6(3):225–233.

31. Al-Rawi SAI, Abouelenein H, Nagdy ME, et al. Assessment of dose gradient index variation during simultaneously integrated boost intensity-modulated radiation therapy for head and neck cancer patients. *Precision Radiation Oncology*. 2022;6(3):216–224.

32. Alashoor MF, Al-Maliki HSK, Al-Khalidy KFA, Alshewered AS. Glioblastoma multiform prognosis beyond craniotomy and chemo irradiation. *Oncology and Radiotherapy*, 2022;16(2):38–41.

33. Mohammed Alrubai AM, Al-Naqqash MA, Alshewered AS. Epidemiological and prognostic single center study of anal carcinoma. *Journal of Coloproctology*. 2020;40(3):202–208.

34. Alrubai AMM, Al-Jassani HMA, Alsaymaree SMR, Alshewered AS. Dermatological sequel of adjuvant breast cancer radiotherapy in Iraqi women. *Oncology and Radiotherapy*, 2020;14(6):1–7.

35. Alshewered A, Kadhim S.A. Evaluation of Colon Cancer Incidence Rates for the Years 2016-2021, Najaf/Iraq: A Study of Risk Assessment. *Surgery, Gastroenterology and Oncology*. 2024;28:s19–s23.