Original Article

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Pathology Section

Diagnostic and Prognostic Significance of CA 19-9 as Tumour Marker in Pancreatic, Hepatobiliary and Other Gastrointestinal Cancers

MITSU VINAY VAISHNAV[1], SAMEEP SHYAMLAL GARG[2], MAYUR JITUBHAI KOKANI[3]

ABSTRACT

Introduction: The CA 19-9 antigen isolated by Koprowski and colleagues in 1979 is a lacto-N-fucopentaose II-like substance and one of the tumour-associated antigens present in serum in the mucin fraction. Close attention has been paid to the role CA 19-9 in the diagnosis of digestive tract tumours. In this study, serum analysis of CA 19-9 levels in 91 patients with gastrointestinal, hepatobiliary and pancreatic carcinoma was done. These data was used to evaluate the clinicians with adequate information on use of CA 19-9 as tumour marker- both diagnostic and prognostic.

Aim: To study the role of tumour marker, CA 19-9 as a diagnostic and prognostic tool, and also to monitor the response of gastrointestinal, hepatobiliary and pancreatic cancer to treatment.

Materials and Methods: This cross-sectional study was done on 91 cases of gastrointestinal, hepatobiliary and pancreatic carcinomas conducted in tertiary care hospital associated with medical college in Jamnagar, Gujarat, India were studied from September 2012 to March 2015 for two years and five months. The sample size was of 91 patients. Statistical method used was sensitivity, specificity, positive predictive value and negative predictive value. The material used was serum of the patient both pre as well as postoperatively and CalBiotech CA 19-9 Elisa Kit was used to determine the Value. The collected data were entered into Microsoft Excel spread sheet. The statistical methods used for variables were Mean and median along with Sensitivity and Specificity. Software used was "Epi Info", version 7.0.

Results: Total 91 cases of gastrointestinal, hepatobiliary and pancreatic carcinomas were studied. Enzyme Linked Immunosorbent Assay (ELISA) was used preoperatively and post operatively to determine the CA 19-9 values in patients of gastrointestinal, hepatobiliary and pancreatic carcinomas. It was found that CA 19-9 is an important tumour marker with sensitivity of 76.31% and specificity of 73.33% for diagnosis of the gastrointestinal, hepatobiliary and pancreatic carcinoma. When aided with Fine Needle Aspiration Cytology (FNAC) and histopathological findings it helps in giving a sure shot diagnosis. It also provides useful prognostic information for the same.

Conclusion: This study helps to understand the role of CA 19-9 as diagnostic and prognostic marker for pancreatic, hepatobiliary and gastrointestinal carcinomas.

Keywords: Carbohydrate antigen, Oncology, Prognostic tumour markers

INTRODUCTION

Colon specific antigen, a predominantly carbohydrate antigen, was the initial name given to CA 19-9 [1]. This antigen was initially generated against a colorectal cancer cell line; however, it was found more frequently in the sera of patients with the pancreatic carcinoma than in colorectal or stomach carcinoma [2].

The CA 19-9 has sensitivity and specificity of 70-90% and 68-91% respectively to differentiate between the pancreatic carcinoma and chronic pancreatitis [3-6]. The CA 19-9 is also one of the most significant prognostic factors for both patients with resectable and those with unresectable gastrointestinal and hepatobiliary cancers [7-9].

High preoperative levels of CA 19-9 in patients signifies the possibility of early reoccurrence, hence it helps surgeons in making a better therapeutic decision [10]. Non resectable tumours the remaining mass can be measured after chemotherapy or radiotherapy but it is quite difficult to do so in mass with obscure margins so changes in value of CA 19-9 provides good insight into response of tumour to chemotherapy or radiotherapy [11,12].

Objectives of the study were:

- Establish the role of CA 19-9 as a novel marker which can be used to differentiate benign gastrointestinal lesions from gastrointestinal carcinomas
- To establish the valuable role CA 19-9 plays to determine the prognosis and re-occurrence in patients of gastrointestinal carcinoma.

It is a simple, inexpensive and routinely done blood test which can keep an eye on patients of gastrointestinal carcinomas and alert the clinician whenever required.

MATERIALS AND METHODS

This was a prospective descriptive cross-sectional study done from September 2012 to March 2015. The patients were admitted in a tertiary care hospital associated with medical college in Jamnagar, Gujarat, India. Institutional approval was obtained for this study with the number "ECR/6/Inst/Guj/2013/RR-16". Total 91 cases of the gastrointestinal, hepatobiliary and pancreatic carcinomas were included in the study.

