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Original Article

Elevated CA19-9 in IgG4-Related Autoimmune Pancreatitis: A Single-Center Retrospective Cohort Study

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ABSTRACT

Background: IgG4-related autoimmune pancreatitis (AIP) may mimic pancreatic malignancy when CA19-9 is elevated. This study assessed the prevalence and clinical relevance of CA19-9 elevation in IgG4-related AIP.
Methods: A one-year retrospective cohort study was conducted at SLN Medical College and Hospital, Koraput, including 100 patients with IgG4-related AIP. Elevated CA19-9 was defined as >37 U/mL.
Results: CA19-9 elevation was present in 60.0% of patients. Elevated CA19-9 was significantly associated with higher serum IgG4, bilirubin, obstructive jaundice, biliary stricture, and ERCP stenting. CA19-9 correlated positively with serum IgG4 and bilirubin. Among steroid-treated patients, CA19-9 declined significantly, with normalization in 72.7% of those with elevated baseline values.
Conclusion: CA19-9 elevation is common in IgG4-related AIP and is strongly linked to cholestasis and biliary involvement. Its post-steroid decline supports its use as an adjunctive monitoring marker, not as a standalone malignancy marker.

Keywords*: Autoimmune pancreatitis; IgG4-related disease; CA19-9; cholestasis; steroid response.*

INTRODUCTION

Autoimmune pancreatitis (AIP) is a unique type of chronic pancreatitis that is characterized by inflammation of the pancreas that is mediated by the immune system. It is clinically important because it may closely mimic pancreatic malignancy and commonly presents with pancreatic enlargement, obstructive jaundice, abdominal pain, narrowing of the pancreatic duct and sometimes a focal pancreatic mass. A significant breakthrough in the understanding of type 1 AIP as an IgG4-related disease was the discovery of significantly raised serum IgG4 levels in patients with sclerosing pancreatitis [2]. IgG4-related disease is now considered a systemic fibro-inflammatory disorder that can involve the pancreas, biliary tract, salivary glands, retroperitoneum, kidneys, lymph nodes, and other organs [3].

Diagnosis of IgG4-related AIP is difficult as the clinical, radiological and biochemical characteristics are similar to pancreatic ductal adenocarcinoma. To improve diagnostic accuracy, the International Consensus Diagnostic Criteria for AIP include pancreatic imaging, ductal imaging, serum IgG4 levels, other-organ involvement, histopathology, and response to steroid therapy [4]. The Mayo Clinic HISORt criteria also highlight the importance of histology, imaging, serology, other-organ involvement, and steroid responsiveness in the diagnosis [5]. These structured criteria are important because incorrect diagnosis can result in either unnecessary pancreatic surgery or delayed diagnosis of malignancy.

Carbohydrate antigen 19-9 (CA19-9) is a serum tumour marker that is commonly used in the diagnosis of suspected pancreaticobiliary malignancy, especially pancreatic cancer [6]. However, CA19-9 is not malignancy-specific and can also be raised in other benign conditions, including obstructive jaundice, cholangitis, pancreatitis, liver disease, pulmonary disease, diabetes mellitus and other inflammatory disorders [7]. In IgG4-related AIP, CA19-9 may be elevated because of pancreatic inflammation, biliary obstruction, IgG4-related sclerosing cholangitis, or cholestasis, which can lead to a diagnostic dilemma between benign inflammatory disease and pancreatic cancer.

Several studies have indicated that CA19-9 should not be used alone to assess suspected AIP. The combination of serum IgG4 and CA19-9 is more useful for diagnostic discrimination between AIP and pancreatic carcinoma than either marker alone [8]. More recent biomarker strategies, such as immunoglobulin G glycosylation patterns, have also been highly accurate in distinguishing autoimmune pancreatitis from pancreatic ductal adenocarcinoma [9]. More recent evidence has specifically pointed to the fact that there may be significant elevation of CA19-9 in IgG4-related autoimmune pancreatitis, which further emphasizes the need for careful interpretation of CA19-9 in these patients [10].

Steroid responsiveness is an important clinical feature of IgG4-related AIP. Decrease of CA19-9 after proper treatment can be indicative of an inflammatory rather than malignant etiology of marker elevation, particularly if there is clinical, biochemical, and radiological improvement. Thus, the assessment of the CA19-9 elevation and its association with IgG4-related AIP is clinically useful for diagnosis and follow-up.

