



Original Research Article

Study of serum cholesterol binding reserve in case of coronary artery diseases with special emphasis on acute coronary syndrome

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ABSTRACT

Coronary heart disease is continuously increase in India. Acute myocardial infarction (AMI) and unstable angina are now recognized as part of a spectrum of clinical disease collectively known as acute coronary syndromes (ACS). The serum cholesterol binding reserve, should be a useful factor for predicting the risk of coronary heart disease.

Materials and Methods: Subjects who were diagnosed clinically and chemically as CHD patients were selected out of the patients Gandhi Medical College in department of Cardiology, Hamidia Hospital, Bhopal. This study was done in 25 controls and 50 cases which were divided sexwise and age wise. There were 25 controls, 11 females and 14 males. Total coronary arterial diseases cases were 50 in number, There were 14 males & 11 females in acute coronary syndrome cases and were 14 males and 11 females stable angina.

Result: The serum cholesterol was higher and SCBR was significantly lower in stable angina ($25.7 \pm 7 \text{ mg\%}$) & acute coronary syndrome ($60.2 \pm 6.2 \text{ mg\%}$) as compared to controls ($186.1 \pm 27 \text{ mg\%}$) and ($60.2 \pm 6.2 \text{ mg\%}$). Lower SCBR the higher tendency to develop atherosclerosis and hence the higher the risk of coronary heart disease.

Conclusion: It concluded that SCBR and SC maybe considered together as a better biochemical markers for the risk of atherosclerosis.

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1. Introduction

Coronary heart disease is continuously increasing in India. Coronary heart disease (CHD) is a major cause of mortality and morbidity all over the world. The cause of NCD (noncommunicable diseases) deaths in 2012 was CVD (17.5 million deaths, or 46.2% of NCD deaths). As per 2014 statistics by the World Health Organization, 26% of total mortality in India is contributed by CVD.^{1,2}

CVD have no geographic & racial boundaries, they occur throughout the world in all races and in all strata of society though variation occur between sexes, ages and socioeconomic status.

It's a process by which arteries are narrowed due to formation of plaque. Some individuals with advanced

atherosclerosis of coronary arteries experience chest pain & shortness of breath with mild exertion.³ Normal human serum can solubilise considerable amount of exogenous cholesterol in addition to its cholesterol content. This capability was known as serum cholesterol binding reserve (SCBR).⁴

Elevated cholesterol concentrations in serum associated with cardiovascular disease (LDL) particles promote atherosclerosis development in coronary arteries disease.⁵

It is believed that higher concentrations of cholesterol in serum enhance plaque formation, while on the other hand the ability of the serum to keep cholesterol in the form of soluble lipoprotein complexes is an opposing factor which retards the process.³ Accordingly, the serum cholesterol binding reserve, (herein designated SCBR) which is a measure of this ability should be a useful factor for predicting the risk of coronary heart disease. SCBR and

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high density lipoprotein cholesterol in patients can also maintain hemodialysis. There was a positive correlation between SCBR and the duration for which the patients had been maintained by hemodialysis. The lower the SCBR the higher the tendency to develop atherosclerosis and hence the higher the risk of coronary heart disease.⁶

Reverse cholesterol transport prevent deposition of cholesterol in tissue and thought to be antiatherogenic and HDL cholesterol level has been shown to low risk of coronary heart disease.³

Acute myocardial infarction (AMI) and unstable angina are now recognized as part of a spectrum of clinical disease collectively known as acute coronary syndromes (ACS). ACS is caused primarily by atherosclerosis.⁷ Decrease of the SCBR in the presence of elevated cholesterol and/or triglyceride levels is associated with the development of coronary artery disease.⁸

2. Materials and Methods

This study were conducted in the department of medical biochemistry GMC Bhopal in association with department of cardiology Hamidia hospital Bhopal.

It comprises of 2 groups, group a- cases of 50 subject (ASC & AS) group b- control 25 subject with 35-70 year of both genders. This study group comprised of 50 cases of acute coronary syndrome and stable angina, age and sex matched controls fulfilling the inclusion and exclusion criteria.