Inclusion criteria: Present study includes individuals of age 20-100 years, with both the genders, presenting chief complaint of anorexia, malaise, nausea, vomiting, substantial weight loss, mid-epigastric pain, melena, hemetemesis, dysphagia, jaundice, epigastric lump etc. was considered with correlation Ultrasonography (USG), Computer Tomography (CT) scan, Magnetic resonance imaging (MRI) findings.

Exclusion criteria: Patients who did not provide consent and who did not wish to be contacted by the investigator were excluded from the study and were not followed-up.

Study Procedure

- Calbiotech Elisa Kit was used to calculate value of CA 19-9 in serum of patients.

- Preoperative values of CA 19-9 was collected in patients who fulfilled the inclusion criteria.
- Postoperative or post-treatment CA 19-9 values were collected in patients 30 days after surgery or after 3 rounds of chemotherapy whichever was earlier.
- Proper follow-up was done of patients through telephonic communication.
- Pre and Preoperative and postoperative CA 19-9 values were recorded in of patients who survived.

Reference value: Normal value of CA 19-9 in healthy individuals is less than 35 U/mL. So the cut-off value of CA 19-9 is 35 U/mL [10-20].

STATISTICAL ANALYSIS

The collected data were entered into Microsoft Excel spread sheet. The statistical methods used for variables were mean and median along with sensitivity and specificity. Software used was "Epi Info", version 7.0.

RESULTS

The cases in the study included both benign and malignant lesions of gastrointestinal, hepatobiliary and pancreatic region. All the cases which were labeled as malignant on radiological examination were included in the study. Hence, few benign cases were also included.

The number of cases of pancreatic lesions was 28, gall bladder tumours were 18, colorectal tumours were 23, gastric tumours were nine and periampullary carcinoma were 13 [Table/Fig-1].

Lesion/Organ	Percentage of cases (n)
Pancreatic lesion	31% (28)
Gall bladder tumours	20% (18)
Colorectal tumours	25% (23)
Gastric tumours	10% (9)
Periampullary tumours	14% (13)

[Table/Fig-1]: Distribution of types of lesions in the study.

A) Pancreatic Lesion/Pancreatitis

There were 28 cases of pancreatic lesions which included acute pancreatitis (2), serous cystadenoma of pancreas (1), mucinous cystadenoma of pancreas (1) and ductal adenocarcinoma of pancreas (24). Post-treatment CA 19-9 levels were measured in 12 cases of ductal adenocarcinoma of pancreas [Table/Fig-2-4].

Gross and Microscopic Images both Cytological and histopathological are provided. The cytology of this case was done intraoperatively. On cytology the diagnosis of Adenocarcinoma was given and on histopathology diagnosis of well-differentiated adenocarcinoma was given [Table/Fig-5a-c].

B) Gall Bladder Tumours/Choledocholithiasis

There were 18 cases of gall-bladder lesion which included choledocholithiasis (3) and cholangiocarcinoma (15). Post-treatment CA 19-9 levels were measured in 08 cases of cholangiocarcinoma [Table/Fig-6-8].

Gross and microscopical image of Adenocarcinoma of Gall Bladder. The adenocarcinoma is located at the neck of the gall bladder and it is a well-differentiated adenocarcinoma [Table/Fig-9].

C) Colorectal Tumours

There were 23 cases of colorectal tumours which included colorectal adenomas (3) as well as colorectal carcinoma (20). Post-treatment CA 19-9 levels were measured in 10 cases of colorectal carcinoma [Table/Fig-10-12].

Clinopathological factors	Number (%)	CA 19-9 (Mean)	CA 19-9 (Median)
Age: (n=28)			
20-39 years	03 (10.7)	289.63	250.9
40-59 years	14 (50)	232.03	178.8
>60 years	11 (39.2)	350.20	350.2
Sex: (n=28)			
Male	18 (64.28)	395.85	218.85
Female	10 (35.72)	320.26	198.20
Location: (n=26)			
Head of pancreas	21 (80.8)	445.08	253.6
Body and tail	05 (19.2)	173.18	193.8
Tumour size: (n=26)			
<4 cm	12 (46.15)	211.30	182.3
>4 cm	14 (53.85)	548.35	306.7
Neoplasm: (n=26)			
Benign	02 (7.70)	62.35	62
Malignant	24 (92.30)	420.35	252.25
Differentiation: (n=24)			
Well	02 (8.33)	150.1	150.1
Moderately	14 (58.33)	186.25	194.7
Poorly	08 (33.33)	897.6	897.6
Staging: (n=24)			
Stage I	1 (4)	11	11
Stage IIA	5 (21)	214.78	186.8
Stage IIB	5 (21)	172.70	193.8
Stage III	5 (21)	337.6	282.8
Stage IV	8 (33)	806.48	627.2
Metastasis: (n=24)			
Lymph node	13 (55)	617.14	362.2
Distant organs	04 (16)	806.71	627.2
Both LN and distant organ	04 (16)	1339	1402.2
Metastasis			
No Metastasis	03 (13)	183.92	186.8
FNAC: (N=28)			
Positive for malignancy	7 (25)	634.87	186.8
Benign	1 (3.58)	NA	NA
Negative	3 (10.71)	NA	NA
Not done	17 (60.71)	NA	NA

