

## ASSOCIATION OF BLOOD GROUP A WITH INCREASED RISK OF CORONARY HEART DISEASE IN THE PAKISTANI POPULATION

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**Background:** Many reports have appeared in recent years showing an association between blood groups and cardiovascular diseases. Clinical studies in developed countries have shown that individuals of the A blood group phenotype are more susceptible to Coronary Heart Disease (CHD). **Methods:** The present study was designed to investigate the correlation of ABO blood groups and CHD in the South Asian population. 252 CHD patients and 75 healthy controls were recruited from Karachi and Nawabshah, Pakistan. **Results:** The results obtained in this study show that the prevalence of CHD in blood group A is invariably higher than in all other ABO blood groups. It is striking that despite the fact that the most prevalent blood group among Pakistanis is phenotype B, the incidence of CHD is highest in individuals with blood group phenotype A. **Conclusion:** This suggests that a certain CHD risk is associated with phenotype A. Thus, we conclude that, in the Pakistani cohort investigated in the present study, blood group phenotype A is associated with a substantially increased risk for CHD, which seems independent of conventional cardiovascular risk factors.

**Keywords:** Blood Group, Coronary heart disease, Pakistan

### INTRODUCTION

Many reports have appeared in recent years suggesting an association between blood groups and various manifestations of heart disease. Most of these studies investigated patients with Coronary Heart Disease (CHD). The high incidence of CHD in the South Asian population is striking, particularly as this high incidence also persists in immigrants of South Asian origin living in industrialized or developed countries.<sup>1</sup> This latter observation was first reported from Singapore, South Africa, and Trinidad in the 1950s. Reliable population based data on coronary mortality from South Asia are not available,<sup>2</sup> but it is known that a high coronary mortality is common to Gujrati Hindus, Punjabi Sikhs, and Muslims from Pakistan and Bangladesh.<sup>3,4</sup>

Clinical studies have shown that individuals of the A phenotype blood group are more susceptible to cardiovascular diseases.<sup>5,6</sup> In British men, the incidence of ischaemic heart disease is higher in patients with blood group A.<sup>7</sup> Likewise, in the Hungarian population, again blood group A is more common in patients with CHD.<sup>8</sup> In a most recent study carried out in Copenhagen, Denmark, the Lewis blood group phenotype Le (a-b-) was found to be associated with an increased risk for CHD in men; this appears independent of conventional cardiovascular risk factors like smoking, obesity, diabetes mellitus, high cholesterol, triglycerides, etc.<sup>9</sup> This is contrasted by the Northwick Park Heart Study which showed that, in the investigated UK population, the incidence of ischaemic heart disease is significantly higher in patients with blood group

phenotype AB than in those with groups O, A or B.<sup>10</sup>

The present study was designed to investigate the correlation of ABO blood groups and CHD in the South Asian population, as the distribution of ABO blood groups in South Asia is different from the one in Europe, Middle East, North Africa, USA, and Australia (Table 1)<sup>11-14</sup>

### MATERIALS AND METHODS

327 non obese male and female subjects were selected for this study. Their ages ranged from 40 to 55 years (Mean 52). Out of these, 75 were age and gender matched healthy controls, 152 were CHD patients, and 100 had arterial hypertension combined with CHD. All subjects were screened out for other systemic diseases like diabetes mellitus, carcinoma of any kind, tuberculosis, or rheumatism.

**Patients:**

252 CHD patients included in the present study were recruited from either the Cardiology Wards or Out Patient Departments of cardiac clinics in Karachi (Jinnah Postgraduate Medical Centre) and Nawabshah (People's Medical College Hospital), Pakistan.

**Healthy Controls:**

75 healthy volunteers were recruited from Karachi and Nawabshah and included in the study. In another part of the study, the overall Pakistani population and their ABO blood group distribution was used as control.

The standard agglutination test as recommended by the Institute of Blood Transfusion of Pakistan was used to determine A, B, O and AB blood groups

(Institute of Blood Transfusion, Lahore, Pakistan, Techniques in Blood Grouping Serology, 1965). For determination of A, B, O and AB blood groups, a drop of blood was mixed with antisera, and agglutination was observed within two minutes.

The risk of CHD was calculated according to the following algorithm: The occurrence of CHD (%) in the respective blood groups of the study cohort was divided by the occurrence of the respective blood group (%) in control individuals in either the cohort or the Pakistani population as a whole.

