

# Determinants of Recurrent Acute Pancreatitis: Findings from a Cross-sectional Study in South India

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## Abstract

**Background:** Recurrent acute pancreatitis (RAP) is a major clinical issue that may progress to chronic pancreatitis. While global data exist, evidence from South India is limited, where demographic and lifestyle patterns differ. **Objectives:** To identify demographic, clinical, etiological, lifestyle and outcome-related factors associated with RAP amongst patients at a tertiary care hospital in Kerala. **Materials and Methods:** A cross-sectional study was conducted in the Department of General Surgery, Government Medical College, Thrissur, including 203 RAP patients over 12 months. Data were collected using a structured questionnaire and analysed with SPSS v16. Descriptive statistics and univariate/multivariate analyses were performed. **Results:** The mean age was  $45.1 \pm 10.6$  years, with most cases between 30 and 50 years. RAP showed a striking male predominance (97.5%) and 75.9% were married. Alcohol consumption (85.2%) and smoking (56.2%) were the major lifestyle factors, with most alcohol users reporting daily intake for >10 years. Most had normal body mass index (77.3%) and disease duration was 2–5 years in 63.1%. Interstitial pancreatitis was the predominant radiological finding (92.1%). Alcohol was the leading aetiology (85.2%), followed by biliary causes (11.3%). Nearly all patients (99.0%) were managed conservatively, and most episodes were mild (Glasgow score <3 in 92.6%). Hospital stay was usually 5–10 days (68.0%). Almost all patients (98.5%) were aware of their disease, but sustained abstinence from alcohol was rare. **Conclusion:** RAP in Kerala predominantly affects middle-aged men, strongly linked to alcohol and smoking. Targeted preventive strategies, including structured de-addiction, smoking cessation and lifestyle interventions, are essential to reduce recurrence and disease burden.

**Keywords:** Alcohol, cross-sectional study, Kerala, recurrent acute pancreatitis, risk factors, smoking

## INTRODUCTION

Acute pancreatitis (AP) is a significant gastrointestinal disorder associated with severe pain, frequent hospitalisations and substantial healthcare costs. A subset of patients experience recurrent acute pancreatitis (RAP), defined as two or more distinct episodes of AP separated by at least 3 months of complete recovery in a morphologically normal pancreas.<sup>[1]</sup> Initially described in the Marseille classification<sup>[2]</sup> and later incorporated into the TIGAR-O system,<sup>[3]</sup> RAP remains clinically distinct from chronic pancreatitis, although its progression to chronic disease is incompletely understood.<sup>[4,5]</sup>

The global prevalence of pancreatitis in 2017 was 76.2 per 100,000 population, with an incidence of 20.6 per 100,000. While overall incidence is declining, South Asian countries, including India, report increasing disease burden within younger populations.<sup>[6]</sup> In India, AP occurs at a rate of 7.9 per 100,000 (8.6 in men; 8.0 in women),<sup>[7]</sup> with southern states

reporting the highest incidence (114–200/100,000).<sup>[8]</sup> RAP is more common amongst men and typically presents between 30 and 40 years of age.<sup>[9]</sup>

Alcohol, smoking, gallstones, obesity, hypertriglyceridaemia and delayed cholecystectomy are amongst the recognised risk factors for recurrence.<sup>[10–16]</sup> Preventive strategies such as abstinence from alcohol, early gallbladder removal and triglyceride control can significantly reduce risk.<sup>[14,17]</sup> Despite these insights, up to 16%–20% of patients experience recurrent

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attacks, which not only increase morbidity and mortality but also impose a considerable socioeconomic burden.<sup>[10,18,19]</sup>

Data from India on RAP remain sparse, particularly in Kerala, where unique demographic and lifestyle patterns exist. National Family Health Survey (NFHS-5) (2019–2020) reported alcohol use in 19.9% of men and 0.2% of women in Kerala, slightly higher than national averages.<sup>[20]</sup> However, the specific contribution of alcohol and other risk factors to RAP in this region is poorly characterised. This study therefore seeks to identify demographic, lifestyle and clinical determinants of RAP in a central Kerala cohort, with the aim of informing preventive strategies and optimising long-term outcomes.