[Table/Fig-2]: Relationship between Clinicopathological Factors and CA 19-9 Values in Pancreatic Lesions/Pancreatitis.
N: Total number of pancreatic lesions; M: Total number of pancreatic tumours' n: Total number of pancreatic carcinomas

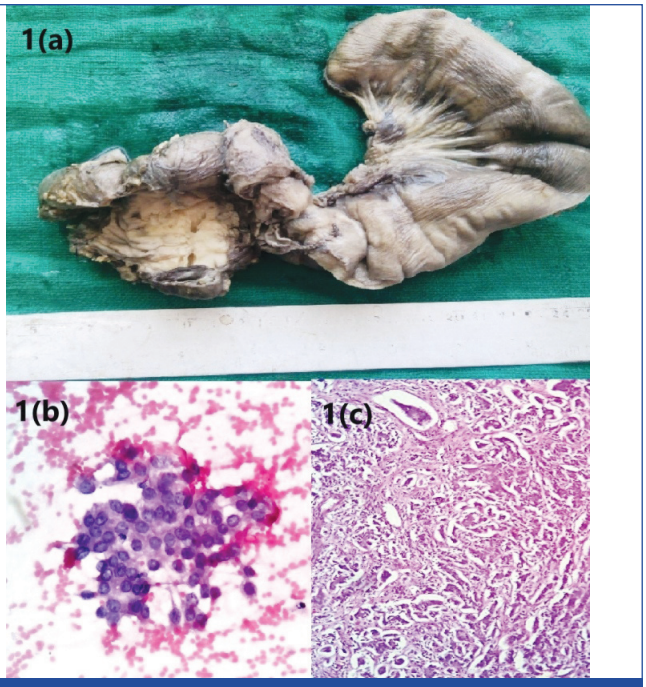
CA 19-9 level	Median survival (Months)
<37 U/mL	28
37- <200 U/mL	18
>200 U/mL	6

[Table/Fig-3]: Preoperative serum CA 19-9 level compared with survival in pancreatic carcinoma.

CA 19-9 level	Median survival (Months)
>50% Decrease in level	18
<50% Decrease in level	6

[Table/Fig-4]: Postoperative changes in serum CA 19-9 compared with survival in pancreatic carcinoma.

The figure is showing gross and microscopic images of adenocarcinoma of colon. Gross is showing right-sided hemicolectomy with cauliflower like growth constricting the lumen. The cytology image correlated with intraoperative FNAC and histopathological image shows well-differentiated adenocarcinoma [Table/Fig-13a-c].



[Table/Fig-5]: (a) Gross- carcinoma of head of pancreas; (b) Intraoperative cytology: adenocarcinoma pancreas H&E 40X; (c) Histopathology: well-differentiated adenocarcinoma of pancreas H&E 10X.

Clinopathological factors	Number	CA 19-9 (Mean)	CA 19-9 (Median)
Age: (n=18)			
20-39 years	00	00	00
40-59 years	10 (55.56%)	161.27	86.6
>60 years	08 (44.44%)	301.225	213.05
Sex: (n=18)			
Male	11 (61.11%)	316.45	40
Female	07 (38.89%)	166.32	120
Neoplasm: (n=18)			
Benign	03 (16.67%)	28.66	23
Malignant	15 (83.33%)	254.43	123.8
Differentiation: (n=15)			
Well	08 (53.33%)	167.7	95.9
Moderately	05 (33.33%)	350.3	370.2
Poorly differentiated	02 (13.33%)	421.7	421.7
Staging: (n=15)			
Stage I	00	00	00
Stage II	04 (26.67%)	217.87	109.45
Stage IIIA	05 (33.33%)	276.2	120
Stage IIIB	03 (20%)	178.16	118.2
Stage IVA	00	-	-
Stage IVB	03 (20%)	383.16	302.3
Metastasis: (n=15)			
Lymph node	05 (33%)	276.34	123.8
Distant organs	03 (20%)	383.16	302.2
Both LN and other organ	02 (13%)	423.6	423.6
Metastasis			
No Metastasis	05 (34%)	283.6	120
FNAC: (n=18)			
Positive for malignancy	05 (27.78%)	260.96	150.9
Choledocholithiasis	00	NA	NA
Negative	02 (11.11%)	NA	NA
Not done	11 (61.11%)	NA	NA

