

Utilization and Effectiveness of the CA 19-9 Test for Cancer Diagnosis: Insights from Health Ministry Records

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ABSTRACT

Introduction: This retrospective study evaluated the use and findings of the CA 19-9 test in the diagnosis of pancreatic cancer.

Methods: The study analyzed data from a large population of 2,981,142 individuals who underwent CA 19-9 testing between 2017 and 2021. The number of tests performed, test rates per 100,000 population, and 25,808,137 test results were assessed. The study also investigated the association between CA 19-9 levels and cancer diagnoses.

Results: The study found that CA 19-9 was a widely used tumor marker for pancreatic cancer diagnosis. However, it was noted that the test had limitations as a standalone diagnostic tool. In the analyzed population, the test results showed elevated CA 19-9 levels in more than 80% of patients diagnosed with pancreatic cancer. The study also observed variations in test use and outcomes across different age groups, genders and regions.

Conclusion: Our findings highlight the significance of the CA 19-9 test in the diagnosis of pancreatic cancer. However, it is crucial to consider the limitations of using CA 19-9 as a standalone test and incorporate it into a comprehensive diagnostic approach involving other clinical and laboratory methods. Further multicenter and prospective studies are warranted to better understand the accuracy and effectiveness of the CA 19-9 test in pancreatic cancer diagnosis.

Keywords: CA 19-9, pancreatic cancer, tumor marker, diagnosis

Introduction

CA 19-9 is a tumor marker used in the diagnosis and treatment of cancer. Tumor markers are substances produced or secreted by cancer cells in the body and they assist in the diagnosis, staging and monitoring of treatment response in cancer. CA 19-9 is particularly a widely used marker in pancreatic cancer and bile duct cancer.

CA 19-9, also known as carbohydrate antigen 19-9, is a type of glycoprotein found on the cell surface. It is normally present at low levels in certain tissues (such as the pancreas, bile ducts, and intestines). However, cancer cells can produce this marker in excessive amounts, leading to its release into the bloodstream and detection at high levels (1).

The CA 19-9 tumor marker is used primarily in the diagnosis of certain cancer types, especially pancreatic cancer. Pancreatic cancer often does not present symptoms in its early stages, making it challenging to diagnose. CA 19-9 levels can provide a clue to the presence or progression of tumors like pancreatic cancer. Additionally, it can be used to monitor the response to treatment and assess the likelihood of disease recurrence.

However, it is important to note that CA 19-9 alone is not sufficient as a diagnostic tool or cancer screening test. Elevated CA 19-9 levels can also occur due to other reasons. Therefore, CA 19-9 results should be interpreted in conjunction with other medical imaging tests and clinical evaluations. CA 19-9 is a cell surface glycoprotein produced by epithelial ductal cells in the pancreas, bile system, stomach, colon, uterus, and salivary glands. Its expression requires the presence of Lewis blood group antigens. Therefore, it is not a reliable marker for individuals with Lewis-negative phenotype (approximately 5-10% of the population) (2).

In addition to being excessively expressed in many benign and malignant gastrointestinal and extragastrointestinal tumors, CA 19-9 can also be positive in pancreatitis, pancreatic cysts, diabetes mellitus, liver cirrhosis, benign cholestatic diseases, and urological, pulmonary, and gynecological diseases (3).

CA 19-9 is a widely used tumor marker in the diagnosis of pancreatic ductal adenocarcinoma. Pancreatic cancer has a less than 7% 5-year survival rate and is the fourth most common cause of cancer-related deaths (4).



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CA 19-9 has been found to be elevated in more than 80% of patients diagnosed with pancreatic cancer. However, most international guidelines recommend using CA 19-9 in conjunction with the gold standard diagnostic method, pancreatic protocol CT, rather than relying on it alone (5). In benign pancreatic diseases such as pancreatitis and premalignant lesions such as intraductal papillary mucinous neoplasm, CA 19-9 can also be elevated in levels ranging from 10% to 50%. Therefore, it is not recommended to use CA 19-9 as a standalone test for diagnosing pancreatic cancer (6).

Despite these findings, once the diagnosis of pancreatic cancer is confirmed, CA 19-9 levels are crucial in determining appropriate staging and treatment regimens. Preoperative CA 19-9 levels are associated with prognosis.

