

## EVALUATION OF PANCREATIC TUMOR ON CONTRAST ENHANCED COMPUTED TOMOGRAPHY AND ITS CORRELATION WITH LAB TEST CA19-9

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DOI: <https://doi.org/10.5281/zenodo.17801506>

### Keywords

Pancreatic tumor, Pancreatic ductal adenocarcinoma (PDAC), Contrast enhanced computed tomography (CECT), CA 19-9

### Article History

Received: 11 September 2025

Accepted: 21 October 2025

Published: 21 November 2025

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### Abstract

**Background:** PDAC is the most common and deadly pancreatic cancer, often diagnosed late, with a 5-year survival below 10%. Risk factors include cystic lesions, pancreatitis and genetic syndromes. Imaging, particularly CECT, is the standard for diagnosis, staging, and treatment monitoring, while CA19-9 serves as a biomarker for disease presence and progression, though its specificity and sensitivity are limited.

**Objective:** To determine the correlation between the staging of pancreatic tumors on Contrast Enhanced CT scan and serum CA 19-9 levels.

**Methodology:** This 4-month prospective study of 31 participants with suspected or confirmed pancreatic tumors involved abdominal CECT and serum CA 19-9 measurement. Demographic, clinical, imaging, and laboratory data were collected and anonymized, with statistical analysis using SPSS 27 to assess CA 19-9's diagnostic utility.

**Results:** The study included 31 participants (13 males, 18 females), with 8 smokers and 3 alcohol users. Clinically, 24 experienced pains, 19 had nausea, 12 reported weight loss, and a few had jaundice. Tumors were mainly located in the pancreatic body (11), head (9), tail (8), and diffusely (3), with most being homogeneous (22) and hypodense (25), and tumor sizes predominantly 2–4 cm. CECT staging revealed benign, malignant, localized malignant, advanced, and metastatic tumors, with moderate CT severity in most cases. Serum CA 19-9 levels varied, and metastasis was observed in 4 participants.

**Conclusion:** This study of 31 pancreatic tumor patients, higher serum CA 19-9 levels strongly correlated with advanced tumor stage, CT severity, and metastasis, while gender showed no significant association. This indicates CA 19-9 is a reliable marker for tumor progression and disease severity.

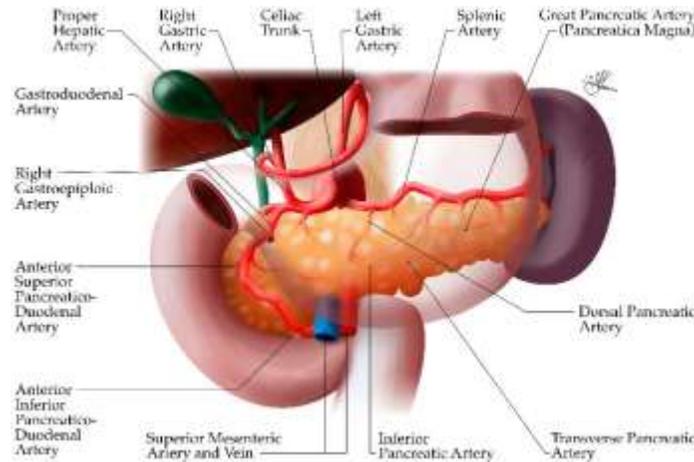
### INTRODUCTION

Pancreatic carcinoma is a highly lethal disease, with a 5-year survival rate of approximately 9% in the United States. It ranks as the seventh leading cause of cancer-

related mortality in the country [1]. The cancer of the pancreas at the early stage can be treated by surgical resection as well as neoadjuvant and/or adjuvant

chemo radiotherapy, but; diagnosis of disease is normally late in patients. When the cancerous cells are confined, it causes vague or of symptoms new modalities on how to screen high-risk patients and identify them. An early-stage pancreatic carcinoma is in a desperate condition. Needed. Improvement of genomic outcomes in human pancreatic. Bio specimens, including tissue and others have opened

the possibility that the early detection of Pancreatic carcinoma by DNA-based molecular methods is a very deadly condition whose probability is low. The 5-survival rate of about 9 percent in the United States and its death rate is placed at the number seven. It defined the world in 2020.