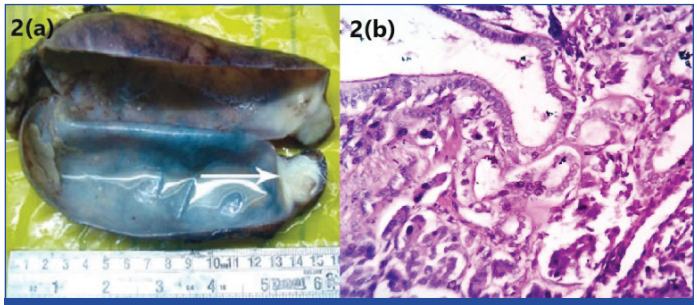
[Table/Fig-6]: Relationship between clinicopathological factors and CA 19-9 values in gall bladder tumours and choledocholithiasis.
N: Total number of cases of Gall Bladder; n: Total number of cases of Cholangiocarcinoma

CA 19-9 level	Median survival (Months)
<37 U/mL	---
37- <200 U/mL	23.25
>200 U/mL	10.25

[Table/Fig-7]: Preoperative Serum CA 19-9 level compared with survival in cholangiocarcinoma (Median survival data not mentioned as none of the patients we were able to follow-up had CA 19-9 value less than 37).

CA 19-9 level	Median survival (Months)
>50% Decrease in level	20
<50% Decrease in level	13.5

[Table/Fig-8]: Postoperative changes in serum CA 19-9 compared with survival in cholangiocarcinoma.



[Table/Fig-9]: (a) Gross-adenocarcinoma of gall bladder; (b) Histopathology- Well-differentiated adenocarcinoma of gall bladder H&E 20x.

Clinopathological factors	Number	CA 19-9 (Mean)	CA 19-9 (Median)
Age: (n=23)			
20-39 years	04 (17.3%)	76.3	28.4
40-59 years	10 (43.5%)	123.44	92.75
>60 years	09 (39.2%)	159.4	103
Sex: (n=23)			
Male	13 (56.5%)	128.03	82.10
Female	10 (43.5%)	107.74	92.75
Location: (n=23)			
Right side colon	03 (13.0%)	96.56	89.2
Left side colon	08 (34.8%)	145.48	70.45
Rectum	12 (52.2%)	124.5	89.2
Neoplasm: (n=23)			
Adenomas	03 (13%)	18	15
Malignant	20 (87%)	156.56	100
Differentiation: (n=20)			
Well	05 (25%)	75.35	26.6
Moderately	12 (60%)	166.41	107.35
Poorly	03 (15%)	182.13	211
Staging: (n=20)			
Stage I	03 (15%)	30.86	34.4
Stage II	05 (25%)	66.42	82.1
Stage III	06 (30%)	105.96	111
Stage IV	06 (30%)	309.95	227.6
Metastasis: (n=20)			
Lymph node	09 (45%)	204.24	163.8
Distant organs	06 (30%)	309.95	227.6
Both	03 (15%)	400.73	423.6
No metastasis	02 (10%)	44.2	32.7
FNAC: (n=23)			
Positive	06	106.25	96.1
Adenomas	00	NA	NA
Negative	02	NA	NA
Not done	15	NA	NA