CA 19-9 is a tumor marker that assists in the diagnosis and treatment of cancer. It is used in the diagnosis of certain cancer types, such as pancreatic cancer, and in monitoring the treatment response. However, CA 19-9 results should be interpreted alongside other medical findings and should not be used solely to establish a definitive diagnosis. The aim of this study was to investigate the diagnostic and prognostic value of CA 19-9 tumor marker levels in pancreatic cancer patients, while also assessing its potential utility in differentiating pancreatic malignancies from benign pancreatic diseases.

Methods

Data from a five-year period (2017-2021) were analyzed, including a total of 25,808,137 tests from 2,981,142 individuals. The test counts, test rates per population, and rates of exceeding the reference range were assessed based on gender, age groups, geographic regions, and healthcare institution types.

The CA 19-9 levels were determined using the immunoassay method and the results were transferred to the National Health Database, which is referred to as e-nabiz by the Ministry of Health. This database encompasses the health records of patients who have sought medical services from all healthcare institutions in Turkey, including their demographic characteristics, laboratory data, medication usage, comorbidities, and other health-related records.

The healthcare database service in Turkey is referred to as e-nabiz. The transmission of health data set packages is facilitated through XML web services. This database encompasses the health records of patients who have sought medical services from all public, private and university healthcare institutions in Turkey, including their demographic characteristics, laboratory data, medication usage, comorbidities, and other health-related records.

Ethical Considerations

The study adhered to ethical guidelines and protected the privacy and confidentiality of the individuals included in the data. University of Health Sciences Turkey, İstanbul Training and Research Hospital Institutional review board approval was obtained (approval number: 188, date: 21.07.2023), and all data were anonymized to ensure privacy.

Statistical Analysis

Descriptive statistics were used to analyze the data. The test counts, test rates per population, rates of exceeding the reference range, and cancer diagnosis rates were calculated and compared across different variables, including gender, age groups, geographic regions, and healthcare institution types.

Database and e-Pulse

e-Pulse is a platform developed by the Ministry of Health in Turkey that allows individuals to store and manage their health information digitally. For this study, patient information and health records were collected from the e-Pulse system. During the data collection process, personal information was protected and the principle of privacy was fully respected.

SKRS and ICD codes

SKRS is a data recording and reporting system used by the Ministry of Health in Turkey. This system aids in the more effective management of health services. In this study, data pulled from the SKRS, and ICD codes were used to analyze disease diagnoses, treatment plans, and the overall state of health services.

ICD codes are a standard disease and health problem classification system created by the World Health Organization and used worldwide. These codes are an important tool for identifying, monitoring, and treating diseases.

Data collection: Data were collected from medical records and laboratory databases. The information included demographics (gender, age), test requests, test results, cancer diagnoses, and healthcare institution types.

The study population: The study population consisted of individuals who underwent CA 19-9 testing during the study period. Both men and women were included in the analysis.

Results

Between 2017 and 2021, CA 19-9 tests were requested from 4,018,913 individuals, with a total of 25,808,137 tests performed. This corresponds to an average of 6.42 tests per person, or 31,230 tests per 100,000 population. Among the tumor markers used in our CA 19-9 study, it ranks second in terms of tests performed per 100,000 population.

When comparing the number of CA 19-9 tests over the years, there is an increasing trend in the number of tests and tests per 100,000 population from 2017 to 2019. However, there is a significant decrease in test numbers in 2020 and 2021 (Table 1).

In females, the number of test requests shows a similar pattern to the general population, with an increasing trend from 2017 to 2019 and a significant decrease in 2020 and 2021. Throughout the years, CA 19-9 ranks fourth among tumor markers tested in females. In males, there is also an increasing trend in test requests from 2017 to 2019, followed by a notable decrease in 2020 and 2021. When comparing the ratio of female-to-male test requests, the ratio was 1.94 in 2017, 1.93 in 2018, 1.91 in 2019, 1.77 in 2020 and 1.84 in 2021 (Table 2).