The present single center retrospective cohort study was conducted in Saheed Laxman Nayak Medical College and Hospital, Koraput, for a period of one year with 100 patients to evaluate the role of raised CA19-9 in IgG4 related autoimmune pancreatitis. This study could contribute to the regional evidence of the frequency and clinical significance of CA19-9 elevation in IgG4-related AIP and could aid in more conservative interpretation of tumour-marker elevation in patients with pancreaticobiliary symptoms.

OBJECTIVES

1. To estimate the prevalence of elevated CA19-9 levels among patients diagnosed with IgG4-related autoimmune pancreatitis.
2. To assess the association between CA19-9 levels and serum IgG4 levels in patients with autoimmune pancreatitis.
3. To evaluate the change in CA19-9 levels following treatment, particularly after steroid therapy, and its usefulness in monitoring disease response.

METHODS

Study design and setting

This single-center retrospective cohort study was conducted at SLN Medical College and Hospital, Koraput, over a one-year period. Medical records of patients diagnosed with IgG4-related autoimmune pancreatitis were reviewed. The study included 100 patients who had available baseline serum IgG4 and CA19-9 measurements.

Study population

Patients were included if they had a documented diagnosis of IgG4-related autoimmune pancreatitis based on compatible clinical presentation, pancreatic imaging findings, elevated serum IgG4 levels, exclusion of malignancy where clinically indicated, and/or response to steroid therapy. Patients with confirmed pancreaticobiliary malignancy, unavailable baseline CA19-9 values, or insufficient clinical or laboratory data were excluded.

Data collection and variables

Demographic, clinical, laboratory, imaging, treatment, and follow-up data were extracted from hospital records. Variables included age, sex, baseline serum IgG4, baseline CA19-9, total bilirubin, obstructive jaundice, biliary stricture, ERCP stenting, pancreatic imaging pattern, steroid therapy, follow-up CA19-9, follow-up serum IgG4, duration of follow-up, and clinical response.

Pancreatic imaging patterns were categorized as diffuse pancreatic enlargement, focal pancreatic head enlargement, or segmental pancreatic enlargement. Clinical response after steroid therapy was classified as complete, partial, or suboptimal based on documented symptomatic, biochemical, and radiological improvement.

Definitions and outcomes

Baseline CA19-9 was defined as the value measured at diagnosis or before initiation of steroid therapy. Elevated CA19-9 was defined as >37 U/mL. Patients were grouped as normal CA19-9, ≤37 U/mL, or elevated CA19-9, >37 U/mL.
The primary outcome was the prevalence of elevated baseline CA19-9. Secondary outcomes were the association between CA19-9 and serum IgG4, the relationship of CA19-9 with cholestatic features, and the change in CA19-9 following steroid therapy. CA19-9 normalization was defined as a follow-up value ≤37 U/mL among patients with elevated baseline CA19-9.

Statistical analysis

Continuous variables were summarized as mean ± standard deviation or median with interquartile range, as appropriate. Categorical variables were presented as n (%). Group comparisons were performed using Welch's t-test or the Mann–Whitney U test for continuous variables and the chi-square test for categorical variables.

Correlation between baseline serum IgG4 and CA19-9 was assessed using Pearson and Spearman correlation analyses. Logistic regression was used to estimate associations with elevated CA19-9, including serum IgG4, bilirubin, obstructive jaundice, and biliary stricture. Paired baseline and follow-up CA19-9 values after steroid therapy were compared using paired t-test and Wilcoxon signed-rank test. Change in CA19-9 elevation status after treatment was assessed using McNemar's test. A p-value <0.05 was considered statistically significant.

RESULTS

Study population and prevalence of elevated CA19-9

The baseline profile of the study cohort according to CA19-9 status is summarized in Table 1. CA19-9 elevation was observed in 60 (60.0%) patients, with an estimated prevalence of 60.0% (95% CI, 50.2%–69.1%). Overall, the cohort showed a middle-aged distribution with male predominance, elevated serum IgG4 levels, and frequent biliary involvement.

Patients with elevated CA19-9 had higher serum IgG4 and bilirubin levels than those with normal CA19-9. The main clinical distinction between groups was biliary involvement: obstructive jaundice, biliary stricture, and ERCP stenting were all more common among patients with elevated CA19-9. In contrast, age, sex distribution, and pancreatic imaging pattern did not differ significantly between CA19-9 groups.