**RESULTS**

As shown in Table 1, in the cohort investigated in the present study, the incidence of CHD in individuals with blood group A is 46.71%, while this incidence is 32.24% in individuals with blood group B, 17.76% in blood group O, and 3.29% in blood group AB. By comparison, the incidence of blood groups A, B, O, and AB in healthy subjects in the cohort is 17.3%, 37.3%, 41.3%, and 4.0%, respectively. This results in CHD risks as shown in Table 2. The relative risk of CHD in individuals with blood group A is 3.14 fold that in blood group B, 6.35 fold that in blood group O, and 3.32 fold that in blood group AB.

Extending the number of healthy control individuals beyond the study cohort by using the nationwide distribution of ABO blood groups in Pakistan, yields incidences of ABO blood groups in Pakistan as shown in Table 3. Taking into account the occurrence of ABO blood groups in the overall population of Pakistan as a whole, calculating the risk for CHD in the study cohort yields values as given in Table 2. The relative risk for CHD in individuals with blood group A, based on the extended control platform, is 2.50 fold that in blood group B, 4.11 fold that in blood group O, and 6.05 fold that in blood group AB.

**Table 1: Frequency of ABO blood groups in coronary heart disease patients and controls**

Blood Group	Control	CHD	Age
	%	%	Mean ± SD
A	17.3	46.71	52.57 ± 3.62
B	37.3	32.24	53.35 ± 1.72
O	41.3	17.76	53.29 ± 1.74
AB	4.0	3.29	53.45 ± 1.04
Total	75	252	327

**Table 2: Risk of coronary heart disease (CHD) by ABO blood group in the study cohort as compared to study controls (CHD Risk) and as compared to the overall Pakistani population (CHD Risk Pak)**

Blood Group	CHD Risk	CHD Risk Pak
A	2.730	2.203
B	0.870	0.881
O	0.430	0.536
AB	0.823	0.364

**Table 3 Distribution of ABO Blood Groups by Country\***

Country	Blood Groups			
	A	B	O	AB
Australia	40%	10%	47%	3%
Britian	42%	8%	47%	3%
Germany	26.60%	13.40%	60%	?
India	29%	28%	32%	11%
Iraq	30.9%	22.5%	46.7%	?
Israel	25.5%	16.7%	57.8%	?
Morocco	18%	20.9%	61.1%	?
Pakistan	21.20%	36.61%	33.14%	9.05%
USA	41%	10%	45%	4%
Yemen	19.4%	5.5%	75.1%	?

Sources: Nasim et al., 1987; Afzal et al., 1977; Denborough, 1962; Medalie et al., 1971.

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**DISCUSSION**

In summary, the results obtained in this study show that, in this Pakistani cohort, the prevalence of CHD in blood group A is invariably higher than in all other ABO blood groups, very similar to the report by Whincup et al.<sup>7</sup> from England, and from other parts of Europe<sup>2-6,8,10,13-15</sup> or USA<sup>9</sup>. The clinical picture of CHD in South Asians is similar to that in Europeans. Smoking in South Asians living in England is generally less common than in Europeans.<sup>1</sup> It has been suggested that atherogenic constituents in ghee (clarified butter), commonly used in South Asian cooking, constitute a possible cause of the high CHD risk among South Asians including Pakistanis.<sup>16</sup> This has been supported by a report of McKeigue et al.<sup>2</sup> which states that South Asian immigrants to England and Wales have elevated mortality from CHD as compared to the indigenous British population. The South Asians consumed less saturated fat (S) and cholesterol and more polyunsaturated fat (P) and vegetable fibre. The P/S ratio of the South Asians' diet was 0.85, as compared to 0.28 in the diet of the indigenous British population. This was also reflected in the very high linoleic acid content of the immigrants' plasma lipids. The high incidence of CHD in South Asian immigrants cannot be explained by these facts alone, as the higher P/S ratio would rather be suggestive of a relative reduction of the CHD risk. Furthermore, plasma LDL levels are, on average, lower in South Asians than in Europeans.<sup>2</sup> The basis for advising South Asians to reduce saturated fat intake on a mass scale, so as to lower average plasma cholesterol, is therefore open to question. It is striking that, despite the fact that the most prevalent blood group among Pakistanis is phenotype B,<sup>11</sup> the incidence of CHD is highest in individuals with blood group phenotype A. This suggests that an increased CHD risk is associated with phenotype A as compared to phenotype B and,

even more so, when compared with blood group phenotype O. Our results obtained in blood group phenotype AB are less conclusive, as, due to the scarcity of individuals with blood group AB among the Pakistani population, the number of individuals with phenotype AB included in the study was only.<sup>13</sup>