Anatomic illustration of pancreatic arterial vascularization, anterior view. [18]

The early-stage pancreatic cancer can be treated with surgery resection and neoadjuvant and /or adjuvant chemo radiotherapy; nonetheless, the condition normally manifests in patients with advanced stages of the disease as a result of lack misty in nature when it is apparent that the cancer is localized. New approaches to screening high-risk patients in order to identify pre-existing pancreatic carcinoma in earlier stages are hopelessly needed [2]. The proper evaluation of responsiveness to treatment is significant during the care of cancer patients. Most of the popular methods of response evaluation today are based on the current standard approach of response assessment which involves the evaluation of the response using a visual inspection. Response Evaluation Criteria in Solid is one of the types of tumors. The tumors (RECIST) v has four classes; complete remission, partial response (PR), stable and progressive disease. Other categories include outstanding disease (SD) and progressive disease (PD). However, RECIST is not the most suitable surrogate marker always of patient survivability especially of certain forms of tumors or treatment

modalities. Some tumor specific or treatment specific response criteria have been proposed like the Modified Choi criteria of gastrointestinal stromal tumors RECIST in hepatocellular carcinoma, and ire CIST in immune based therapeutics. As far as pancreatic ductal adenocarcinoma is concerned. In the treatment response, CT has been the staple of expressing treatment response (PDAC) evaluation. However, it has repeatedly been mentioned by many writers that imaging checks often undermine a genuine response to treatment. proved as repeatable. In comparison to this, the predictive role of the carbohydrate antigen 19-9 (CA 19-9) variations There have been constant reports of during first-line treatment. The latest national comprehensive cancer Recommendation of use of network guidelines [3]. One of them is pancreatic ductal adenocarcinoma most deadly malignancies involving cancers because of their 5-year survival that is below 10 percent and that keeps on increasing steadily. Among pancreatic neoplasia PDAC is the most frequent form that makes 90 percent of pancreatic malignancies, primarily being characterized by the enhanced desmoplastic and duct stratification with the morphologically changed.

Symptoms, which are sometimes not usual and they are very apparent the situation that late in the disease process of PDAC and unavailability of screening modalities to pancreatic cancer and its precursor lesions makes early detection of this disease nearly impossible. In this way, pancreatic cancer tends to be diagnosed way too late. late according to the fact that the median survival the timing after occurrence of metastasis or local invasion varies between six to twelve months. A very early start Only a very early start Only an early, only an early start surgical resection gives good long term survival opportunities. Although a phenomenal progress has been recorded in purifying designations of the genetic variance of cancers of the pancreas that similarly are articulated in an array of histopathological subtypes of PDAC and its multiple precursor lesions, no significant achievement in regard to the development of therapy has already been done. This is the reason why PDAC as one of the The therapy of the majority of the most therapy resistant tumor entities. mostly with neo adjuvant and adjuvant chemotherapy. Development of PDAC may be through oxygen dependent and oxygen-independent mechanisms. the development of several precursors and independent of such precursors [4]. Contrast-enhanced computed tomography (CECT) is the most frequently used technique for diagnosis and staging of pancreatic carcinoma [5,6]. Even in some researches, CECT is regarded as one of the gold standards [7]. The most mortal solid tumor is caused by pancreatic ductal adenocarcinoma. Malignancy, as it is also known, is normally diagnosed at a late point in time, and when it reaches inoperable domain. The prolonged survival is linked to early or incidental detection. the feasibility of a PDAC screening regime based on the utilization of a single test in the case of asymptomatic individuals is not possible because of very low prevalence rates and possible harms of false finding. Computed tomography (CT) Non-contrast, which is commonly used to verify the motions of body parts. Clinical signs, it has the possibility of massive screening, but, the non-contrast CT scan has been thought of as a long way back in terms of the PDAC identification. impossible. In this case, we come up with a deep learning model, pancreatic cancer a pond detection using artificial intelligence (PANDA) which is able to detect and categorize detect pancreatic lesions with high precision through non contrast CT.

PANDA is trained on a sample of 3,208 patients of one center [8].

Early and accurate staging of pancreatic tumors is crucial for planning effective treatment and improving patient survival. Contrast-enhanced CT scan plays a key role by providing detailed imaging to assess the extent of tumor spread, while the CA 19-9 laboratory test offers important biochemical insights into tumor activity. Correlating CT staging with CA 19-9 levels can therefore help validate the combined use of imaging and laboratory markers, leading to more reliable clinical decision making and optimized patientcare.

## MATERIAL AND METHODS

The study follows a prospective observational design, conducted in a tertiary care hospital. A sample size of 31 participants was determined using a 95% confidence level, a 5% margin of error, and an estimated 2% prevalence, with participants selected through convenient sampling over four months after the synopsis approval. The inclusion criteria involved individuals with suspected or confirmed pancreatic tumors, those who underwent a CECT scan of the abdomen with a pancreatic protocol, and those with CA 19-9 serum levels measured within one week of the CECT. Exclusion criteria included prior pancreatic treatments, other primary cancers, incomplete imaging or lab results, benign pancreatic conditions, non-malignant jaundice, and any issues with renal function or contrast allergies. The equipment used in the study included a Toshiba 64-slice CT scanner with a pancreatic protocol and an ELISA analyzer for CA 19-9 measurements. The dynamic contrast-enhanced multiphase CT was performed by injecting intravenous contrast, capturing images during the pancreatic parenchymal phase (about 40 seconds after injection) for the best tumor visibility, and during the portal venous phase (about 65-70 seconds) to identify liver metastases. A dual-phase or biphasic protocol, which includes both phases after a single injection, is recommended for comprehensive staging.

