Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/zyy8dz85

"ROLE OF INFLAMMATORY MARKERS CRP AND FERRITIN IN PANCREATIC DUCTAL ADENOCARCINOMA"

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INTRODUCTION

Being aggressively metastasizing to difficult to detect in early stages, pancreatic ductal adenocarcinoma has an extremely high mortality rate. With resistance to many anti cancer drugs to limitations on surgical resection, PDAC needs urgent measures to diagnose as well as monitor progression . Tumer size, metastasis staging, perinural spread are the prognostic factors determining the outcomes in PDAC.

Various molecular markers are potential predictors but have less practical use. These markers are expensive, required expert labs and take time. Hence is the need for cost effective , early and non-invasive biomarkers.

To formulate management plan, it is crucial to identify prognostic markers. Easily available and reliable markers may help in avoiding unnecessary investigations. No comprehensive study is done yet to consider inflammatory markers in diagnosis of PDAC . This study was aimed to evaluate the role of CRP, ferritin as baseline reliable markers in overall management of PDAC.

There is urgent requirement of reliable biomarker other than CA 19-9 to monitor detection and treatment of pancreatic cancer patients. Previous epidemiological reports have shown a large association of chronic pancreatitis, with higher risk of PDAC. On a molecular basis, inflammation promote oncogene activity and inhibit cancer cell aging.

MATERIAL AND METHODS

This retrospective study was done after obtaining approval from institutional Ethical committee .We included PDAC patients between Nov.2023 to Oct. 2024 . The diagnosis was done by tissue biopsy, cytology or surgical excision. We excluded other cancer patients and patients with abnormal renal function and abnormal liver function.

The study population included 100 cases diagnosed with pancreatic adenocarcinoma between Nov.2023 to Oct. 2024 and 100 controls with an even sex distribution.

Baseline characteristic was obtained from the participants. Demographic baseline data included Age , Sex , BMI, Smoking , alcohol, Diabetes mellitus.

Table no. 1 Baseline characteristics in cases and controls

Variable	(n=100) PDAC	(n=100) Non PDAC	P Value
Age	54	54	0.7
Male	28	35	0.13
BMI Underweight< 18.4	1	2	0.25
Normal 18.5-24.9	24	25	
Overweight 25-29.9	22	20	
Obese >30	11	15	

MEASURED PARAMETERS

Laboratory data included CRP, Ferritin, Hemogram and CA 19-9 levels.

STATICAL ANALYSIS

Data was analysed by IBM SPSS software continuous variables with normal distribution was assessed with unpaired t Test. P Value <0.05 were considered statistically significant.
We considered P<0.05 as statically significant. SPSS version 20.0 for windows was used for the analysis.

RESULTS

Total 200 participants were included in the study.

Table no. 1 Basline patient Characteristics

Characteristic	Number (%)
All	200 (100%)
Age years	
<70	140 (70%)
≥70	60(30%)
Sex	
Male	132 (66%)
Female	68 (34%)
DM	
Yes	80 (40%)
No	120 (60%)
Tumour status	
Locally advanced	35 (17%)
Metastatic	165(83%)
BMI Underweight< 18.4	
Normal 18.5-24.9	24
Overweight 25-29.9	22
Obese >30	11

The mean age of patient was 58.3±8.6 years.

Table no. 2 Comparison of CRP between Cases and Controls

Group	Mean	Std Dev	Min	Max	T-statistic	P-value
Case	20.47	4.92	8.83	34.83	38.26	0.0
Control	3.0	1.02	0.75	5.33		

Table no. 3 Comparison of Ferritin between Cases and Controls

Group	Mean	Std Dev	Min	Max	T-statistic	P-value
Case	588.12	139.41	166.76	969.73	37.64	0.0
Control	100.71	29.2	30.92	169.01		

In this study, the inflammatory markers CRP and ferritin were compared between pancreatic ductal adenocarcinoma (PDAC) patients and healthy controls. The results show a highly significant elevation of both markers in the patient group, indicating the presence of a strong systemic inflammatory response commonly associated with pancreatic malignancy.