2.1. Inclusion criteria

All acute coronary syndrome patients attending ICU of the department of cardiology Bhopal, Include stable angina patients, coronary heart patient, hypertension.

2.2. Exclusion criteria

Age group below 30 and above 70 years. Diabetic and renal failure.

Estimation of total cholesterol by enzymatic end point CHOD-POD method.

Estimation of serum cholesterol binding reserve S.C.B.R by the Liebermann-burchard B. Zak et al., anal Chem method.⁹ S.C.B.R was calculated by subtracting the value of cholesterol content in the serum before incubation with the sonicated cholesterol from the value obtained after the incubation and filtration. Total cholesterol was estimated in both the tubes simultaneously and S.C.B.R was calculated.^{10,11}

2.3. Statistical analysis

Study design case control cross-sectional study. The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and Data were analyzed using 2002-

2005by graphpad software inc.

T- test, whichever appropriate, was used for comparison of categorical variables. The difference of the means of analysis variables was tested with the unpaired t-test. If the p-value was < 0.01, then the results will be considered to be significant.

3. Result

This study was done in 25 controls and 50 cases which were divided sex wise and age wise. Age wise divided into 2 groups. Group I has 35-50 years aged persons & group II has 51-70 year old persons.

Total coronary arterial diseases cases were 50 in number which were divided into two parts, group first was acute coronary syndrome patients and second was stable angina patients. This study was approved by ethical committee on research, Gandhi Medical College, Bhopal (M.P.).

Peter Libby MD recognize that disruption of plaques causes many acute coronary syndromes (ACS). The disrupted plaque represents a "solid-state" stimulus to thrombosis. Alterations in circulating prothrombotic or antifibrinolytic mediators in the "fluid phase" of the blood can also predispose toward ACS. Recent results have established the multiplicity of "high-risk" plaques and the widespread nature of inflammation in patients prone to develop ACS.⁽¹²⁾

3.1. Control group

There were 25 controls, 11 females and 14 males. The level of SC (serum cholesterol) in normal healthy individuals ranged from 152-260 mg% with mean value of 186.1 ± 27 mg%. There was statistically not significant difference between males and females.

The level of SCBR (serum cholesterol binding reserve) in controls ranged from 50-80 mg% with mean value of 60.2 ± 6.2 mg%. The difference between the level of males and females was statistically not significant ($p > 0.05$).

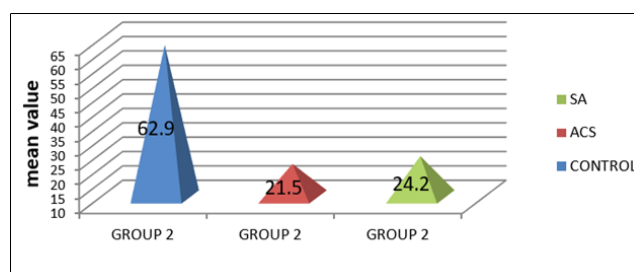


Fig. 1: Show this chart level of serum cholesterol binding reserve in age group II in cases and control

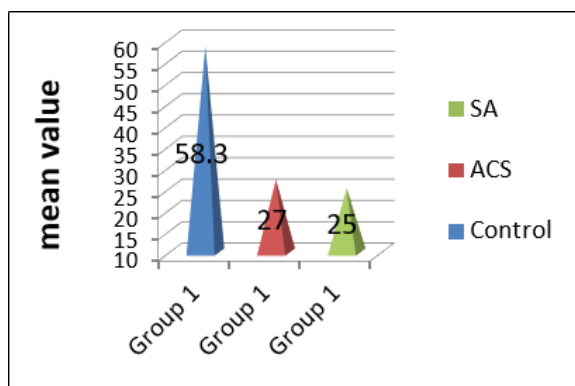


Fig. 2: Show this chart level of serum cholesterol binding reserve in different age group in cases and control

3.2. ACS group

Acute coronary syndrome (ACS) is associated with thrombin formation, triggered by ruptured or eroded coronary atheroma. K. Brummel-Ziedins 2007 Investigated Thrombin generation based on circulating coagulation protein levels, could distinguish between acute and stable coronary artery disease (CAD).¹²

There were 14 males & 11 females in acute coronary syndrome cases.