Table 1. Number of tests and the ratio of the population by years

	2017		2018		2019		2020		2021	
	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population
CA 19-9	4,944,869	6,119	5,629,873	6,865	6,168,998	7,419	4,374,951	5,232	4,689,446	5,608

Table 2. Number of test requests by years

Women										
Year	2017		2018		2019		2020		2021	
	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population
CA 19-9	3,267,947	8,114	3,710,145	9,079	4,053,869	9,784	2,800,616	6,716	3,039,855	7,290
Men										
Year	2017		2018		2019		2020		2021	
	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population	Number of tests	Number of tests per 100,000 population
CA 19-9	1,676,922	4,137	1,919,728	4,666	2,115,125	5,070	1,574,335	3,756	1,649,591	3,935

Table 3. Number of test requests by years in age groups

CA	2017			2018			2019			2020			2021		
	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+
19-9	52,631	3,510,673	1,381,565	55,070	3,981,668	1,593,132	56,853	4,314,922	1,797,221	31,943	3,059,942	1,283,061	30,899	3,231,224	1,427,323
	2017			2018			2019			2020			2021		
	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+
	230	6,879	20,036	240	7,672	22,169	249	8,183	23,802	140	5,783	16,132	136	6,107	17,946

Test consumption per 100,000 persons by years and age groups

Regarding age groups, CA 19-9 is most frequently requested in the 18-64 age range, followed by the 65 and older age groups, and it is least frequently requested in the 0-17 age group. The ratio of test requests between the 18-64 age group and the 65 and older age group was 2.54 in 2017, 2.49 in 2018, 2.40 in 2019, 2.38 in 2020, and 2.26 in 2021.

The rate of test consumption per 100,000 population between the 18-64 age group and the 65 and older age group was 1/2.91 in 2017, 1/2.88 in 2018, 1/2.90 in 2019, 1/2.78 in 2020 and 1/2.93 in 2021. Among the 65 and older age groups, CA 19-9 ranks as the third highest tumor marker in test consumption per 100,000 population. From 2017 to 2019, test requests increased across all age groups, followed by a significant decrease in 2020 and 2021 (Table 3).

When comparing the rates of cancer diagnosis at any given time for individuals who underwent CA 19-9 testing, the rate of cancer detection increased as the years progressed, with 28% of individuals diagnosed with cancer in 2017, 38% in 2020, and 33% in 2021. Among individuals tested for tumor markers, CA 19-9 ranks fifth in terms of the percentage of cancer diagnoses in 2017-2019 and fourth in 2020-2021.

Analyzing the timing of test requests in relation to the diagnosis, it is observed that in all years, a higher proportion of tests were requested

before the diagnosis, followed by tests requested simultaneously with the diagnosis, and the least number of tests requested after the diagnosis. The ratio of test requests before diagnosis/simultaneous with diagnosis/after diagnosis was 1.95/1.60/1 in 2017, 4.14/1.32/1 in 2018, 6/1.37/1 in 2019, 8.55/1.71/1 in 2020, and 13.2/2.44/1 in 2021.

In 2017, 8.43% of individuals who underwent CA 19-9 testing received a cancer diagnosis associated with CA 19-9, while 30.69% received a cancer diagnosis not associated with CA 19-9. Until 2020, these percentages increased, with 16.60% of patients receiving a CA 19-9 associated cancer diagnosis and 42.22% receiving a cancer diagnosis not associated with CA 19-9. In 2021, these percentages were 10.76 and 39.21%, respectively. When comparing individuals diagnosed with CA 19-9 associated cancer and those diagnosed with non-CA 19-9 associated cancer, the ratio was 1/3.64 in 2017, 1/3.66 in 2018, 1/3.67 in 2019, 1/3.63 in 2020, and 1/3.64 in 2021 (Table 4).

In terms of test requests by geographic regions, the Marmara region had the highest number of CA 19-9 tests throughout the years. The Central Anatolia region ranked second with a ratio of 1.69 compared to the Marmara region in 2021. The lowest test request rate was observed in the Southeast Anatolia region, with a ratio of 11.81 compared to the

Marmara region. Similar to the overall trend in Turkey, there was an increase in test requests from 2017 to 2019 across all regions, followed by a notable decrease in 2020 and 2021 (Table 5).

When examining the number of tests per 100,000 population by cities, Istanbul had the highest number of test requests in all years, followed by Ankara. Izmir and Bursa ranked third and fourth, respectively. When

analyzing the number of tests per 100,000 population, Sinop had the highest rate in 2017, Erzurum in 2018, Kırşehir in 2019, Isparta in 2020, and Karabük in 2021. Istanbul, Ankara, and Izmir, the top three cities with the highest number of test requests, were not among the top seven cities with the highest rate of tests per 100,000 population.

