# Association of ABO Blood Group with Coronary Atherosclerosis: An Autopsy Based Cross Sectional Study Conducted in a Tertiary Care Hospital

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## Abstract

The incidence of the cases of sudden unexpected deaths due to cardiovascular causes are readily increasing worldwide. The coronary arterial heart disease is considered to be epidemic in India. Previous literatures show that ABO blood group is an inherent risk factor for the development of coronary atherosclerosis apart from the conventional risk factors. The present study was conducted during June 2020 to April 2021with a sample size of 100 cases aged 25 to 50years whose hearts were examined by routine techniques and blood grouping done by slide agglutination technique. It showed that there was a statistically significant association between the ABO blood group and coronary atherosclerosis with p-value of 0.012. In general, the non-O blood group especially the blood group-A had higher risk for coronary atherosclerosis when compared to the O-blood group individuals. As this incidence occurs at a much younger age group, it is recommended that the screening for coronary atherosclerosis should begin at a much younger age especially by including the screening for ABO blood group apart from the conventional risk factors as blood group A had higher risk. Further, this study also opens up the gate for genetic studies in future in order to understand the exact association between ABO blood group and the coronary atherosclerosis at the gene level in detail.

**Keywords:** ABO blood group, Coronary atherosclerosis, Inherent risk factor, Younger age.

## Introduction

Non – communicable diseases are the diseases of long duration and slow progression. The diseases of the cardiovascular system tops in the list of non – communicable diseases followed by diabetes mellitus, diseases of the respiratory system and cancer, etc. They together besides producing significant morbidity and disability, they are also

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the leading cause of mortality worldwide. Among the various causes of the sudden unexpected deaths, the cardiovascular cause is the most common cause of the sudden unexpected death. About 8 percentage of the cardiovascular deaths is due to the disease of the coronary arteries[1]. About more than 19 million people die of acute coronary event consequent upon coronary artery disease every year worldwide[2].

According to the report of Registrar General of India, it was reported that the mortality rate due to coronary artery disease is higher in the Southern India whereas the mortality rate in Northern India was mainly due to stroke[3]. It was also estimated that the incidence of the cardiac diseases occurs about 10 to 15 years earlier in Indian population than the people of other countries [4]. The atherosclerotic coronary artery disease is of greater concern among the young adults because of its potential to cause a greater incapacitation. As the coronary atherosclerosis and its complications pose a serious health concern among the society, this study aimed to find out the association between the ABO blood groups and the coronary atherosclerosis.

## Materials and Methodolgy

The study of the atherosclerotic coronary arterial diseases is an extremely difficult task in the living subjects and so the postmortem examination is the best possible method to study them. The present study is conducted in the Department of Forensic Medicine and Toxicology at the Government Stanley Medical College, Chennai. The cases which were subjected to postmortem examination in the age group of 25 to 50 years were studied. The study was conducted during the one year period from June 2020 to April 2021 in this centre. After receiving the request for the postmortem examination, the autopsy is conducted. During the autopsy, the heart was taken out by the routine dissection technique. Then about 2ml of blood is collected from the right ventricle using a sterile syringe and needle for the purpose of doing blood grouping. The blood grouping is done by the standard slide agglutination technique. Then the heart specimen is subjected for examination. All

the coronary vessels are examined for the presence of atherosclerosis by making serial sections at an interval of 2 to 3mm. After making gross examination of the vessels, then multiple sections are taken from the coronary arteries and subjected to histopathological examination.

**Study Design:** Cross – Sectional Study.

**Study Population**: All the cases in the age group of 25 to 50 years subjected to postmortem examination in Govt. Stanley Medical College and Hospital Mortuary.

**Place of the Study:** Department of Forensic Medicine and Toxicology at the Government Stanley Medical College, Chennai.

**Study Period:** One year (from June 2020 to April 2021).

**Inclusion criteria:**

- All cases in the age group of 25 to 50 years subjected to postmortem examination in Govt. Stanley Medical College, Chennai Mortuary on receiving requisition from the concerned Investigating Officer.

**Exclusion criteria:**

- All the cases where the bodies are decomposed.
- Heavily mutilated dead bodies where organs are heavily damaged.
- Cases with previous history of any cardiac surgeries like CABG, etc.
- People belonging to different ethnic and racial groups.

## Results and Observations

The collected data was analysed with IBM SPSS Statistics for Windows, Version 23.0 (Armonk, NY: IBM Corp). To describe about the data descriptive statistics, frequency analysis, percentage analysis was used for categorical variables and the mean and S.D were used for continuous variables. To find the significance in categorical data Chi-Square test was used. In the above statistical tool, the probability value 0.05 is considered as significant level.