The level of serum cholesterol ranged from 144-256mg% with mean of value 196 ± 32 mg%, which is higher value as compared to controls.

Higher value were observed in males (202 ± 47 mg%) than females (187.4 ± 23 mg%), which is statistically not significant difference ($p > 0.05$), when compared with control (182 ± 28 mg%).

Similarly not significant difference was noted (210 ± 58 mg%) in group II (50-80yrs) patients as compared to control.

The SCBR ranged from 10-35 mg% with mean value of 25.6 ± 7.9 mg% which is statistically highly significant difference ($p < 0.001$) as compared to controls.

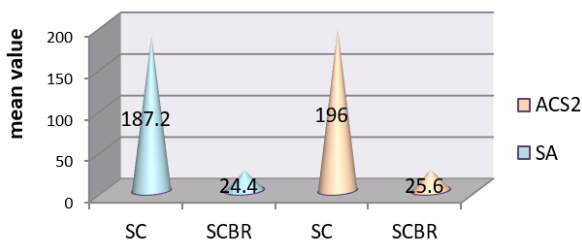


Fig. 3: Show this chart compared level of serum cholesterol and SCBR in between cases

Table 1 shows that of serum cholesterol binding reserve were highly significantly statically & value lower in cases than control

In Males, mean SCBR value was 24.1 ± 8 mg% and female's 25.3 ± 7.2 mg% which is slightly higher than males.

When SCBR compared with control, in males mean 59 ± 4.2 mg% and females 60.2 ± 6 mg% this show statistically highly significant difference ($P < 0.001$).

In groups (age wise) observation, we found that SCBR were statistically ($p < 0.001$) significant higher in group I & group II as compared to control.

3.3. Stable angina group

Chronic stable angina (CSA) is a major symptomatic presentation in about half of the patients with coronary heart disease (CHD).¹³

There were 14 males and 11 females. In group (age wise), there were 15 patients in group I and 10 in group II.

The SC ranged from 144-250 mg% with mean value was 190 ± 32 mg% which was statistically not significant difference ($p > 0.05$) as compared to control.

The mean values of SC were compared sexwise with control, statistically no significant difference ($p > 0.05$) observed.

Higher mean value was seen in females (193 ± 25 mg%) then males (189 ± 30 mg%).

In groups (age wise), SC mean value was noted which is statistically not significant ($p > 0.05$) as compared to control.

The SCBR ranged from 10-35 mg% with mean value 25.4 ± 6.2 mg% which was statistically ($p < 0.001$) highly significant and lower value as compared to control (60.2 ± 6.8 mg%).

In Males, SCBR mean value (25.7 ± 7 mg%) is higher than females (22.9 ± 8 mg%) which was statistically highly significant difference as compared to controls SCBR.

All the value of SCBR & SC are lower in stable angina group as compared to ACS.

Charlesh. Hennekens find the S.C.B.R. values in premature myocardial infarction also were lower among patients than controls, and the difference was statistically significant between patients and controls.¹⁴ Its results in case control studies of premature myocardial infarction have demonstrated the usefulness of SCBR in assessing the risk of coronary artery disease.

4. Discussion

Børresen, K. Maartmann-Moe study said Serum reserve cholesterol binding capacity (srcbc) was studied in 28 members of five with familial hypercholesterolemia (HC). A significantly lower srcbc was found in family members heterozygous or homozygous for HC than in their healthy relatives. Hypothetically, the low srcbc in HC patients could contribute to their propensity to develop premature atherosclerosis.¹⁵

S L H. Lawrence M Fishman study Serum cholesterol-binding reserve (SCBR), was measured in 43 male patients

Table 1: Showing statistical analysis of serum cholesterol binding reserve in mg% in cases stable angina, ACS and control