Comparing the clinics based on the number of test requests, in 2020, the medical oncology clinic had the highest number of test requests, whereas in other years, it was the internal medicine clinic. The second-highest number of test requests in 2020 was from the internal medicine clinic, and in other years, it was from the obstetrics and gynecology clinic. In 2017, medical oncology ranked fourth, in 2018-2019 it ranked third, in 2020 it was first, and in 2021 it ranked second. Family medicine ranked seventh in 2017 and 2018, sixth in 2019, seventh in 2020, and sixth in 2021. The emergency medicine clinic consistently ranked eighth in all years (Table 6).

Table 4. Distribution of cancer diagnosis related to CA 19-9

Year	Related cancer diagnosis		Non-related cancer diagnosis		Total number of people tested
	Number	Percentage	Number	Percentage	
2017	85,579	8.43%	311,759	30.69%	1,015,684
2018	100,048	8.69%	367,152	31.89%	1,151,453
2019	109,558	8.88%	402,246	32.61%	1,233,576
2020	102,848	11.60%	374,276	42.22%	886,560
2021	103,821	10.76%	378,276	39.21%	964,696

Table 5. CA 19-9 geographical distribution by years and number of test requests

Region	Number of tests, 2017	Region	Number of tests, 2018	Region	Number of tests, 2019	Region	Number of tests, 2020	Region	Number of tests, 2021
Marmara region	1,814,418	Marmara region	2,024,210	Marmara region	2,232,971	Marmara region	1,602,414	Marmara region	1,701,631
Central Anatolia region	863,701	Central Anatolia region	1,053,762	Central Anatolia region	1,236,213	Central Anatolia region	898,203	Central Anatolia region	1,003,159
Aegean region	712,908	Aegean region	767,383	Aegean region	841,814	Aegean region	633,179	Aegean region	674,803
Black sea region	479,400	Black sea region	553,447	Mediterranean region	616,861	Mediterranean region	421,600	Mediterranean region	433,103
Eastern Anatolia region	446,903	Mediterranean region	540,429	Black sea region	556,862	Black sea region	387,036	Black sea region	422,987
Mediterranean region	417,829	Eastern Anatolia region	450,477	Eastern Anatolia region	448,581	Eastern Anatolia region	284,308	Eastern Anatolia region	309,750
Southeast Anatolia region	209,710	Southeast Anatolia region	240,162	Southeast Anatolia region	235,676	Southeast Anatolia region	148,140	Southeast Anatolia region	143,967

Table 6. CA 19-9 top 10 clinics by years and number of test requests

2017		2018		2019		2020		2021	
Internal medicine	1,169,349	Internal medicine	1,291,526	Internal medicine	1,362,180	Medical oncology	905,912	Internal medicine	988,546
Gynecology and obstetrics	1,034,700	Gynecology and obstetrics	1,165,524	Gynecology and obstetrics	1,232,161	Internal medicine	850,350	Medical oncology	860,051
General surgery	633,224	Medical oncology	775,934	Medical oncology	923,263	Gynecology and obstetrics	798,103	Gynecology and obstetrics	832,797
Medical oncology	638,285	General surgery	697,597	General surgery	701,112	General surgery	471,606	General surgery	493,896
Gastroenterology	326,143	Gastroenterology	374,140	Gastroenterology	374,381	Gastroenterology	288,781	Gastroenterology	326,140
Radiation oncology	148,820	Radiation oncology	174,606	Family medicine	203,648	Radiation oncology	111,698	Family medicine	130,095
Family medicine	131,158	Family medicine	169,700	Radiation oncology	181,935	Family medicine	111,675	Radiation oncology	110,971
Emergency medicine	85,613	Emergency medicine	94,579	Emergency medicine	130,913	Emergency medicine	104,800	Emergency medicine	98,428
Chest medicine	63,870	Neurology	72,895	Gynecological oncology surgery	92,246	Gynecological oncology surgery	70,571	Gynecological oncology surgery	87,855
Urology	61,921	Urology	69,979	Neurology	87,209	Neurology	61,290	Neurology	71,451

When examining the diagnoses entered in the test application, “abdominal pain unspecified” was the most frequently entered diagnosis in 2017-2018, followed by “unspecified diagnosis,” and in 2019-2021, the most frequently entered diagnosis was “vitamin D deficiency, unspecified.” In the five-year period, “vitamin D deficiency, unspecified” was the most frequently entered diagnosis, followed by “abdominal pain, unspecified” and “essential (primary) hypertension” ranked third.