**Table 1: Comparison between Coronaries with ABO Blood group:**

| | | | Blood group | | | | Total |
|---|---|---|---|---|---|---|---|
| | | | A | B | O | AB | |
| Coronaries | Normal lumen without atherosclerosis | Count | 5 | 20 | 25 | 4 | 54 |
| | | % | 23.8% | 55.6% | 67.6% | 66.7% | 54.0% |
| | With atherosclerotic changes | Count | 16 | 16 | 12 | 2 | 46 |
| | | % | 76.2% | 44.4% | 32.4% | 33.3% | 46.0% |
| Total | | Count | 21 | 36 | 37 | 6 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

$\chi^2$- value= 10.870, p=0.012*

* Statistically significant difference as $p < 0.05$ level

The above table 1 shows the comparison between coronary atherosclerosis with ABO Blood groups by Pearson's chi-square test which shows $\chi^2$ =10.870, p value = 0.012. It shows that there is statistically significant association between Coronary atherosclerosis and ABO Blood groups as the p value is less than 0.05.

This shows that blood group A has highest percentage followed by blood group B, O and AB. This is in concordance with the study conducted by KANCHANA SUJIRACHATO et al [5].The study conducted by P.H.WHINCUP et al [6] also showed that the prevalence of coronary atherosclerosis and ischaemic heart disease was higher among the A – blood group individuals. The study conducted by YOUNIS A.M. SKAIK also showed that the blood group – A was most commonly associated with the myocardial infarction[7].

The systematic review and meta-analysis conducted by ZHUO CHEN et al., also showed that the risk of CAD was higher in non – O blood group than the O-blood group individuals with an Odds ratio of 0.85[8]. The study conducted by CLARA CARPEGGIANI et al., showed that the non – O blood group was significantly associated with the family history of coronary atherosclerosis[9]. Few studies such as conducted by MITCHELL et al.,[10] and PRIYANKA GARG et al.,[11] showed that O-blood group has higher risk for coronary atherosclerosis.

In a study conducted among the young patients with myocardial infarction at London, about 39% of the participants of the study showed positive family history with the findings of premature coronary arterial heart disease [13]. The children born to the parents with the premature coronary arterial heart disease had an increased rate of prevalence for the insulin resistance, abnormalities in the lipid metabolism and obesity which strengthens the belief that all these are having a common genetic lineage which will be inherited as well [12]. These group of individuals with a positive family history will have more number of arterial abnormalities than the other persons who had myocardial infarction without any positive family history for coronary atherosclerosis especially among the individuals aged less than 45 years [14].

Recently several studies conducted by genome – wide association showed that the variants at the ABO locus in the chromosome was associated with the plasma lipids. This in turn will lead to increased levels of the plasma lipid in certain ABO blood groups thereby increasing the risk for the development of the atherosclerosis [15, 16]. There are also several other studies which showed that the variants at the ABO blood group locus was associated with the certain inflammatory markers such as the soluble intercellular adhesion molecule – 1 (ICAM -1), plasma soluble P – Selectin and E – Selectin levels and TNF – α (Tumour Necrosis Factor – α) in the blood. These inflammatory markers were the markers of inflammation for the development of the coronary heart disease [17-21].

**Table 2: Comparison between LAD (Left Anterior Descending Artery) Atherosclerosis with ABO Blood group:**

| | | | Blood group | | | | Total |
|---|---|---|---|---|---|---|---|
| | | | A | B | O | AB | |
| LAD | 0 - 25% occlusion | Count | 7 | 10 | 8 | 1 | 26 |
| | | % | 43.8% | 66.7% | 66.7% | 50.0% | 57.8% |
| | 26 - 50% occlusion | Count | 6 | 3 | 2 | 1 | 12 |
| | | % | 37.5% | 20.0% | 16.7% | 50.0% | 26.7% |
| | 51 - 75% occlusion | Count | 3 | 2 | 1 | 0 | 6 |
| | | % | 18.8% | 13.3% | 8.3% | 0.0% | 13.3% |
| | 75 - 100% occlusion | Count | 0 | 0 | 1 | 0 | 1 |
| | | % | 0.0% | 0.0% | 8.3% | 0.0% | 2.2% |
| Total | | Count | 16 | 15 | 12 | 2 | 45 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

$\chi^2$- value= 6.341, p=0.705*

*No Statistically significant difference as p > 0.05 level

The above table shows comparison between different grades of atherosclerosis in LAD with ABO Blood group by Pearson's Chi-square test which shows $\chi^2$ = 6.341, p value = 0.705. This shows that there is no statistically significant association between different grades of atherosclerosis in LAD and ABO Blood group.