Table 1. Baseline characteristics according to CA19-9 status

Characteristic	Overall N=100	Normal CA19-9 n=40	Elevated CA19-9 n=60	Test statistic	p-value
Age, years, mean ± SD	51.5 ± 11.4	51.5 ± 12.4	51.5 ± 10.8	t=−0.03	0.978
Male sex, n (%)	68 (68.0%)	23 (57.5%)	45 (75.0%)	χ^2=2.62	0.105
Baseline serum IgG4, mg/dL, median (IQR)	367.1 (275.4–458.2)	329.1 (260.1–429.2)	380.3 (316.6–489.3)	U=887.0	0.028
Baseline CA19-9, U/mL, median (IQR)	43.8 (26.7–78.4)	24.6 (17.7–29.0)	63.2 (49.4–127.5)	U=0.0	<0.001
Total bilirubin, mg/dL, median (IQR)	4.0 (1.5–6.7)	1.6 (1.1–3.5)	5.3 (3.4–6.9)	U=577.5	<0.001
Obstructive jaundice, n (%)	52 (52.0%)	8 (20.0%)	44 (73.3%)	χ^2=25.26	<0.001
Biliary stricture, n (%)	55 (55.0%)	14 (35.0%)	41 (68.3%)	χ^2=9.47	0.002
ERCP stenting required, n (%)	17 (17.0%)	1 (2.5%)	16 (26.7%)	χ^2=8.29	0.004
Pancreatic imaging pattern, n (%)				χ^2=1.02	0.602
Diffuse pancreatic enlargement	42 (42.0%)	19 (47.5%)	23 (38.3%)	—	—
Focal pancreatic head enlargement	46 (46.0%)	16 (40.0%)	30 (50.0%)	—	—
Segmental pancreatic enlargement	12 (12.0%)	5 (12.5%)	7 (11.7%)	—	—

CA19-9 elevation was defined as >37 U/mL. Continuous variables were compared using Welch's t-test or the Mann–Whitney U test; categorical variables were compared using the chi-square test

Association between serum IgG4, cholestasis, and CA19-9

The relationship between baseline CA19-9, serum IgG4, and cholestatic features is presented in Table 2 and Figure 1. Baseline serum IgG4 showed a positive association with CA19-9, and increasing IgG4 remained associated with elevated CA19-9 after adjustment for bilirubin.

Markers of cholestasis showed a stronger relationship with CA19-9 than serum IgG4 alone. This pattern suggests that CA19-9 elevation in IgG4-related autoimmune pancreatitis should be interpreted in the context of biliary obstruction and cholestatic biochemistry rather than considered an isolated marker of malignancy.

Table 2. Association of baseline CA19-9 with serum IgG4 and cholestasis markers

Analysis	Estimate	Test statistic	p-value
Baseline IgG4 vs baseline CA19-9	Pearson r=0.371	t=3.95; df=98	<0.001
Baseline IgG4 vs baseline CA19-9	Spearman ρ=0.358	Rank correlation	<0.001
Serum IgG4 per 100 mg/dL increase	OR=1.45; 95% CI, 1.06–1.98	Wald z=2.30	0.021
Serum IgG4 per 100 mg/dL increase, adjusted for bilirubin	aOR=1.43; 95% CI, 1.01–2.02	Wald z=2.02	0.044
Total bilirubin vs baseline CA19-9	Spearman ρ=0.560	Rank correlation	<0.001
Total bilirubin per 1 mg/dL increase	OR=1.47; 95% CI, 1.22–1.77	Wald z=4.01	<0.001

Obstructive jaundice	OR=11.00; 95% CI, 4.20–28.82	Wald z=4.88	<0.001
Biliary stricture	OR=4.01; 95% CI, 1.72–9.35	Wald z=3.21	0.001

ORs represent the odds of elevated CA19-9 >37 U/mL. aOR, adjusted odds ratio; CI, confidence interval.