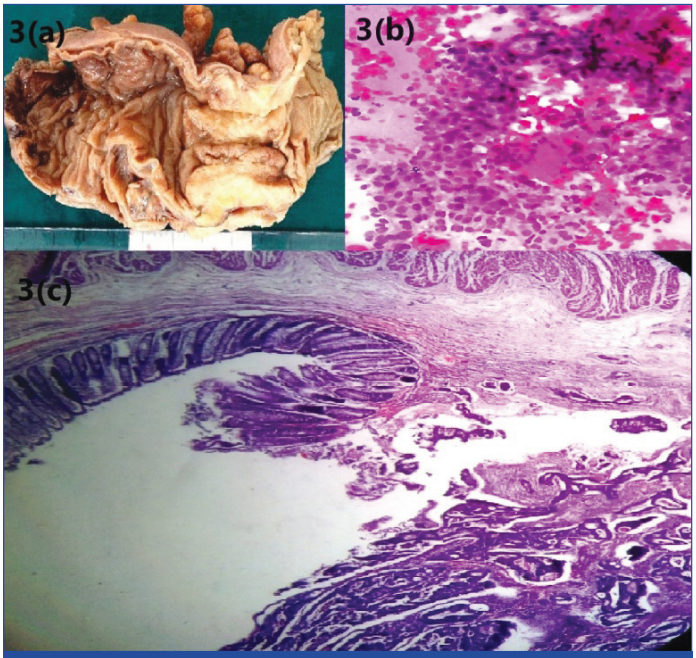
[Table/Fig-10]: Relationship between clinicopathological factors and CA 19-9 values in colorectal tumours.
N=Total number of cases of colorectal lesion, n=Total number of cases of colorectal carcinoma

CA 19-9 Level	Median survival (Months)
<37 U/mL	29
37- <200 U/mL	17.66
>200 U/mL	7

[Table/Fig-11]: Preoperative serum CA 19-9 level compared with survival in colorectal carcinoma.

CA 19-9 Level	Median survival (Months)
>50% Decrease in level	24.5
<50% Decrease in level	15.33

[Table/Fig-12]: Postoperative changes in serum CA 19-9 compared with survival in colorectal carcinoma.



[Table/Fig-13]: (a) Gross: Adenocarcinoma of colon; (b) Histopathology- intraoperative cytology- Adenocarcinoma colon H&E 10x; (c) Well-differentiated adenocarcinoma of colon H&E 20x.

D) Gastric Tumours

There were 09 cases of gastric tumours which included gastric adenoma (2) and gastric adenocarcinomas (7). Post-treatment CA 19-9 levels were measured in 05 cases of gastric carcinoma [Table/Fig-14-16].

The gross image is of ulcerative growth on lesser curvature of stomach and histopathological image is showing well-differentiated adenocarcinoma of stomach [Table/Fig-17a,b].

E) Periampullary Tumours

There were 13 cases of periampullary carcinoma which included periampullary adenoma (3) and periampullary adenocarcinoma [10]. Post-treatment CA 19-9 levels were measured in 05 cases of periampullary carcinoma [Table/Fig-18-20].

The gross image is showing constrictive growth in second part of duodenum and histopathological image is showing well-differentiated adenocarcinom of periampullary region [Table/Fig-21a,b].

The information about overall statistics for diagnosing various gastro-intestinal, hepatobiliary and pancreatic carcinoma using CA 19-9 as tumour marker with cut-off value of 37 U/mL was tabulated [Table/Fig-22].

DISCUSSION

Very few studies have been done on usefulness of CA 19-9 as a diagnostic and prognostic marker. Mostly, all the studies have been concentrated on either pancreatic carcinoma, cholangiocarcinoma, gastric carcinoma, colorectal carcinoma or ampullary carcinoma individually and respectively [1-10].

Clinopathological factors	Number (%)	CA 19-9 (Mean)	CA 19-9 (Median)
Age: (n=09)			
20-39 years	3 (33.4)	16.56	12
40-59 years	4 (44.4)	98.12	76
>60 years	2 (22.2)	180.5	180.5
Sex: (n=09)			
Male	4 (44)	79.3	29.7
Female	5 (56)	97.2	106
Location: (n=09)			
Antro-pyloric region	7 (77.78)	113.6	36
Greater curvature	2 (22.22)	62	62
Neoplasm: (n=09)			
Adenomas	2 (22)	10	10
Malignant	7 (78)	111.88	106
Differentiation: (n=07)			
Well	2 (28.5)	68.25	68.25
Moderately	3 (43.0)	95.23	36
Poorly 21a,b	2 (28.5)	180.5	180.5
Staging: (n=07)			
Stage IA	1 (14)	20.5	20.5
Stage IB	0	00	00
Stage II	1 (14)	36	36
Stage IIIA	1 (14)	116	116
Stage IIIB	2 (29)	67.85	67.85
Stage IV	2 (29)	237.5	237.5
Metastasis: (n=07)			
Lymph node	4 (57)	126.675	111
Distant organs	2 (29)	237.5	237.5
No metastasis	0	00	00
Both LN and metastasis	1 (14)	255	255