## MATERIALS AND METHODS

The study was designed as a hospital-based cross-sectional analysis conducted over 12 months, extendable to 18 months with appropriate ethical clearance and undertaken in the Department of General Surgery, Government Medical College, Thrissur, with the primary objective of identifying the demographic distribution and the various risk factors associated with RAP. Specific areas of interest included the influence of age, sex and body mass index (BMI); lifestyle determinants such as alcohol intake, smoking and dietary habits and environmental and clinical factors contributing to the recurrence and severity of the disease. In addition, the study sought to explore the common aetiological causes, the average duration of hospital stay, the severity of clinical episodes and the diagnostic as well as therapeutic strategies employed in the management of RAP. By addressing these facets, we aimed to delineate the patterns and determinants of recurrence in patients presenting to our institution, thereby contributing region-specific insights to the literature.

All patients admitted with AP were screened, and those fulfilling the diagnostic criteria for RAP were recruited. RAP was defined as two or more distinct attacks of AP with complete recovery between episodes, in the absence of features suggestive of chronic pancreatitis. Eligible participants were between 12 and 79 years of age. Patients with proven chronic pancreatitis or those unwilling to participate were excluded.

The sample size was calculated using the finite population correction method, with an assumed prevalence of 7%,<sup>[6]</sup> an absolute precision of 2% and a 95% confidence level. Considering an annual patient load of approximately 300 cases of RAP at our hospital, the minimum required sample size was estimated at 203.

Data collection was carried out using a standardised, validated questionnaire in both Malayalam and English, along with a structured pro forma. Information regarding socio-demographic characteristics, clinical presentation, laboratory and imaging findings, etiological factors, alcohol and smoking patterns, dietary habits and awareness about the disease was obtained through the direct interviews and case records. The diagnosis of

AP was based on the Revised Atlanta Classification, requiring the presence of at least two of the following: (a) characteristic abdominal pain, (b) serum amylase or lipase more than three times the upper normal limit or (c) imaging features consistent with pancreatitis. Responses were documented through Google forms, collated and compiled into a master database for the analysis.

Data analysis was performed using the SPSS software version 16 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were expressed as proportions for the categorical variables and as means (standard deviation) or medians (interquartile range) for the continuous variables. Continuous variables were compared using the one-way analysis of variance or the Kruskal–Wallis test, with subsequent two-group comparisons by *t*-test or Mann–Whitney test when appropriate. Categorical data were analysed using the Chi-square test. Associations between alcohol consumption, smoking, BMI categories (<25, 25–30, >30) and RAP were further examined using the Cochran–Armitage trend test and Spearman correlation. To adjust for confounding factors such as age, sex and BMI, multivariable logistic regression was employed, with stratified analyses performed for sex, drinking and smoking categories. Model adequacy was assessed using the Hosmer–Lemeshow goodness-of-fit test, and a two-sided  $P < 0.05$  was considered statistically significant.

## RESULTS

Of the 203 patients studied, most were between 30 and 60 years of age, with the highest proportion in the 40–50 year group (33.5%). Very few participants were <20 years (1.0%) or >70 years (0.5%). The mean age was  $45.1 \pm 10.6$  years, indicating that RAP predominantly affected middle-aged adults.

Amongst the 203 participants, the vast majority were male (97.5%), while only 2.5% were female, demonstrating a clear male predominance in RAP. 154 (75.9%) were married and 49 (24.1%) were unmarried, indicating that the majority of patients with RAP were married. 46 participants (22.7%) were underweight, while the majority, 157 (77.3%), had a normal BMI. The mean BMI of the study population was  $20.03 \pm 1.88$  kg/m<sup>2</sup>. Most participants were from Thrissur district (69.5%), followed by Palakkad (21.7%) and Malappuram (6.4%), while only a small proportion (2.5%) were from Ernakulam.