## RESULTS

A total of 31 participants were included in the study, comprising 13 males (41.9%) and 18 females (58.1%), with females representing the majority. Regarding

lifestyle factors, 23 participants (74.2%) were non-smokers, while 8 (25.8%) were smokers. Most participants abstained from alcohol, with 28 individuals (90.3%) reporting no alcohol use and 3 (9.7%) reporting alcohol consumption. Clinical symptoms were common in the study population. Pain was reported in 24 participants (77.4%), whereas 7 participants (22.6%) reported no pain. Jaundice data were available for 29 participants; of these, 26 (89.7%) had no jaundice, and 3 (10.3%) presented with jaundice, with 2 cases missing data. Nausea was present in 19 participants (61.3%), and 12 participants (38.7%) reported weight loss, while the majority did not experience weight loss. Tumor characteristics varied in location and appearance. Tumor location was most commonly in the body of the pancreas (11 cases, 35.5%), followed by the head (9 cases, 29.0%), tail (8 cases, 25.8%), and diffuse involvement (3 cases, 9.7%). Regarding tissue characteristics, 22 cases (71%) had homogeneous parenchyma, while 9 cases (29%) were heterogeneous. Most lesions were hypodense (25 cases, 80.6%), with fewer cases appearing heterodense (5 cases, 16.1%) or isodense (1 case, 3.2%). Tumor size ranged from less than 2 cm (9 cases, 29%) to greater than 6 cm (4 cases, 12.9%), with the majority falling in the 2-4 cm range (12 cases, 38.7%). CECT staging showed that benign tumors accounted for 9 cases (29%), malignant 7 cases

(22.6%), localized malignant 10 cases (32.3%), advanced 1 case (3.2%), and metastatic tumors 4 cases (12.9%). The CT severity index indicated mild severity (0-3) in 6 cases (19.4%), moderate (4-6) in 17 cases (54.8%), and severe (7-10) in 8 cases (25.8%). Serum CA 19-9 levels were normal (<37 U/mL) in 10 participants (32.3%), mildly raised (37-100 U/mL) in 7 (22.6%), moderate (100-500 U/mL) in 4 (12.9%), high (>200 U/mL) in 6 (19.4%), and very high (>500 U/mL) in 4 (12.9%). Metastasis was absent in 27 participants (87.1%) and present in 4 participants (12.9%). Among the 31 participants, males had 3 benign, 4 malignant, 5 localized malignant, and 1 advanced tumor, with no metastasis, while females had 6 benign, 3 malignant, 5 localized malignant tumors, and 4 metastatic cases. Gender showed no significant association with CECT stage ( $\chi^2 = 5.479$ ,  $p = 0.242$ ) or CT severity index ( $\chi^2 = 2.484$ ,  $p = 0.289$ ), though metastasis occurred only in females ( $\chi^2 = 3.317$ ,  $p = 0.069$ ). Serum CA 19-9 levels were strongly correlated with tumor stage (Pearson  $R = 0.685$ , Spearman  $\rho = 0.794$ ,  $p < 0.001$ ) and CT severity index ( $R = 0.769$ ,  $\rho = 0.780$ ,  $p < 0.001$ ). High CA 19-9 levels (>200 U/mL) were significantly associated with metastasis ( $\chi^2 = 9.644$ ,  $p = 0.047$ ), whereas normal and mildly elevated levels were mostly seen in non-metastatic cases. Table no.1 and table no.2 showing all results.

Table no.1

HISTORY FEATURES		
Parameter	Frequency(n)	Percentage(%)
Non-smokers	23	74.2
Smokers	8	25.8
No-alcohol	28	90.3
Alcohol-use	3	9.7
Pain	24	77.4
No-Pain	7	22.6
Jaundice	3	10.3
No-Jaundice	26	89.7
Nausea	19	61.3
Weight-Loss	12	38.7