CRP in PDAC

The mean CRP level in cases was 20.47 mg/L, which was markedly higher than the 3.0 mg/L observed in the control group. This difference was statistically significant (p=0.0), with a very high t-statistic (38.26), indicating a strong association between elevated CRP and the presence of PDAC.

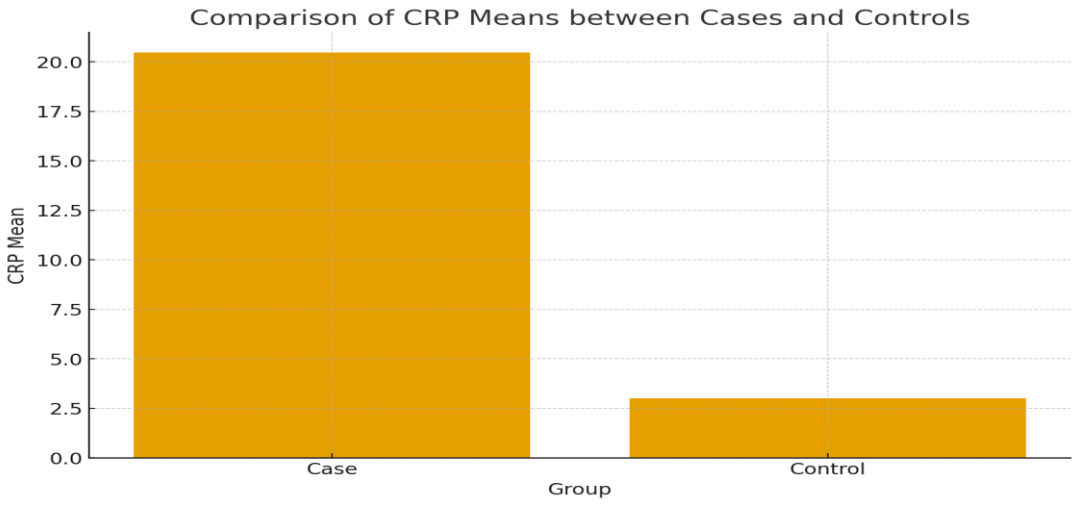
This finding supports previous literature describing CRP as an acute-phase reactant produced in response to cytokines such as IL-6, IL-1β, and TNF-α. These cytokines are abundantly released in the tumor microenvironment of pancreatic cancer. Elevated CRP is known to correlate with,Tumor burden,Advanced disease stage,Poor overall survival,Cancer cachexia and systemic inflammation. Given that a majority of the patients in this study were metastatic, the elevated CRP may also reflect disease aggressiveness. Therefore, CRP has the potential to serve not just as a diagnostic adjunct but also as a prognostic indicator for PDAC