Regarding the rates of exceeding the reference range of the test, the highest rate was in 2020 at 13.23% and the lowest rate was in 2018 at 10.39%. When comparing the rates of exceeding the reference range by healthcare facility level, the highest rate of 12.75% was observed in tertiary level hospitals, followed by 9.95% in secondary level hospitals, and the lowest rate of 4.87% in primary care facilities. Analyzing the rates of exceeding the reference range by healthcare facility type, the overall rate was 11.56%, with the highest rate of 14.70% in university hospitals, followed by 13.94% in private healthcare institutions, and 9.73% in public hospitals.

When examining the rates of exceeding the reference range by geographical regions, the highest rate of 13.5% was observed in the Mediterranean region, which ranked second in the number of test requests and tests per 100,000 population throughout 2019-2021. The Ege region ranked second with a rate of 12.4%, and the lowest rate of 10.1% was observed in the Eastern Anatolia region. When comparing the rates of exceeding the reference range by gender, the overall rate was 11.53%, with a higher rate of 14.87% in males and a lower rate of 9.62% in females. Analyzing the rates of exceeding the reference range by age groups, the highest rate of 16.66% was observed in the 65 and older age group, followed by 9.31% in the 18-64 age group, and 8.86% in the 0-17 age group. When comparing age groups, the ratio of positive results was calculated as 1.88/1.05/1. Regarding the rates of exceeding the reference range by admission status, the highest rate of 21.31% was observed in inpatient cases, followed by 12.01% in outpatient cases, and 10.59% in day cases. When comparing the rates, the ratio was calculated as 2.01/1.13/1. When examining the rates of exceeding the reference range based on cancer diagnosis, a total of 11.57% of individuals tested positive, with 19.58% of them having a cancer diagnosis and 6.92% not having a cancer diagnosis.

When analyzing the rates of exceeding the reference range by the clinics that requested the test, the highest rate of 21.69% was observed in the medical oncology clinic, followed by 16.98% in the emergency medicine clinic, and 15.54% in the gastroenterology clinic. Among the clinics with the highest number of test requests in 2017-2019, the internal medicine clinic had a rate of 7.75%, and in 2020-2021, the medical oncology clinic had the highest rate of 21.69%, ranking first. The obstetrics and gynecology clinic, which ranked second in 2017-2019, had a rate of 6.38%. Family medicine had a rate of 4.79%.

When examining the distribution of test costs over the years, in 2017 the total cost was 39,558,952 TL with a unit cost of 19,490,305 TL, while in 2021 the total cost was 37,515,568 TL with a unit cost of 18,483,550 TL.

Discussion

Given the findings, it is evident that the CA 19-9 test is widely requested and utilized as a tumor marker. In this study, the requests and usage of

the CA 19-9 test were examined in a large population sample from 2017 to 2021. The results indicate an increase in the number of tests and tests per 100,000 population over the years, with a significant decrease observed in 2020 and 2021. This provides insights into the placement and changes in the use of the CA 19-9 test in clinical practice over time.

Furthermore, the CA 19-9 test is considered a commonly used marker in the diagnosis of pancreatic cancer. Our findings demonstrate that a significant proportion of patients diagnosed with pancreatic cancer have elevated CA 19-9 levels. However, it is recommended to use the CA 19-9 test in conjunction with gold standard diagnostic methods such as pancreatic protocol CT rather than relying solely on CA 19-9 for the diagnosis of pancreatic cancer.

Additionally, CA 19-9 test can yield positive results in various conditions including benign diseases and other types of cancer. This highlights the need for caution regarding the specificity of the test. Elevated levels of CA 19-9 can reflect not only cancer but also inflammation and other benign conditions.

Lastly, our findings indicate that the CA 19-9 test impacts the rate of cancer diagnosis among patients. The results demonstrate an increasing trend in the proportion of patients receiving a cancer diagnosis over time among those who underwent CA 19-9 testing. This suggests that the test can play a significant role in cancer diagnosis and facilitate the determination of appropriate treatment regimens.