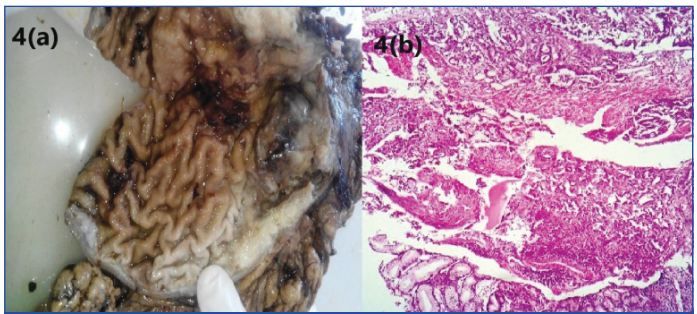
[Table/Fig-14]: Relationship between clinicopathological factors and CA 19-9 values in gastric tumours.
N=Total number of cases of gastric lesion, n=Total number of cases of Gastric carcinoma

CA 19-9 level	Median survival (Months)
<37 U/mL	24
>37 U/mL	7.5

[Table/Fig-15]: Preoperative serum CA 19-9 level compared with survival in gastric carcinoma.

CA 19-9 level	Median survival (Months)
>50% Decrease in level	29
<50% Decrease in level	9.66

[Table/Fig-16]: Postoperative changes in serum CA 19-9 compared with survival in gastric carcinoma.



[Table/Fig-17]: (a) Gross- Adenocarcinoma of stomach; (b) Well-differentiated adenocarcinoma of stomach H&E 10x.

This is one of a kind of study where all, pancreatic carcinoma, cholangiocarcinoma, gastric carcinoma, colorectal carcinoma or ampullary carcinoma have been studied together and the final

Clinopathological factors	Number (%)	Ca 19-9 (Mean)	CA 19-9 (Median)
Age: (n=13)			
20-39 years	01 (7.6)	88	88
40-59 years	07 (53.8)	210.88	35
>60 years	05 (38.6)	251.36	300
Sex: (n=13)			
Male	07 (53.85)	230.43	180
Female	06 (46.15)	186.633	158.4
Neoplasm: (n=13)			
Adenomas	03 (23.08)	48.26	36.8
Malignant	10 (76.92)	258.80	290
Differentiation: (n=10)			
Well	05 (50)	174.60	180
Moderately	03 (30)	288.33	380
Poorly	02 (20)	425.00	425
Staging: (n=10)			
Stage I	03 (30)	29.33	28
Stage II	03 (30)	280	280
Stage III	03 (30)	454	450
Stage IV	01 (10)	300	300
Metastasis: (n=10)			
Lymph node	04 (40)	415	405
Distant organs	01 (10)	300	300
Both LN and metastasis	01 (10)	300	300
No metastasis	04 (40)	213	180
FNAC: (n= 10)			
Positive	03	255	180
Negative	00	NA	NA
Not done	07	NA	NA

[Table/Fig-18]: Relationship between clinicopathological factors and CA 19-9 values in periampullary tumours.
N=Total number of cases of periampullary lesion, n=Total number of cases of periampullary carcinoma

CA 19-9 level	Median survival (Months)
<37 U/mL	28
>37 U/mL	10.25

[Table/Fig-19]: Preoperative serum CA 19-9 level compared with survival in periampullary carcinoma.

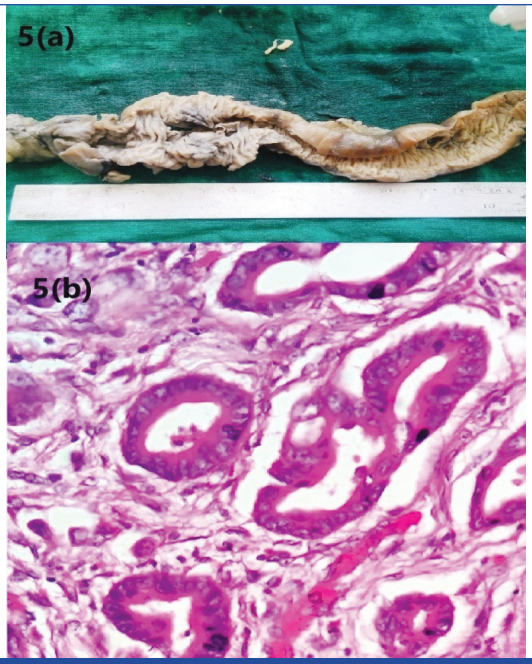
CA 19-9 level	Median survival (Months)
>50% Decrease in level	21
<50% Decrease in level	9

[Table/Fig-20]: Postoperative changes in serum CA 19-9 compared with survival in periampullary carcinoma.

sensitivity and specificity of CA 19-9 as a tumour marker has been established. Also, the CA 19-9 values have been associated with age, sex, site, staging, grading and metastases of the tumours. Along with that pre and postoperative values have been studied to determine the usefulness of CA 19-9 as prognostic marker.