Case	Range of control and case	SCBR MEAN ±SD	Control MEAN ±SD	t-value	p-value	Result
Stable Angina	50-80/10-36	24.5±8.2	60.2±6.8	17.9	<0.001	HS
Acute Coronary Syndrome	50-80/11-36	25.6±7.9	60.2±6.8	18.4	<0.001	HS

with maturity onset diabetes in the age range of 35–59 years who were under treatment with insulin, these results indicate an association of decreased SCBR with diabetes and are consistent with the hypothesis that low SCBR is associated with accelerated atherosclerosis and enhanced risk for coronary heart disease.¹⁶

Ashim Ghatak also showed Serum cholesterol binding reserve percentage (SCBR%) in patients with diabetes mellitus (22.17±13.40%) was significantly lower than in controls (40.93±8.69%).¹⁷

In study of GOYAL SP Serum total cholesterol and serum cholesterol binding reserve (SCBR) were estimated in 50 healthy subjects and 25 cases with ischaemic heart disease (IHD) and their seventy asymptomatic first degree relatives. The critical levels for predicting risk of IHD were 30 mg/dl for SCBR and 8 for cholesterol SCBR ratio. The latter was found to be a more sensitive index for predicting the risk of IHD as compared to SCBR alone.¹⁸

In Stable angina cases, were noted that males and females mean value 189±30mg% & 193±31 mg% of respectively. When both were compared to control, it was found that statistically not significant difference in males (P>0.05) and females. Females had higher mean value than males.

Both cases compared sexwise each other show not significant differences (p>0.05) statistically.

Brawnwald Fauci Karper and Hauser showed higher value of serum cholesterol in female as comparison to male.¹⁹

Lowry 1975 has demonstrated lower serum cholesterol level in healthy people and higher in patient of artherosclerosis specially in ischemic heart diseases.²⁰

Bark 1971 on the basis of coronary angiographic studies reported a positive correlation between serum cholesterol and the severity of obstructive disease of coronary vascular tree.²¹

When my study cases were compared to control group wise separately it denoted statistically highly significant difference (p<0.001). It was observed that lower value of S.C.B.R in both age groups as compared to control.

R Chander 1988 also defined the diminished SCBR would be a sensitive marker of hyperbetalipoproteinemia and hepatic damage in alcoholism.²²

Borresen and Berg, Miller (1980) have studied the effect of lipid lowering drug 'Gemsfibrozil' in hyperlipemic humans and found a significant increase in the levels of HDL apoprotein, Apo AI, Apo AII and SCBR. Which show

low level of SCBR and its clinical importance.²³

Hsia et al 1975 reported lower value of S.C.B.R in atherosclerotic patient when compared to normal healthy individuals.²⁴

Braunwald E studies suggest that lipid abnormalities are associated with increased risk of cardiovascular events. Various studies have demonstrated that LDL, HDL, and triglycerides are independent predictors of CVD.²⁵

The association between cholesterol concentrations and CAD and the accumulating evidence that treating hypercholesterolemia in middle-aged men may reduce mortality and morbidity from ischemic heart diseases showed in a comparative study.²⁶

In case ACS, mean value S.C.B.R was 25.4±8 mg and mean serum cholesterol was 196±42 mg% similarly the level of serum cholesterol and S.C.B.R was denoting that S.C.B.R falls with increasing level of serum cholesterol. Table evidence found statistically highly significant difference (p<0.001).

In control the mean value of S.C.B.R was 60.2±6.2mg% and mean value of serum cholesterol was 186.1±27 mg%. The level of serum cholesterol and S.C.B.R was observed that S.C.B.R rises with increasing level of cholesterol.

SCBR is a potential marker for monitoring disease activity in myocardial infarction. It provides better information about the severity of atherosclerosis.²⁷

5. Conclusion

The serum cholesterol was higher and SCBR was significantly lower in stable angina & acute coronary syndrome as compared to controls.

SC was found lower in stable angina cases when compared to acute coronary syndrome, the value were statistically insignificant.

SC and SCBR were insignificant lower in stable angina cases as compared to ACS.

It concluded that SCBR and SC maybe considered together as a better biochemical markers for the risk of atherogenesis.

6. Source of Funding

None.

7. Conflict of Interest

None.

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