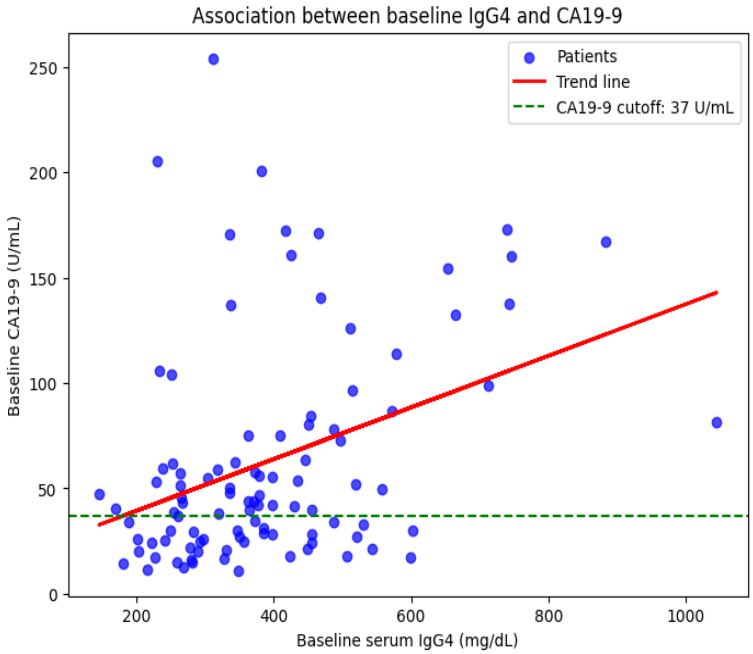

Figure 1. Association between baseline serum IgG4 and CA19-9 levels.
The scatterplot demonstrates a positive association between serum IgG4 and CA19-9. The dashed horizontal line represents the CA19-9 cutoff of 37 U/mL.

Change in CA19-9 following steroid therapy
Treatment response is summarized in Table 3 and Figure 2. Steroid therapy was administered to 90 (90.0%) patients, with follow-up CA19-9 measured at a median of 12 weeks. CA19-9 levels declined significantly after treatment, with concordant reduction in serum IgG4.

Among steroid-treated patients with elevated baseline CA19-9, normalization to ≤37 U/mL occurred in 40 of 55 (72.7%) patients. The reduction in CA19-9 paralleled clinical response in most patients, supporting its utility as an adjunctive follow-up marker when interpreted alongside symptoms, imaging, serum IgG4, and bilirubin. No malignancy was identified during workup and follow-up evaluation.

Table 3. Change in CA19-9 and serum IgG4 following steroid therapy

Parameter	Baseline	Follow-up	Change/response	Test statistic	p-value
CA19-9, U/mL, median (IQR)	46.3 (27.2–83.6)	11.8 (7.8–22.9)	Absolute reduction: 32.6 (19.1–64.7)	W=0.0	<0.001
CA19-9, U/mL, mean ± SD	65.8 ± 53.9	18.9 ± 17.6	Mean reduction: 46.9 ± 40.1	t=11.09	<0.001
Elevated CA19-9 status, n (%)	55 (61.1%)	15 (16.7%)	Normalized: 40/55 (72.7%; 95% CI, 59.8–82.7)	McNemar χ^2=38.03	<0.001
Serum IgG4, mg/dL, median (IQR)	367.1 (271.1–455.3)	157.7 (129.5–207.1)	Decline after steroid therapy	W=0.0	<0.001
Percentage reduction in CA19-9	—	—	Mean: 69.7 ± 13.6%; median: 71.4% (63.3–78.9)	Descriptive	—
Clinical response, n (%)	—	—	Complete: 75 (83.3%); partial: 13 (14.4%); suboptimal: 2 (2.2%)	Descriptive	—

Analysis limited to patients who received steroid therapy, n=90. CA19-9 elevation was defined as >37 U/mL.

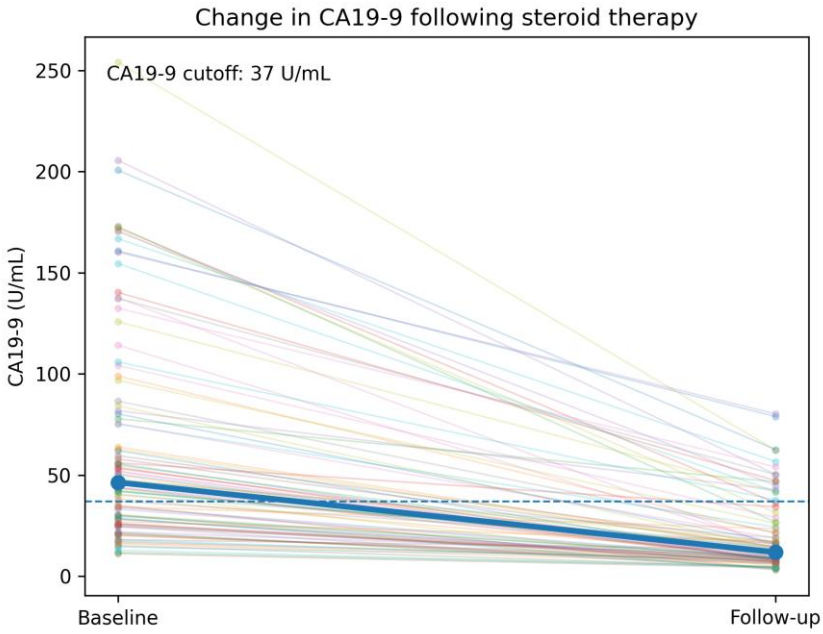

Figure 2. Change in CA19-9 levels following steroid therapy.
Paired values show significant reduction in CA19-9 from baseline to follow-up. The dashed horizontal line represents the CA19-9 cutoff of 37 U/mL.

