HIGH-SENSITIVITY C-REACTIVE PROTEIN: A MARKER FOR CARDIOVASCULAR RISK IN DIABETIC PATIENTS WITH CORONARY ARTERY DISEASE

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ABSTRACT
Background: High-sensitivity C-reactive protein (hsCRP) is an acute-phase reactant and a sensitive marker of systemic inflammation. Chronic low-grade inflammation, as evidenced by elevated hsCRP, is implicated in type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD). This study investigates the relationship between hsCRP levels, metabolic control, and coronary artery disease (CAD) severity in diabetic patients. **Methods:** A cross-sectional study was conducted involving 60 diabetic patients with angiographically proven CAD at AJ Institute of Medical Sciences. hsCRP levels were measured using turbidimetric immunoassay. Associations between hsCRP levels, glycemic control, lipid profiles, and angiographic findings were analyzed. **Results:** Elevated hsCRP levels (≥ 1 mg/L) were observed in all participants, with 25% showing intermediate risk (1-2 mg/L) and 75% showing high risk (≥ 3 mg/L). These risk categories underscore the potential for hsCRP to predict adverse cardiovascular outcomes, with high-risk individuals (≥ 3 mg/L) being more likely to have severe inflammation and associated vascular damage. This highlights the necessity for early intervention and monitoring in patients with elevated hsCRP to mitigate cardiovascular risk. A significant correlation was found between hsCRP levels and the severity of coronary vessel involvement ($p=0.002$). However, no significant correlation was noted between hsCRP and glycaemic control (HbA1c levels). **Conclusion:** Elevated hsCRP levels are strongly associated with CAD severity in diabetic patients but do not correlate significantly with glycaemic control. hsCRP serves as a valuable marker for assessing cardiovascular risk in this population.

INTRODUCTION
Type 2 diabetes mellitus (T2DM) is a global health challenge, characterized by insulin resistance and hyperglycaemia[1]. The chronic complications of T2DM, including microvascular and macrovascular diseases, significantly contribute to morbidity and mortality[2].
C-reactive protein (CRP), particularly in its high-sensitivity form (hsCRP), has emerged as a reliable marker for systemic inflammation and cardiovascular risk[3]. Elevated hsCRP levels

have been linked to CAD, metabolic syndrome, and stroke, particularly in diabetic populations[3]. However, its relationship with metabolic control and CAD severity in diabetic patients remains to be fully elucidated.

METHODS

Study Design: A cross-sectional study conducted at AJ Institute of Medical Sciences, Mangalore

Participants: Sixty patients with T2DM and angiographically confirmed CAD were enrolled. Patients were excluded if they had type 1 diabetes, were pregnant, or were under 18 years of age.

Data Collection: Detailed histories, physical examinations, and laboratory analyses were conducted. hsCRP levels were measured using turbidimetric immunoassay. Fasting and postprandial blood glucose, HbA1c, and lipid profiles were assessed. Coronary vessel involvement was determined from angiographic reports.

Statistical Analysis: Data were analyzed using SPSS (v22). Correlations were determined using Pearson's chi-square test, with $p<0.05$ considered significant.

RESULTS

Demographics and Clinical Characteristics
- Age: Mean age was 54.08 years (±8.8 years).
- Gender: 51.7% male, 48.3% female.
- BMI: 23.33% had elevated BMI ($\geq$25 kg/m²).
- Duration of Diabetes: Mean duration was 11.3 years, with 30% of patients having diabetes for 11-15 years.

hsCRP Levels
- All participants had elevated hsCRP levels.
- Intermediate Risk (1-2 mg/L): 25% of patients.
- High Risk ($\geq$3 mg/L): 75% of patients.

Glycemic Control
- Good glycemic control (HbA1c <6.5%) was observed in 46.7% of participants.
- Poor glycemic control (HbA1c >7.5%) was noted in 15% of participants.
- No significant correlation between hsCRP levels and HbA1c (p=0.444).

Coronary Vessel Involvement
- Single Vessel Disease: 26.67% of patients.
- Double Vessel Disease: 31.67% of patients.
- Triple Vessel Disease: 18.33% of patients.
- Significant correlation between elevated hsCRP levels and severity of vessel involvement (p=0.002).

Lipid Profiles
- Elevated hsCRP levels correlated with higher total cholesterol, LDL, VLDL, and triglycerides, and lower HDL levels (p<0.05).

DISCUSSION

This study underscores the role of hsCRP as a marker of systemic inflammation and its strong association with CAD severity in diabetic patients. Elevated hsCRP levels correlated significantly with lipid abnormalities and the extent of coronary vessel involvement, aligning with existing literature. For instance, studies by Mahajan *et al.* and Bahceci *et al.* have

demonstrated similar associations, highlighting the role of hsCRP in systemic inflammation and cardiovascular risk in diabetic populations[4,5]. These findings corroborate the notion that hsCRP reflects underlying metabolic and vascular derangements[6,7].

Contrary to some studies, no significant correlation was found between hsCRP levels and glycemic control (HbA1c)[8,9,10]. This discrepancy may stem from the study's cross-sectional design, which limits the ability to assess causality, and the relatively small sample size, which may not capture population-wide trends. Future research should explore this relationship longitudinally, with larger cohorts, to determine whether hsCRP could still serve as an indirect marker of glycemic fluctuations over time. This discrepancy may be due to the cross-sectional design and limited sample size.

The findings highlight the utility of hsCRP in cardiovascular risk stratification among diabetic patients. By measuring hsCRP levels, clinicians can better identify patients at higher risk for adverse cardiovascular events and tailor interventions accordingly, such as intensifying lipid-lowering therapies, anti-inflammatory treatments, or lifestyle modifications. This stratification can also guide the frequency of monitoring and the prioritization of preventive strategies in high-risk individuals[11]. Elevated hsCRP may reflect underlying endothelial dysfunction and systemic inflammation, necessitating targeted interventions[12].

CONCLUSION

Elevated hsCRP levels are significantly associated with the severity of coronary artery disease in diabetic patients, emphasizing its role as a prognostic marker. Targeted interventions to reduce hsCRP-related inflammation, such as statin therapy, have shown promise in lowering cardiovascular risk. Studies by Ridker *et al.* (2003) and Kamath *et al.* (2015) have highlighted the effectiveness of statins in reducing hsCRP levels alongside LDL cholesterol, leading to improved cardiovascular outcomes[13,14]. Additionally, anti-inflammatory agents like colchicine, as noted in Elkind *et al.* (2006), and IL-1 inhibitors could be explored for their potential to mitigate hsCRP levels and improve patient outcomes. Lifestyle modifications, including diet and exercise, as supported by findings from Pearson *et al.* (2003), also play a critical role in reducing systemic inflammation and hsCRP levels. However, its lack of correlation with glycemic control suggests that hsCRP primarily reflects cardiovascular risk rather than metabolic control.

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