More than half of the participants (51.2%) had experienced three episodes of pancreatitis, while 42.9% reported four episodes. Only a small proportion had five (5.4%) or six (0.5%) episodes. The majority of participants (63.1%) had a disease duration of 2–5 years, while 22.7% reported illness for  $\leq 2$  years and 14.3% for more than 5 years.

On imaging, the majority of patients had interstitial pancreatitis (92.1%). Other findings included gallstones in 4.4%, pseudocysts in 3.4%, necrotising pancreatitis

in 2.5% and walled-off pancreatic necrosis in 1.5% of cases [Figure 1].

Alcohol was the predominant aetiology, accounting for 85.2% of cases, followed by biliary pancreatitis in 11.3% and idiopathic causes in 3.4%. Nearly all patients (99.0%) were managed conservatively. Only one patient (0.5%) required endoscopic retrograde cholangiopancreatography (ERCP) and another (0.5%) underwent laparotomy with drainage [Figure 2].

Based on the Glasgow severity score, most patients (92.6%) had mild attacks with scores <3, while only 7.4% experienced severe episodes (score ≥3). The majority of patients (68.0%) required hospitalisation for 5–10 days, while 20.7% were discharged within 5 days and 11.3% stayed for more than 10 days. Most patients (58.6%) had hospital admissions lasting 5–10 days, while 31.0% stayed ≤5 days and 10.3% required admission beyond 10 days. Nearly all participants (98.5%) were aware of their diagnosis, while only 1.5% reported no awareness of their existing disease.

Alcohol was the predominant risk factor, reported by 85.2% of participants. Amongst drinkers, most had consumed alcohol for more than 10 years (72.3%), while 26.0% reported 4–10 years and 1.7% had a shorter duration of 2–4 years. The majority consumed alcohol daily, with 65.5% drinking 6–7 times per week. Regarding quantity, two-thirds (66.7%) consumed 100–200 ml/day, while 22.6% reported 90–100 ml/day and 10.2% consumed about 90 ml/day. Amongst alcohol users (n = 177), the most commonly consumed beverages were vodka, rum, whiskey and brandy (each reported by 98.9% of drinkers). Beer was consumed by 48.6%, while local toddy use was uncommon (2.3%).

Amongst alcohol users (n = 177), 95.5% reported abstaining from alcohol after the first episode of pancreatitis, while 4.5% continued drinking. The majority abstained for 2–8 weeks (65.7%), whereas 27.8% abstained for 9–24 weeks and only 6.5% maintained abstinence beyond 24 weeks. The mean duration of abstinence was 11.6 ± 16.3 weeks [Figure 3].

More than half of the participants (56.2%) reported smoking, while 43.8% were non-smokers. Amongst smokers, cigarettes were the most common form (74.6%), followed by combined cigarette and beedi use (17.5%) and beedi alone (7.9%). The mean duration of smoking was 18.0 ± 9.0 years, with 28.9% smoking for 10–15 years and 26.3% for more than 20 years. In terms of quantity, nearly half (46.5%) smoked 5–8 times daily, 31.6% smoked 2–5 times and 21.9% smoked more than 8 times per day [Figure 4].

The majority of participants (94.1%) reported a mixed diet, while 4.9% were exclusively non-vegetarian and only 1.0% were vegetarian. Among non-vegetarian eaters, meat (98.0%) and fish (96.5%) were the most common items, followed by eggs (75.6%). Chicken (96.4%) and beef (82.7%) were the predominant meat types consumed, while mutton (55.8%) and pork (40.1%) were less common.