**Table 3: Comparison between RCA (Right Coronary Artery) Atherosclerosis with ABO Blood group:**

| | | | Blood group | | | | Total |
|---|---|---|---|---|---|---|---|
| | | | A | B | O | AB | |
| RCA | 0 - 25% occlusion | Count | 4 | 5 | 3 | 1 | 13 |
| | | % | 80.0% | 83.3% | 60.0% | 100.0% | 76.5% |
| | 26 - 50% occlusion | Count | 1 | 1 | 1 | 0 | 3 |
| | | % | 20.0% | 16.7% | 20.0% | 0.0% | 17.6% |
| | 51 - 75% occlusion | Count | 0 | 0 | 1 | 0 | 1 |
| | | % | 0.0% | 0.0% | 20.0% | 0.0% | 5.9% |
| Total | | Count | 5 | 6 | 5 | 1 | 17 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

$\chi^2$- value= 2.906, p=0.821*

*No Statistically significant difference at p value > 0.05 level

The above table shows comparison between different grades of atherosclerosis in RCA with ABO Blood groups by Pearson's chi-square test which showed $\chi^2$=2.906, p value = 0.821. It shows that there is no statistically significant association between different grades of atherosclerosis in RCA and ABO Blood groups.

**Table 4: Comparison between LCX (Left Circumflex Artery) Atherosclerosis with ABO Blood group:**

| | | | Blood group | | | Total |
|---|---|---|---|---|---|---|
| | | | A | B | O | |
| LCX | 0 - 25% occlusion | Count | 0 | 5 | 4 | 9 |
| | | % | 0.0% | 100.0% | 100.0% | 90.0% |
| | 26 - 50% occlusion | Count | 1 | 0 | 0 | 1 |
| | | % | 100.0% | 0.0% | 0.0% | 10.0% |
| Total | | Count | 1 | 5 | 4 | 10 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% |

$\chi^2$- value= 10.000, p=0.007 **

** Highly Statistically significant difference at p < 0.01 level

The above table shows comparison between different grades of atherosclerosis in LCX with ABO Blood group by Pearson's chi-square test which shows $\chi^2$=10.000, p value = 0.007. It shows that there is statistically significant association between different grades of atherosclerosis in LCX with ABO Blood group.

**Table 5: Comparison between LCA (Left Coronary Artery) Atherosclerosis with ABO Blood group:**

| | | | Blood group | Total |
|---|---|---|---|---|
| | | | O | |
| LCA | 0 - 25% occlusion | Count | 2 | 2 |
| | | % | 100.0% | 100.0% |
| Total | | Count | 2 | 2 |
| | | % | 100.0% | 100.0% |

NA-Not Applicable

The above table shows comparison between different grades of atherosclerosis in LCA with ABO Blood group by Pearson's Chi-Square test were $\chi^2$-value, p-value is not applicable as 2x2 table is not formed.

## Conclusion

The main purpose of this study was to determine the association of ABO blood group with coronary atherosclerosis. From the results of this study, it may be concluded that there was statistically significant association between the ABO blood group and the coronary atherosclerosis. The persons with blood group – A were at the highest risk of developing coronary atherosclerosis followed by the blood group – B individuals, then by the blood group – O individuals and then least by the individuals with blood group – AB.

In general, the persons with Non – O blood groups (A, B, AB) had higher risk for coronary atherosclerosis when compared to the persons with O blood group. But when individual coronary artery is considered, there was no statistically significant association of coronary atherosclerosis with the ABO blood group except in the LCX. The left anterior descending artery is the most common coronary artery involved in atherosclerosis. In all the coronary arteries, 0 – 25% occlusion of the lumen by coronary atherosclerosis was most commonly seen.

**Limitations:**

This study was conducted among the individuals in the age group of 25 to 50 years in a single centre only with a sample size of 100 during the study period. Although the association between the ABO blood group was established with the development of coronary atherosclerosis significantly, but the exact mechanism of association between ABO blood group and the coronary atherosclerosis is still unclear. Also, the subgroups of A-blood group (A1 and A2) could not be studied in detail.

**Recommendations:**

As the present study showed that apart from the traditional risk factors for CAD like diabetes, hypertension, smoking and alcohol, utmost care should be given to the ABO blood group also as it plays a vital role in association with the development of coronary atherosclerosis as evident from the present study. So, the blood grouping should be included in the routine screening for coronary atherosclerosis

and the persons with Non – O blood group especially Blood group – A must be educated to be extra cautious and avoid the other modifiable risk factors in order to prevent the development of atherosclerotic coronary artery disease and its consequences.

Health education has to be provided to the general population regarding the association of ABO blood group and coronary atherosclerosis in order to reduce the death rate of the disease and thereby improving the quality of life.

Further, the present study also recommends for multicentric studies with a large sample size including all the age groups and all the ethnic groups of population in future inorder to study the association between ABO blood group and coronary atherosclerosis in detail. It also recommends genetic studies regarding the association of ABO blood group and coronary atherosclerosis in future can be conducted inorder to find out the exact nature of this association at the gene level so that the family members can also be screened and prevent the morbidity and mortality of the disease.

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