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Original Article

Sensitivity of Carcinoembryonic Antigen Level in Head and Neck, Breast, Lung, Genitourinary, Gastrointestinal Carcinoma

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ABSTRACT

Objective: To determine the Carcinoembryonic Antigen Levels among patients with epithelial carcinoma presenting at a tertiary care hospital.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Department of Medical Oncology, Jinnah Postgraduate Medical Centre, Karachi Pakistan, from May 2019 to May 2020.

Methodology: Two hundred six patients presenting with a confirmed diagnosis of epithelial carcinoma, aged more than 15 years and of either gender were enrolled in the study. The CEA levels in all the patients were measured using an ELISA kit. The CEA levels were classified as 0-3.0 ng/mL, 3.1-5.0 ng/mL, 5.1-10 ng/mL and >10ng/mL.

Results: The mean age of the cancer patients was estimated as 47.30±14.10 years. Most patients had rectum carcinoma 28(13.59%), followed by CA sigmoid 25(12.14%), respectively. The median CEA level was estimated as 5.80ng/mL ranging from 0.82 to 1000 ng/mL. About 76 patients had CEA level >10ng/mL (36.9%), 55 had CEA level 0-3.0 ng/mL (26.7%), 43 had CEA level 3.1-5.0ng/mL (20.9%), and 32 had CEA level 5.1-10.0ng/mL (15.5%). A statistically significant difference in proportions of CEA levels was found for histological type (p=0.001), type of cancer (p=0.001) and number of Mets (p=0.003).

Conclusion: Rectal cancer profoundly expressed carcinoembryonic antigen levels, followed by sigmoid, colon, and ovarian cancer. Moreover, there is a significant association among carcinoembryonic antigen levels, histology, type and metastasis of cancer.

Keywords: Carcinoembryonic antigen, Epithelial carcinoma, Histology, Metastasis.

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INTRODUCTION

Carcinoembryonic antigen (CEA) was primarily identified by Gold and Freedman in the year 1965. Initially, the antigen was derived from fetal tissues and was considered limited to embryos. However, it was found that CEA remains present in adult blood at shallow levels, between 2 to 4ng/ml.[1] Later on, raised levels of CEA were found in adenocarcinoma of the intestine, and CEA was marked as a diagnostic marker in gastrointestinal tumours.[2] It is also detected in human serum and large intestine expressed 50 to 70 mg CEA.[3] It is classified as one of the oncofetal antigens found in embryonic tissues normally, but most of the tumours have shown increased levels of CEA. Therefore, CEA is a diagnostic biomarker in many types of tumours. The CEA family consists of three branches: CEA-related cell adhesion molecules (CEACAM), pregnancy-specific glycoproteins (PSG) and pseudogenes.[4] CEA is also recognised for regulating the proliferation and differentiation of tumour cells. It is overtly expressed in many epithelium-based tumours and immune abnormalities.[5]

The CEA family members are involved in pleiotropic effects involving cell adhesion, immunity, insulin homeostasis, neovascularisation, pregnancy and carcinogenesis. High levels of CEA are correlated with higher grades of colon tumours.[6] CEA is an extensively used biomarker in diagnosing primary and metastatic colon and rectum tumours. CEA is widely raised in numerous types of cancer and aid in diagnosing suspected cases.[7,8]

Literature has also revealed that not every cancer presents with increased CEA levels.[9] The CEA levels are also significant after surgery to determine the recurrence of the disease. It was also acknowledged that the antigen concentration in body fluids, predominantly in blood, might assist in the care of patients with cancer.[10] The CEA levels can be clinically important ways to screen for tumours in asymptomatic individuals, diagnose tumours in suspected patients, determine the prognosis, and monitor the treatment

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response. To further comprehend the diagnostic nature of CEA as a biomarker, the present study aims to determine the sensitivity of CEA levels in different epithelial carcinomas presenting in tertiary care hospitals in Pakistan.

METHODOLOGY

The prospective longitudinal study was conducted at the Department of Medical Oncology of Jinnah Postgraduate medical centre, Karachi Pakistan, from May 201 to May 2020. The ethical approval was obtained from the Ethical Review Committee (NO.F.2-31-IRB/2019-GENL/20334/JPMC). The sample size was estimated using an Open Epi sample size calculator by taking statistics for elevated CEA level as 32.4%[10] among cancer patients.