Pancreatic Carcinoma

Comparing the study of Dong Q et al., Jiang JT et al., Ferrone CR et al., Kim YC et al., Cwik G et al., Xing H et al., Berger AC et al., Waraya M et al., Saad ED et al., Stemmler J et al., and Reni M et al., with the present study it was found that the studies can be compared as follows [7-9,13-20]. In the study of Dong Q et al., more than 50% of patients were above the age of 60 years while in present study 60% of patients were below the age of 60 years [7]. This discrepancy in percentage was seen because of large sample size and varied age group in study of Dong Q et al., [7]. The male to female ratio in Dong Q et al., was 1.2:1 while



[Table/Fig-21]: (a) Gross-periampullary carcinoma; (b) Well-differentiated adenocarcinoma of ampulla H&E 40.

Statistics	Values (%)
Sensitivity of CA 19-9	76.31
Specificity of CA 19-9	73.33
Positive predictive value	93.55
Negative predictive value	37.93

[Table/Fig-22]: Overall statistics for diagnosing gastrointestinal, hepatobiliary and pancreatic carcinomas (when cut-off value for CA 19-9 is 37 U/mL)

in present study it was 1.8:1. According to location of tumours present study showed good associated with study of Dong Q et al., that majority of pancreatic carcinomas was located in the head of pancreas [7].

In both the studies, Dong Q et al., and present study more than 50% of cases were moderately differentiated [7]. However in present study, more number of cases was of poor differentiation as compared to well-differentiated in the study of Dong Q et al., [7]. Large sample size and geographic distribution can explain the difference. In both the studies, it was observed that median value of CA 19-9 increased as differentiation of tumour decreased.

It was observed present study as well as other studies of Dong Q et al., Jiang JT et al., Ferrone CR et al., and Kim YC et al., that the median value of CA 19-9 increased as stage of disease increases [7-9,13]. The maximum value of CA 19-9 was observed in Stage IV patients. The median values at various stages in present study was comparable to the studies of Ferrone CR et al., [9]; while the median values shows a large amount of discrepancy with median values of studies Dong Q et al., Jiang JT et al., and Kim YC et al., [7,8,13]. The discrepancy was because other studies had big sample size, different geography and they even considered un-resectable pancreatic cancers.

Sensitivity of CA 19-9 was comparable the studies of Cwik G et al., and Xing H et al., [14,15]. Specificity of present study was less as compared to other studies of Cwik G et al., and Xing H et al., because in those studies benign conditions were not considered and also their sample size was larger [14,15]. In this study, we considered all patients who came to the department with clinical history and radiological findings suggesting a gastrointestinal, pancreatic or cholangiocarcinoma. Hence, few such suspected patients turned out to have benign conditions.

In present study, mean survival rate of patient was compared with preoperative serum CA 19-9 value. The survival rate of the patient

was inversely proportional to the CA 19-9 value. The same results were obtained in studied of Ferrone CR et al., and Berger AC et al., [9,16]. Also, the postoperative serum values of CA 19-9 were inversely proportional to the survival of the patients. If postoperative values were <50% of pre-operative values the prognosis was better. Similar observations were seen in studies of Saad ED et al., Stemmler J et al., and Reni M et al., [18-20].

Cholangiocarcinoma

Comparing the study of Quin XL et al., and Harder J et al., with the present study it was found that all the studies can be compared as follows [21,22]. In the study, of Quin XL et al., the mean age of patients was 60 years which was comparable to our present study mean age of 58 years [21]. Qin XL et al., studied patients with Male to Female (M:F) ratio of 1.8:1 [21]. In present study, the male to female ratio was 1.6:1 which is quite comparable.

In regard to differentiation of tumour, Qin XL et al., observed that mean value of CA 19-9 increased as differentiation of the tumour decreased [21]. Highest mean value of serum CA 19-9 was seen in poorly differentiated tumours. In present study, similar observations were made. This result establishes the fact that the poorer the differentiation of the tumour, higher will be the value of CA 19-9. Hence pre-operative CA 19-9 values can give a clue to whether the tumour will be well-differentiated or poorly differentiated.