DISCUSSION

In this single-center retrospective cohort of 100 patients with IgG4-related autoimmune pancreatitis, CA19-9 was elevated in 60.0% of patients, suggesting that CA19-9 elevation is not an uncommon exception in IgG4-related AIP. Patients with high CA19-9 levels were significantly more likely to have high serum IgG4, high bilirubin, obstructive jaundice, biliary stricture, and ERCP stenting than patients with normal CA19-9. The highest correlation was observed with cholestatic and biliary parameters, especially obstructive jaundice, total bilirubin and biliary stricture. CA19-9 levels were significantly reduced after steroid treatment, and 72.7% of steroid-treated patients with elevated baseline CA19-9 levels normalized. These results indicate that the elevation of CA19-9 in IgG4-related AIP is strongly associated with inflammatory involvement of the pancreas and biliary tract and is frequently reversible following treatment.

The high rate of CA19-9 elevation in the current study should be viewed in the light of the known limitations of CA19-9 as a tumor marker. Ballehaninna and Chamberlain reported a sensitivity of about 79%–81% and specificity of 82%–90% for pancreatic cancer in symptomatic patients, but they also noted that CA19-9 is elevated in benign pancreaticobiliary disorders, especially in the presence of obstructive jaundice [11]. This directly contributes to the current observation that CA19-9 was highly correlated with bilirubin and jaundice and not a stand-alone marker of malignancy. The median bilirubin was significantly higher in the elevated CA19-9 group, and obstructive jaundice was a significant risk factor for CA19-9 elevation, which further emphasizes the importance of interpreting CA19-9 in the context of cholestasis.

CA19-9 has also been reported to be elevated in non-pancreaticobiliary benign conditions. Kim et al. studied patients with elevated CA19-9 who did not have malignant or pancreatobiliary disease and concluded that non-malignant causes such as hepatic, pulmonary, gynecological, endocrine, and inflammatory diseases can also cause CA19-9 elevation [12]. Their study population was different from ours, but the important anchor is that CA19-9 is biologically non-specific and can rise in inflammatory or obstructive conditions. The present study applies this concept to IgG4-related AIP, in which inflammatory pancreatic enlargement, biliary stricture, and IgG4-related sclerosing cholangitis may lead to an increase in CA19-9.

The correlation between serum IgG4 and CA19-9 in the present study is also clinically significant. There was a positive correlation between baseline serum IgG4 and CA19-9, and IgG4 was still associated with high CA19-9 after adjusting for bilirubin. This indicates that the elevation of CA19-9 in IgG4-related AIP may be related to cholestasis and immune-mediated disease burden. van Heerde et al. showed that neither CA19-9 nor IgG4 alone was accurate enough to distinguish AIP from pancreatic carcinoma, but the combination of CA19-9 <74 U/mL and IgG4 >1.0 g/L distinguished AIP from pancreatic carcinoma with 94% sensitivity and 100% specificity [13]. The median CA19-9 in the patients with elevated levels was 63.2 U/mL, which falls within the moderate elevation range in which AIP is still a strong possibility, particularly when serum IgG4 is elevated and malignancy has been reasonably excluded.

Chang et al. investigated the relationship between focal-type AIP and pancreatic cancer and demonstrated that the combination of IgG4 and CA19-9 enhanced the diagnostic accuracy. ROC-derived cutoffs of IgG4 and CA19-9 were useful in their study, and the combination of IgG4 >280 mg/dL and CA19-9 <85 U/mL had a diagnostic accuracy of 85.6% for distinguishing AIP from pancreatic cancer [14]. This is especially important for the current cohort, as 46.0% of patients had focal pancreatic head enlargement, which is a common finding that often suggests malignancy. Our results confirm the same clinical message: elevated CA19-9, especially when accompanied by elevated IgG4 and steroid responsiveness, should not be assumed to represent pancreatic cancer.