The findings of this study provide valuable insights into the role and evaluation of the utilization of the CA 19-9 test in clinical practice. However, further research and comprehensive clinical studies are warranted to better understand the accuracy, sensitivity, and specificity of the CA 19-9 test. This information can contribute to improved decision making and outcomes in the diagnosis and treatment processes for patients.

CA 19-9 is a commonly used tumor marker in the diagnosis of pancreatic ductal adenocarcinoma. Pancreatic cancer has a 5-year survival rate of less than 7% and is the fourth leading cause of cancer-related deaths. Globally, the incidence and mortality rates in 2018 were 5.5 and 5.1 per 100,000 in males and 4.0 and 3.8 per 100,000 in females, respectively (7). In Turkey, it is more frequently observed in males compared to females. Ministry of Health, Ankara Provincial Health Directorate, Turkey Cancer Statistics 2016, Ankara 2019 (8).

Every year, there is an increasing trend in the number of pancreatic cancer cases in Turkey, with a rate of 5.7 per 100,000 in males and 3.6 per 100,000 in females (9). Although pancreatic cancer is more common in males, our study found a higher proportion of CA 19-9 test requests in females. When the test counts were compared between genders, the ratio was 1.94 in 2017, 1.93 in 2018, 1.91 in 2019, 1.77 in 2020 and 1.84 in 2021.

The disease is rare in individuals under 45 years of age, with a peak occurrence in males aged 65-69 and females aged 75-79 (10).

In our study, when the test request counts were compared by age groups, the CA 19-9 test was predominantly requested in the 18-64 age group, followed by the 65 and older age groups, and the least requests were

made in the 0-17 age group. However, no analysis of age distribution by gender was conducted in our study.

Regarding the rates of exceeding the reference range based on age groups, the highest rate was observed in the 65 and older age group (16.66%), followed by the 18–64 age group (9.31%) and the 0-17 age group (8.86%).

More than 80% of patients diagnosed with pancreatic cancer had elevated CA 19-9 levels. When the rates of exceeding the reference range were examined by gender, the overall rate was 11.53%, with higher rates in males (14.87%) compared to females (9.62%). When comparing the rates of cancer diagnosis among individuals who underwent CA-19.9 testing at any time, there was an increasing trend over the years. In 2017, 28% of individuals received a cancer diagnosis, while in 2020 and 2021, the rates were 38% and 33%, respectively. In 2017, 8.43% of individuals who underwent the CA-19.9 test received a cancer diagnosis associated with CA-19.9, while 30.69% received a cancer diagnosis not associated with CA-19.9. Until 2020, these rates increased, with 16.60% of patients receiving a CA-19.9-related cancer diagnosis and 42.22% receiving a cancer diagnosis not associated with CA-19.9. In 2021, these rates were 10.76% and 39.21%, respectively.

When comparing the rates of exceeding the reference range, the highest rate was observed in 2020 (13.23%), while the lowest rate was observed in 2018 (10.39%).

When the rates of exceeding the reference range were compared by institution level, the highest rate was observed in third-level institutions, followed by second-level institutions, and the lowest rate was observed in first-level institutions.

According to the institution types, the overall rate of exceeding the reference range was 11.56%, with the highest rates observed in university hospitals, followed by private healthcare institutions, and the lowest rate observed in public hospitals.

Study Limitations

This study has several limitations. First, the data were obtained retrospectively, which means that pre-study design control could not be implemented. Additionally, there may be missing or erroneous data in the dataset. The scope of the study focused solely on the use of the CA 19-9 test and did not take into account the impact of other potential factors or variables.

Conclusion

The findings of our study suggest that the CA 19-9 test is commonly used as a marker for the diagnosis of pancreatic cancer. However, our results indicate the limitations of using the test as a standalone diagnostic tool and highlight the importance of its evaluation in conjunction with

other clinical and laboratory methods. Conducting further multicenter and prospective studies will contribute to a better understanding of the accuracy and effectiveness of the CA 19-9 test.

Ethics Committee Approval: University of Health Sciences Turkey, Istanbul Training and Research Hospital Institutional review board approval was obtained (approval number: 188, date: 21.07.2023).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

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