Sensitivity of CA 19-9 was comparable in to study of Quin XL et al., [21]. Harder J et al., studied prognostic relevance of CA 19-9 in patients with biliary tract cancer [22]. He studied 75 cases of cholangiocarcinoma and observed that median survival was 23.5 months when CA 19-9 level was less than 300 u/mL. Also, when CA 19-9 level was more than 300, the median survival decreased to 13.4 months. In present study, similar results were obtained. In present study, serum CA 19-9 levels which were less than 300 U/mL their median survival was 23.25 months and when CA 19-9 was more than 300 u/mL median survival decreased to 10.25 months. Thus, it is quite comparable.

Colorectal Carcinoma

Comparing the study of Silalahi EM et al., and Al Shuneigat JM et al., with the present study it was found that the studies can be compared by the as [23,24]: The study of Silalahi EM et al., is comparable to present study on basis of age of patient [23]. The mean age in Silalahi JM et al., is 52 years and present study is 57 years. Both these studies are showing male preponderance [23].

Sensitivity of CA 19-9 was not comparable with the study of Al Shuneigat JM as cut-off value for CA 19-9 in the study was <28 U/mL while in present study cut off of 37 U/mL is considered [24]. Specificity of present study was less as compared to Al Shuneigat JM et al., because in other studies benign conditions were not considered [24]. In this study, we considered all patients who came to the department with clinical history and radiological findings suggesting a gastrointestinal, pancreatic or cholangiocarcinoma. Hence, few such suspected patients turned out to have benign conditions.

Gastric Carcinoma

Comparing the study of Lee JC et al., and He CZ et al., with the present study it was found that all the studies can be compared as follows [25,26]. The study of Lee JC et al., is comparable to current study on basis of age of patient having gastric carcinoma [25]. The mean age in study of Lee JC et al., was 57 while in current study was 53 [25].

Sensitivity of CA 19-9 was not comparable with other study of He CZ et al., as he used the cut-off value for serum CA 19-9 as 19 u/mL while in present study it is 37 u/mL [26]. Therefore, the discrepancy of results. Also, geographical location and patient inclusion criteria differ. Sample size also differs considerably.

While in the study He CZ et al., sensitivity of CA 19-9 as a tumour marker is comparable [26]. Specificity of present study was less as compared to other studies of He CZ et al., because in that studies benign conditions were not considered [26]. In this study, all patients who came to the department with clinical history and radiological findings suggesting a gastrointestinal, pancreatic or were considered. Hence, few such suspected patients turned out to have benign conditions.

Periampullary Carcinoma

No studies on associated of CA 19-9 value with periampullary cancer was found.

Limitation(s)

The sample size was smaller than the sample size used for other studies and all patients with clinical and radiological suspected malignancies were included in the study as per inclusion criteria of study, however few cases turned out to be benign and this turned out to affect sensitivity and specificity of the study. Along with that post-treatment values were not measured in 51 cases out of 91 cases studied because of loss of follow-up.

CONCLUSION(S)

The CA 19-9 is less expensive and good alternative to invasive as well as radiological tests. It should not be under-valued by other peers. Clinicians rely heavily on more advanced tests while sometimes simpler tests can provide better results. Elevated levels of CA 19-9 above 37 U/mL are seen in pancreatic carcinoma, cholangio-carcinoma and gastrointestinal carcinoma. Higher levels of CA 19-9 are seen in patients of higher age group, male patients, higher stage of tumour, poor differentiation of tumour and poor prognosis. It also provides information about prognosis, survival rate and re-occurrence of tumour in patients.

Hence, clinicians should not undervalue the use of tumour markers like CA 19-9 and use this test frequently in patients to prevent more cost bearing and invasive procedures. It has a good sensitivity and specificity and also is a good measure of prognosis and survival rate.

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PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Pathology, NAMO Medical Education and Research Institute, Silvassa, Dadra and Nagar Haveli, India.
2. Associate Professor, Department of Pathology, NAMO Medical Education and Research Institute, Silvassa, Dadra and Nagar Haveli, India.
3. Associate Professor, Department of Pathology, NAMO Medical Education and Research Institute, Silvassa, Dadra and Nagar Haveli, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Sameep Shyamlal Garg,
H. No. 208, Block D, Pramukh Garden, Opposite Yogi Hospital,
Silvassa-396230, Dadra and Nagar Haveli, India.
E-mail: drsameepgarg2@gmail.com

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