Table no.2

CT FEATURES			
Category	Parameter	Frequency (n)	Percentage (%)
Tumor Location	Head	9	29.0
	Body	11	35.5
	Tail	8	25.8
	Diffuse	3	9.7
Tumor Tissue	Homogeneous	22	71.0
	Heterogeneous	9	29.0
Tumor Density	Hypodense	25	80.6
	Heterodense	5	16.1
	Isodense	1	3.2
Tumor Size	<2 cm	9	29.0
	2-4 cm	12	38.7
	4-6 cm	6	19.4
	>6 cm	4	12.9
CECT Staging	Benign	9	29.0
	Malignant	7	22.6
	Localized Malignant	10	32.3
	Advanced	1	3.2
	Metastatic	4	12.9
CT Severity Index	Mild (0-3)	6	19.4
	Moderate (4-6)	17	54.8
	Severe (7-10)	8	25.8
Serum CA 19-9 Levels	Normal (<37 U/mL)	10	32.3
	Mildly Raised (37-100 U/mL)	7	22.6
	Moderate (100-500 U/mL)	4	12.9
	High (>200 U/mL)	6	19.4
	Very High (>500 U/mL)	4	12.9
Metastasis	Present	4	12.9
	Absent	27	87.1

**DISCUSSION**

In this study, we evaluated the correlation between pancreatic tumor characteristics on contrast-enhanced computed tomography (CECT) and serum CA 19-9 levels. Our findings demonstrate that higher CA 19-9 levels were strongly associated with more advanced CECT stages and greater CT severity, with elevated levels observed in localized malignant, advanced, and metastatic tumors.

These results are consistent with previous studies, which have reported that CA 19-9 reflects tumor burden and can serve as a useful biomarker for disease progression, although its specificity may be limited in benign pancreatic conditions or early-stage tumors. In 2022 Jianli Su et al. demonstrated that combining multi-detector CT (MDCT) with serum tumor markers including CA19-9, CA242, and CEA significantly improved diagnostic accuracy,

preoperative evaluation, and prognostic assessment in pancreatic cancer patients. The authors reported that MDCT alone had variable accuracy across stages (ranging from 62.96% to 80%), while the addition of tumor markers increased sensitivity, accuracy, and negative predictive value, and higher marker levels were associated with worse 2-year event-free survival. Similarly, our study found that serum CA19-9 levels strongly correlated with tumor stage and CT severity on contrast enhanced CT, with higher levels observed in advanced and metastatic cases. Both studies highlight the importance of integrating imaging with tumor biomarkers to better assess disease burden and progression. While Su et al. included additional markers (CA242, CEA) and a larger sample size, our study reinforces that CA19-9 alone is a reliable indicator of tumor severity and metastasis, supporting its role in clinical decision-making for pancreatic tumors [43]. In 2023 Zhang et al. evaluated the prognostic value of combining preoperative CECT features with serum CA19-9 levels to predict disease-free survival (DFS) after curative R0 resection in pancreatic ductal adenocarcinoma (PDAC) patients. They identified key imaging and biomarker parameters, including tumor size >4 cm, extrapancreatic organ infiltration, lymph node involvement, peripheral enhancement, and CA19-9

>180 U/mL, as independent predictors of DFS, and demonstrated that the combined preoperative model outperformed conventional postoperative clinicopathological and TNM staging models. Similarly, our study found a strong correlation between CA19-9 levels and tumor stage, CT severity, and metastasis on contrast-enhanced CT, indicating that higher CA19-9 levels are associated with more advanced disease. Both studies underscore the clinical value of integrating imaging with serum biomarkers: while Zhang et al. focused on prognostic prediction post-surgery, our study supports the role of CA19-9 in assessing disease severity and staging preoperatively, reinforcing its utility in guiding management decisions for pancreatic tumors [44].

### Case 1

A 68-year-old male patient presented with abdominal pain, vomiting, and mild fever. Computed tomography (CT) revealed a large mass in the head of the pancreas measuring 9.5 × 3.7 cm (Level 4), with heterogeneous enhancement and encasement of the superior mesenteric vein. Mild pancreatic duct dilation was also noted. The findings are most consistent with pancreatic adenocarcinoma.



### Case 2

A 55-year-old female patient presented with recurrent epigastric pain and nausea. Computed tomography

(CT) demonstrated a lesion in the tail of the pancreas measuring 3.9 × 2.7 cm (Level 2), showing

homogeneous enhancement without vascular involvement. Mild peripancreatic fat stranding was also noted.



## CONCLUSION

This study concluded that the serum CA 19-9 levels showed a strong positive correlation with tumor stage and CT severity on CECT, indicating that higher CA 19-9 levels are associated with more advanced disease. Gender was not significantly associated with tumor stage or CT severity, although metastasis was observed only in females, showing a trend toward significance. High CA 19-9 levels (>200 U/mL) were significantly associated with the presence of metastasis. These findings suggest that serum CA 19-9 is a reliable marker for assessing tumor progression and disease severity in pancreatic cancer.

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