Recent comparative studies using newer biomarkers also underscore the shortcomings of traditional markers. Shih et al. compared serum IgG glycosylation profiles in 86 AIP patients, 115 pancreatic ductal adenocarcinoma patients, and 57 controls. Their glycosylation-based model was able to distinguish AIP from pancreatic ductal adenocarcinoma with 93.8% accuracy, 94.6% sensitivity, and 92.9% specificity [15]. The implication for the current study is that in diagnostically challenging cases, particularly in the presence of focal pancreatic enlargement and jaundice, CA19-9 and IgG4 alone may not be enough. IgG glycosylation was not evaluated in our cohort, but our results suggest that multimodal interpretation is necessary and not only based on CA19-9.

The recent report by Farrukh et al. is particularly relevant to the current study as it focused on the diagnostic dilemma of significant CA19-9 elevation in IgG4-related autoimmune pancreatitis [16]. They noted that the elevation of CA19-9 may be seen in IgG4-related AIP and IgG4-related sclerosing cholangitis, which may be confused with pancreaticobiliary malignancy [16]. In our study, 60.0% of patients had elevated CA19-9 levels, and the elevated group had significantly higher rates of obstructive jaundice, biliary stricture, and ERCP stenting. This offers cohort-level support for the case-based concern raised by Farrukh et al., especially in patients with cholestatic features.

One of the most important findings of this study is the significant decrease in CA19-9 following steroid therapy. In steroid-treated patients, median CA19-9 dropped from 46.3 U/mL to 11.8 U/mL, with 72.7% of patients with elevated baseline CA19-9 normalizing after steroid treatment. Kamisawa et al. suggested that corticosteroid therapy should be considered for symptomatic AIP, especially in patients with obstructive jaundice, abdominal symptoms, and extrapancreatic lesions, and that steroid responsiveness is an important therapeutic characteristic of AIP [17]. The present study further suggests that CA19-9 can also significantly decrease with steroid-induced disease control, and thus can be used as an adjunctive follow-up marker in conjunction with symptoms, bilirubin, serum IgG4, and imaging.

The treatment response pattern in our cohort is also similar to long-term multicenter outcome data. Hart et al. found that 99% of patients with type 1 AIP treated with steroids went into clinical remission, and that 71% of jaundiced type 1 AIP patients required biliary stenting. They also noted that relapse was more likely to occur in type 1 AIP and was especially common in those with IgG4-related sclerosing cholangitis [18]. In the current study, 90.0% of patients were treated with steroid therapy, 83.3% of patients had complete clinical response, and 17.0% required ERCP stenting. Although our stenting rate was lower than that reported by Hart et al., the direction of association was similar: biliary involvement identified a clinically more complex subgroup and was strongly linked to CA19-9 elevation.

The clinical implication of this study is that CA19-9 should be interpreted as a contextual marker in IgG4-related AIP. Raised CA19-9 in a patient with pancreatic enlargement, jaundice and biliary stricture should be carefully evaluated for malignancy, but should not be used alone as a diagnostic tool for cancer. CA19-9 elevation may be a marker of inflammatory pancreaticobiliary disease in patients with elevated serum IgG4, compatible imaging, and subsequent steroid responsiveness. In this cohort, the substantial post-treatment decrease in CA19-9 levels suggests that it can be used as a monitoring marker, but in conjunction with clinical response, bilirubin, IgG4, and imaging.

There are limitations to this study. It was a retrospective study, which could have led to selection and documentation bias. Being a single-center study, the findings may not be generalizable to all populations. Not all patients had a histopathological confirmation, which is a reflection of real-world practice but reduces diagnostic certainty. Follow-up was relatively brief, and long-term risk of relapse, recurrent CA19-9 elevation, and subsequent malignancy could not be fully evaluated. The study has its limitations, but it offers valuable regional evidence from a tertiary-care center in Koraput and contributes to the literature that shows that elevation of CA19-9 is common in IgG4-related AIP, is associated with cholestasis, and is often reversible following steroid therapy.

CONCLUSION

The present study demonstrates that elevated CA19-9 in IgG4-related autoimmune pancreatitis is strongly associated with biliary obstruction and serum IgG4 elevation, and that CA19-9 levels significantly decline after steroid therapy. These findings reinforce that CA19-9 should not be used as a standalone marker of malignancy in suspected AIP. Instead, it should be interpreted through an integrated diagnostic framework incorporating serum IgG4, bilirubin, pancreaticobiliary imaging, exclusion of malignancy, and treatment response.

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