Inclusion Criteria: Patients presenting with a confirmed diagnosis of epithelial carcinoma, aged more than 15 years and of either gender were enrolled in the study.

Exclusion Criteria: Patients with renal disorders and pregnancy were excluded from the study.

A non-probability consecutive sampling technique was employed for the selection of subjects and verbal informed consent was taken from all the included patients. The researcher noted data on socio-demographics and clinicopathological features in the questionnaire. The CEA levels in all the patients were measured using an ELISA kit. The CEA levels were classified as 0-3.0ng/mL, 3.1-5.0ng/mL, 5.1-10ng/mL and >10 ng/mL.2.[11]

Table: Comparison of Carcinoembryonic Antigen (CEA) Levels with Clinico-Pathological Features (n=206)

Variables	CEA Levels				*p*-value
	0-3.0 ng/mL	3.1-5.0 ng/mL	5.1-10.0 ng/mL	>10 ng/mL	
Age Groups					
<45 years	28 (35.4%)	18(22.8%)	8(10.1%)	25(31.6%)	0.064
≥45 years	27(21.3%)	25(19.7%)	24(18.9%)	51(40.2%)	
Gender					
Male	34(30.1%)	26(23%)	17(15%)	36(31.9%)	0.336
Female	21(22.6%)	17(18.3%)	15(16.1%)	40(43%)	
Histology					
Adenocarcinoma	43(24.4%)	34(19.3%)	25(14.2%)	74(42%)	0.001
Squamous Cell Carcinoma	12(40%)	9(30%)	7(23.3%)	2(6.7%)	
Grade					
I	7(30.4%)	6(26.1%)	3(13%)	7(30.4%)	
II	29(25%)	24(20.7%)	19(16.4%)	44(37.9%)	0.997
III	15(27.8%)	10(18.5%)	8(14.8%)	21(38.9%)	
IV	4 (30.8%)	3(23.1%)	2(15.4%)	4(30.8%)	
Clinical stage					
II	19(39.6%)	14(29.2%)	6(12.5%)	9(18.8%)	0.006
III	22(25.6%)	19(22.1%)	16(18.6%)	29(33.7%)	
IV	14(19.4%)	10(13.9%)	10(13.9%)	38(52.8%)	
Type of cancer					
Carcinoma Head and Neck	10(71.4%)	4(28.6%)	0	0	
Carcinoma Rectum	5(17.9%)	5(17.9%)	2(7.1%)	16(57.1%)	
Carcinoma Breast	7(46.7%)	2(13.3%)	4(26.7%)	2(13.3%)	
Carcinoma Sigmoid	9(36%)	5(20%)	3(12%)	8(32%)	
Carcinoma Lung	2(13.3%)	2(13.3%)	5(33.3%)	6(40%)	
Carcinoma Stomach	3(20%)	3(20%)	2(13.3%)	7(46.7%)	
Carcinoma Ascending	4(26.7%)	5(33.3%)	2(13.3%)	4(26.7%)	0.001
Carcinoma Colon	8(36.4%)	3(13.6%)	2(9.1%)	9(40.9%)	
Carcinoma Pancreas	2(22.2%)	0	2(22.2%)	5(55.6%)	
Carcinoma Anus	2(20%)	7(70%)	0	1(10%)	
Carcinoma Ovary	2(10%)	5(25%)	4(20%)	9(45%)	
Carcinoma Gall Bladder	0	1(20%)	1(20%)	3(60%)	
Carcinoma Oesophagus	1(10%)	0	4(40%)	5(50%)	
Carcinoma Endometrium	0	1(33.3%)	1(33.3%)	1(33.3%)	
Number of Mets					
No	46(31.9%)	35(24.3%)	23(16%)	40 (27.8%)	
1	9(18%)	7(14%)	6(12%)	28(56%)	0.003
2	0	1(10%)	3(30%)	6(60%)	
3	0	0	0	2(100%)	

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was set as the cut-off value for significance

RESULTS

The mean age of the included cancer patients was estimated as 47.30±14.10 years. About 47(22.8%) had hypertension (HTN), 41(19.9%) had diabetes mellitus (DM), and almost 100 patients had no comorbidity (48.5%). Out of 206, 89 patients had a history of blood transfusion (43.2%), and 94 had a history of surgery (45.6%). Most of the patients had adenocarcinoma 176(85.4%), Grade-2 116(56.3%) and Stage-III (n=86, 41.7%) of the tumour. Almost 50(24.3%) patients had one number of metastases, and the liver was the most frequent metastasis site 24(11.7%). Out of 206 patients, 80 were treatment naive 91(44.2%).