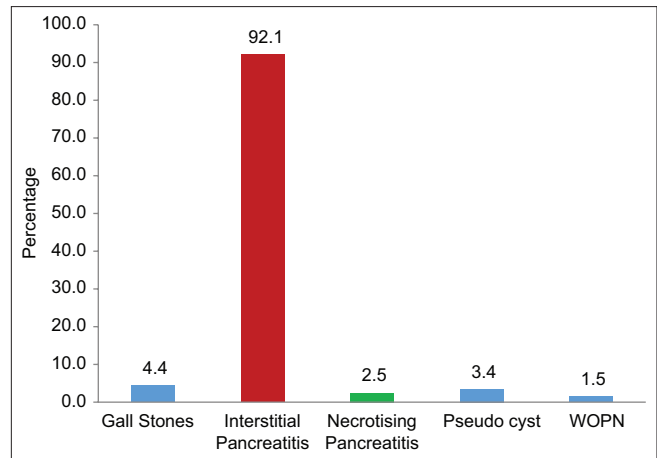


Figure 1: Distribution of computed tomography findings amongst study participants. WOPN: Walled-off pancreatic necrosis, computed tomography

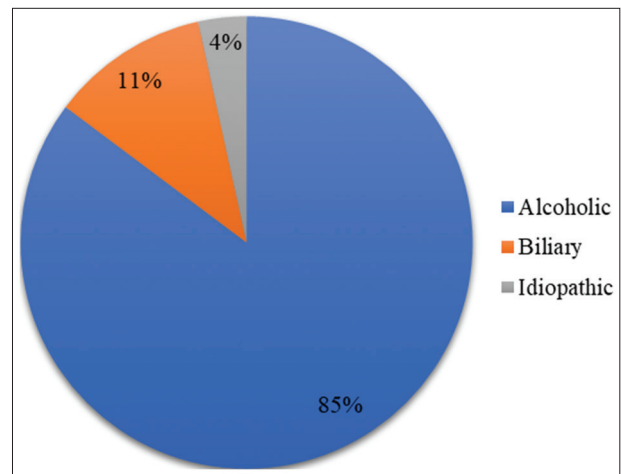


Figure 2: Distribution of diagnosis amongst study participants

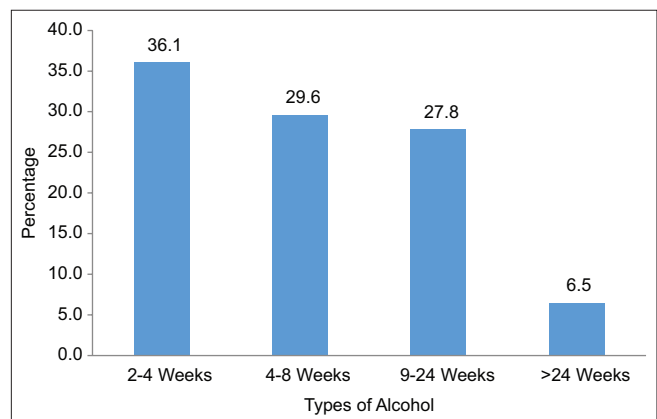
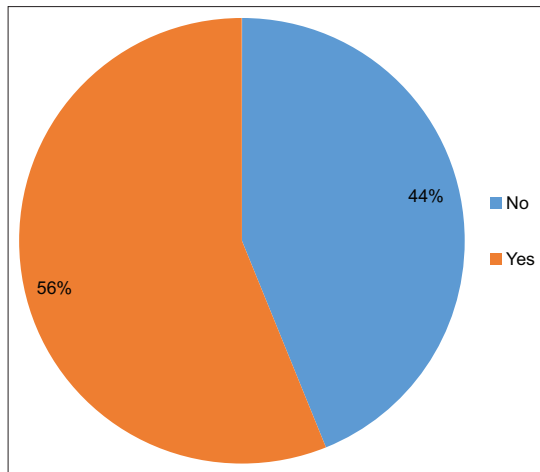


Figure 3: Distribution of duration of abstain from alcohol

Apart from alcohol and smoking, only a small proportion of participants reported other addictions, including gudka (4.9%), pan (3.9%) and betel chewing (0.5%). The majority (90.6%) had no additional addictive habits [Figure 5].