## **CONCLUSION**

Thus, we conclude that, in the Pakistani cohort investigated in the present study, blood group phenotype A is associated with a substantially increased risk for CHD. This seems to be independent of conventional cardiovascular risk factors. It is assumed that this observation can be extrapolated to the Pakistani population, if not the South Asian population as a whole, as the study cohort, being recruited in the cosmopolitan area of Karachi and in Nawabshah, comprised a representative blend of the overall population of Pakistan and South Asia (Punjabi, Pathan, Sindhi, Uttar Pradesh, Gujrati, Bengali, Behari, Rajastani, Balochi, Tamil). At present, the mechanisms underlying this observation are unknown. More work will be needed regarding blood group AB, because this is the least common blood group in the Pakistani population, and was the least well represented in our study.

## **REFERENCES**

1. McKeigue PM. Coronary heart disease in Indians, Pakistanis and Bangladeshis: aetiology and possibilities for prevention. *Br. Heart J.*, 1992, 67: 341-342.
2. McKeigue PM, Miller GJ, Marmot MG. Coronary heart disease in South Asians overseas – a review. *J. Clin. Epidemiol.*, 1989, 42: 597-609.
3. Balarajan R, Adelstein AM, Bulusul, Shukla U. Patterns of mortality among migrants to England and Wales from the Indian subcontinent. *Br. Med. J.*, 1984, 289: 1185-1187.
4. McKeigue PM, Marmot MG. Mortality from coronary heart disease in Asian communities in London. *Br. Med. J.*, 1988, 297: 903.
5. Platt D, Muhlberg W, Kiehl L, Schmitt-Ruth R. ABO blood groups system, age, sex, risk factor and cardiac infarction. *Arch. Gerontol. Geriatr.*, 1985, 4(3): 241-249.
6. Fox MH, Webber LS, Thurmon TF, Berbenson GS. ABO blood group associations with cardiovascular risk factor variables. *Hum. Biol.*, 1986, 58 (4): 549-584.
7. Whincup PH, Cook DG, Phillips AN, Shaper AG. ABO blood group and ischaemic heart disease in British men. *Br. Med. J.*, 1990, 300: 1679-1682.
8. Tarjan Z, Tonelli M, Duba J, Zorandi A. Correlation between ABO and Rh blood groups, serum cholesterol and ischaemic heart disease in patients undergoing coronarography. *Orv. Hetil.*, 1995, 136(15): 767-769
9. Ellison RC, Zhang Y, Myers RH, Swanson JL, Higgins M, Eckfeldt J. Lewis blood group phenotype as an independent risk factor for coronary heart disease. *Am. J. Cardiol.*, 1999, 83: 345-348.
10. Meade TW, Cooper JA, Stirling Y, Howarth DJ, Ruddock V, Miller GJ. Factor VIII, ABO blood group and the incidence of ischaemic heart disease; *Br. J. Haematol.*, 1994, 88(3): 601-607.
11. Nasim FH, Ashraf M, Sheikh QI, Kokab T, Shaheen Q. Distribution of ABO and Rh blood groups in the residents of Bahawalpur. *J. Pak. Med. Assoc.*, 1987, 37: 7-8.
12. Afzal M, Ziaur-Rehman, Hussain F, Siddiqui RH. A survey of blood groups. *J. Pak. Med. Assoc.*, 1977, 27: 426-429.
13. Denborough MA. Blood groups and Ischaemic Heart disease. *Br. Med. J.*, 1962, 2: 927.
14. Medalie JH, Levene C, Papier C, Goldbourt U, Dreyfuss F, Oron D, Neufeld H, Riss E. Blood groups, myocardial infarction and angina pectoris among 10,000 adult males. *N. Eng. J. Med.*, 1971, 285 (24): 1348-1353.
15. McKeigue PM, Marmot MG, Adelstein AM. Diet and risk factors for coronary heart disease in Asians in North West London. *Lancet.*, 1985, II: 1086-1090.
16. Jacobson MS. Cholesterol oxides in Indian ghee: Possible cause of unexplained high risk of atherosclerosis in Indian immigrant populations. *Lancet*, 1987, II: 656-658.

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