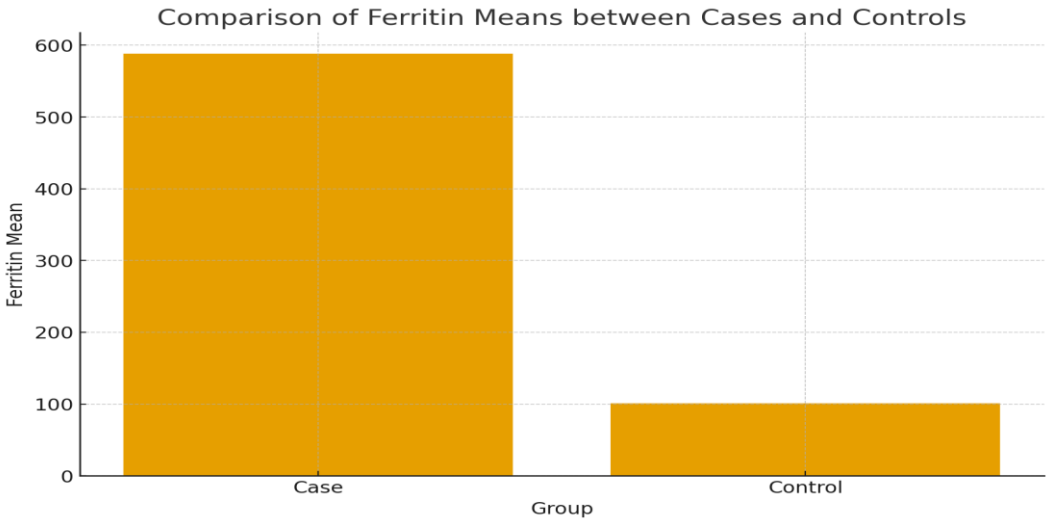
Ferritin in PDAC

A striking elevation in serum ferritin was also observed. PDAC cases had a mean ferritin level of 588.12 ng/mL, while controls had 100.71 ng/mL, with a significant p-value (0.0) and t-statistic (37.64).

Ferritin acts not only as an iron storage protein but also as an inflammatory marker. High ferritin levels in cancer patients can reflect,Altered iron metabolism, Increased oxidative stress,Tumor-induced inflammatory response, Iron sequestration by macrophages within the tumor microenvironment

Studies have reported that ferritin promotes tumor proliferation through iron-dependent metabolic pathways. The substantial standard deviation in cases (139.41) may indicate heterogeneity in tumor burden or metabolic activity across individuals.





DISCUSION

Long term chronic inflammation is key etiological factor in cancer progression. This study has been formulated to study comparative levels of CRP and Ferritin in Pancreatic Cancer and age and sex matched controls.

Increased secretion of inflammatory cytokines IL6 in turn causing values of CRP and inflammatory response to tumor antigen mifht explain increase in CRP in Pancreatic cancer patients. A study by Mistsung et al found increased CRP indicative of aggressiveness of Pancreatic cancer.

Veno et al (2000) found prognostic significance of elevated CRP in metastatic pancreatic cancer patients. A smaller study in Japan demonstrated poor prognosis in post operative patients with elevated CRP levels. In contrast, Garcea et al (2012) reported no association between plasma CRP levels and Tumour recurrence. In this study, we have found significant increase in plasma CRP levels in patients with pancreatic ductal adenocarcinoma than normal.

Iron addiction or Feritinophagy is the underlying mechanism in ensuring sufficient iron to the cancer cell.

Many studies have shown high levels of ferritin had prognostic significance in poor overall survival in pancreatic ductal adenocarcinoma patients.

Kim Lestral et al found serum ferritin as independent prognostic factor in inoperable cases of pancreatic ductal adenocarcinoma.

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Overall prognosis for PDAC is still poor though multi modality management exists.

Surgical resection of borderline resectable PDAC is a dilemma as early recurrence to unnecessary surgery are the concequences.

Thus pre-operative Cost effective, non invasive, inflammatory biomarkers are needed in management of PDAC.

CONCLUSION

This study has demonstrated the significant role of **CRP and ferritin as predictable inflammatory markers in patients with pancreatic ductal adenocarcinoma (PDAC)**. Elevated levels of these markers among PDAC cases, in comparison to controls, highlight the presence of systemic inflammation associated with tumor burden and disease progression.

Furthermore, the **high CRP values** reflect acute-phase inflammatory response, which is often linked with tumor aggressiveness and poor prognosis in PDAC. Similarly, **elevated ferritin levels** may

indicate increased oxidative stress, altered iron metabolism, and cancer-associated inflammation, all of which are commonly observed in pancreatic malignancies.

The findings suggest that **CRP and ferritin may serve as useful, cost-effective, and easily measurable biomarkers** for early identification of inflammatory changes in PDAC, assessing disease severity,monitoring response to treatment, and possibly predicting overall prognosis.

However, larger studies with long-term follow-up are required to validate these markers as strong prognostic indicators and to explore their potential inclusion in **routine diagnostic and monitoring protocols** for pancreatic ductal adenocarcinoma.

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