The majority of the patients had rectum carcinoma 28(13.59%), followed by Ca sigmoid 25(12.14%), Ca colon 22(10.68%) and Ca ovary 20(9.71%). The median CEA level was estimated as 5.80ng/mL ranging from 0.82 to 1000ng/mL. About 76 patients had CEA level >10ng/mL (36.9%), 55 had CEA level 0-3.0 ng/mL (26.7%), 43 had CEA level 3.1-5.0 ng/mL (20.9%), and 32 had CEA level 5.1-10.0 ng/mL (15.5%). The relationship was statistically significant between CEA levels and the histological type of tumour (p= 0.001). Of the patients with rectum carcinoma, the majority had CEA level >10ng/mL 16(57.1%), while in patients with CA sigmoid, 9(36%) patients had CEA level 0-3.0 ng/mL and 8(32%) had CEA level >10 ng/mL. The proportions of CEA levels differ significantly across different epithelial carcinomas (p=0.001). Among patients with several Mets as 1, 28(56%) had a CEA level>10 ng/mL, whereas in patients with several Mets as 2, 6(60%) had a CEA level>10 ng/mL. A statistically significant association was found between the number of Mets and CEA levels (p=0.003) (Table).

DISCUSSION

The results of the present study showed that out of 206 participants, the highest carcinoembryonic level was expressed in rectal cancer. Many kinds of research have been conducted that CEA levels are used to diagnose colorectal cancer [3,6,10-12]. Leusch *et al*. reported a strong correlation between high levels of serum CEA and the tumour grade in colorectal cancer.[13] Campos-da-Paz *et al*. also agreed that elevated CEA level is a biomarker of many other types of cancer, not only for colorectal cancer. It can also be used as a biomarker for metastatic cancers.[14] Other studies have also reported the significance of CEA levels in terms of non-cancerous disease, for example, cirrhosis, rectal polyps, emphysema, inflammation, and peptic ulcer.[15]

The present study findings agree with Hao *et al*.[6] study. Further, he elaborated that the CEA level could be a marker of ongoing bodily injury. The CEA levels are detected in body fluids and biopsy tissues.[16] Epithelial injury is also one of the causes to increase CEA levels that leads to tumorigenesis and tissue fibrosis. The raised CEA levels were also associated with ageing, smoking and different comorbid such as diabetes and hypertension. This explains that CEA levels in the body are elevated whenever the body undergoes a state of inflammation and pathological or physiological injury.[17,18]

One study assessed the significance of serum tumour markers in gastric cancer patients. The review showed that CEA was associated with TNM staging, and increased CEA levels were expressed in liver metastases.[19] Similar results are found in the present study, showing that CEA levels are statistically significant with the metastasis of the tumour. The current study also revealed that CEA levels are associated significantly with histology and type of cancer. The adenocarcinomas and squamous cell carcinomas are more likely to have raised CEA levels. Some studies also confirm that CEA levels, when detected in the early stages of the disease, help assess the disease's survival and prognosis. The CEA levels are also recognised in assessing treatment response.[8] Within the limitation of this study, we recommend that further studies be conducted in this context. The studies should define the survival and prognosis of the disease in the Pakistani population.

CONCLUSION

In conclusion, the study evaluated sensitivity levels of carcinoembryonic antigen. The results showed that rectal cancer profoundly expressed CEA levels, followed by sigmoid, colon, and ovarian cancer. Moreover, there is a significant association among CEA levels, histology, type and metastasis of cancer. Therefore, we recommend frequent screening of CEA levels in every suspected patient to increase the survival and prognosis of diseases.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

MH & GH: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

MD & RI: Study design, drafting the manuscript, data interpretation, approval of the final version to be published.

AH & SK: Concept, critical review, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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