**Figure 4:** Shows smoking status amongst study populations

## DISCUSSION

This study provides a comprehensive profile of RAP in a South Indian cohort. The majority of patients were middle-aged men, with alcohol and smoking identified as the predominant risk factors. These findings echo the global consensus that lifestyle factors, particularly alcohol, remain the principal drivers of RAP.<sup>[1]</sup>

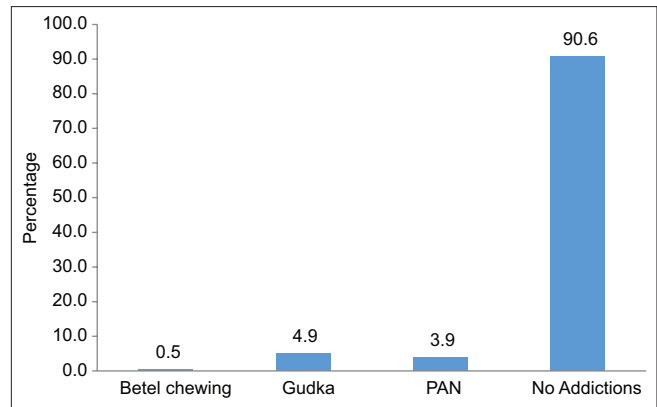
The strong male predominance in our cohort (97.5%) is consistent with prior Indian data<sup>[7,8]</sup> and with international studies showing higher rates of alcohol- and tobacco-associated RAP amongst men, while gallstone-related RAP is more frequent in women.<sup>[12]</sup> Historically, early classifications of pancreatitis<sup>[2-5]</sup> recognised the challenge of distinguishing RAP from early chronic pancreatitis, and our findings similarly highlight this overlap.

Age distribution in our study peaked between 30 and 50 years, which aligns with Scandinavian data showing a younger age of onset for RAP compared to single-episode AP.<sup>[9]</sup> The Global Burden of Disease study<sup>[6]</sup> demonstrated that pancreatitis prevalence increases with age, peaking later in women, reinforcing the sex-and age-related differences we observed.

Alcohol accounted for 85.2% of RAP cases in our series, a higher proportion than reported in European<sup>[10]</sup> or Chinese cohorts.<sup>[19]</sup> This likely reflects Kerala's unique epidemiological profile, as the NFHS-5 survey<sup>[20]</sup> showed alcohol use in nearly one-fifth of adult men in the state. Our results align with North American<sup>[11]</sup> and Asian data,<sup>[13,14]</sup> which emphasise alcohol, hypertriglyceridaemia and smoking as critical contributors to recurrence.

Most patients experienced three to four attacks within 2–5 years of their first episode. This parallels the findings of Yu *et al.*,<sup>[13]</sup> who noted recurrence in about 11% within 3 years and long-term studies summarised by Guda *et al.*,<sup>[1]</sup> where the majority of recurrences occurred in the first 4 years. Our data confirm that the early years after an initial episode represent the highest-risk window.

While nearly all patients in this study were managed conservatively, disease burden remained significant, with



**Figure 5:** Shows distribution of any other addictions amongst study population. PAN: Pan masala

frequent hospitalisations of 5–10 days. This reflects global observations that, despite reduced mortality, RAP continues to carry substantial morbidity, economic costs and impaired quality of life.<sup>[17,21]</sup>

Importantly, awareness of disease was high (98.5%), and most patients attempted abstinence, yet relapse was common. This gap between awareness and sustained behaviour change underscores the need for structured de-addiction and lifestyle modification programs. Prior work has shown that alcohol abstinence and early management of gallstones or hypertriglyceridemia reduce recurrence risk.<sup>[14-16]</sup> However, in practice, adherence remains a challenge.

## Limitations

Our study is cross-sectional and single-centre, limiting generalisability. Genetic factors and biochemical markers were not assessed. Nonetheless, it adds valuable region-specific data from Kerala, where alcohol dominates the aetiological spectrum far more than in Western populations.

## CONCLUSION

RAP in Kerala predominantly affects middle-aged men with long-standing alcohol and smoking exposure. Compared with Western populations where gallstones are more frequent, the aetiological profile here is strongly alcohol-driven. These findings underscore the urgent need for region-specific prevention strategies, focusing on alcohol control, smoking cessation and early management of metabolic risk factors.

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## Conflicts of interest

There are no conflicts of interest.

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