Assessment of Ischemic Heart Disease and its Risk Factors among Asymptomatic Hospital Visitors

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Abstract
Objectives: The prevalence of Ischemic Heart Disease (IHD) and risk factors of IHD is increasing in developing countries, including India due to changes in lifestyle and dietary changes. Reports regarding asymptomatic ischemic heart disease (AIHD) among general population showed varying results. Studying the prevalence and associated risk factors of AIHD among the hospital visiting population is worthwhile.

Materials & Methods: One hundred patients attending a tertiary care hospital, not known to have IHD or symptoms of IHD were included. ECG was recorded and IHD was diagnosed using Minnesota criteria. After collecting blood for lipid profile, height, weight, waist circumference (WC) and hip circumference (HC) were measured.

Results & Discussion: Among the study population, males (n=57) had increased age and height compared to females (n=43). HC, WC and body mass index (BMI) were increased in females compared to males. Among IHD risk factors BMI, WC and waist-hip ratio (WHR) were positively correlated with systolic BP and diastolic BP. The incidence of AIHD was found to be 13% among the study group. Compared to non-ischemic group age factor, triglycerides (TGL) and VLDL cholesterol were significantly elevated among AIHD subjects. On regression analysis, age and TGL were found to be independent risk factors to develop AIHD among this study population.

Conclusion: Prevalence of AIHD among hospital visiting patients is 13%. Age, TAG and VLDL were significantly increased in AIHD subjects compared to controls. Further regression analysis revealed age and TAG as associated risk factors to develop AIHD in this study population.

Keywords: Asymptomatic ischemic heart disease, Risk factors of IHD

1. Introduction
Ischemic heart disease (IHD) is characterized by impaired myocardial function due to decreased blood flow and it is the leading cause of death in developed countries. In India, the estimated adult prevalence (of the age >30yrs) of IHD is around 8-10 percent in urban settings and 3-4 per cent in rural areas, reflecting a rise of six-fold and two-fold respectively between 1960 and 2002.¹

Among IHD risk factors age, sex and family history are non-modifiable risk factors and smoking,
hypercholesterolemia, diabetes mellitus, hypertension and metabolic syndrome are modifiable. There are currently 40.9 million people with diabetes and 118 million people with hypertension, which is anticipated to reach 69.9 and 213 million respectively, by 2025. These startling numbers are compounded by the fact that Indians succumb to diabetes, high blood pressure and heart attacks 5-10 years earlier than their Western counterparts in their most productive years. Panwar et al had demonstrated that smoking, low fruit/vegetables intake, fibrinogen, homocysteine, hypertension and dyslipidaemia are the significant contributors of premature CHD in Indian population. The associated lifestyle and dietary changes have led to rise in smoking habits, hypertension, obesity, diabetes and in turn, coronary artery disease (CAD) in developing countries like India.

Research studies exploring the prevalence of asymptomatic IHD (AIHD) in various parts of India have alarming outcomes. Gopinath et al have reported the prevalence of asymptomatic IHD as 6.7% among urban population of New Delhi with 5.6 % affecting males and 7.6 % females. Female sex and systemic hypertension were identified as the potential risk factors to develop silent IHD among that population. Another study conducted in industrial settings of Delhi, detected its prevalence as 7.3 %. Similar study on HIV positive subjects had shown the prevalence of 10 % with older age, diabetes and hypertension as the common risk factors. Data regarding the burden of AIHD among hospital visiting patients and associated risk factors for IHD among them was not seen in literature.

2. Materials and Methods

This study was conducted with one hundred patients of age > 35 years presenting to the outpatient department (OPD) of Sri ManakulaVinayagar Medical College & Hospital (SMVMCH), Puducherry after getting approval from Institute Human Ethical Committee. An informed consent was taken from all subjects. After excluding the history suggestive of ischemic heart disease, each participant was given a validated questionnaire to get baseline information, blood pressure (BP) was measured and electrocardiogram was recorded. Blood sample was collected and serum was separated for further biochemical investigations. Presence of ischemic heart disease was diagnosed using Minnesota criteria.

2.1 Anthropometric Measurements

Height was measured using a standard stadiometer with the subjects standing in erect posture and the readings were taken to the nearest 0.1 cm. Waist circumference was measured at the midpoint between the lower border of the rib cage and iliac crest. Hip circumference was measured at the level of greater trochanter. Basal metabolic index (BMI) was calculated using the standard formula, weight (kg) / height (m^2). Waist Hip Ratio (WHR) was calculated with the above parameters.

2.2 Biochemical Analysis

Fasting blood samples were collected from study subjects and serum was separated. Serum total cholesterol wasmeasured by cholesterol oxidase – peroxidase methodand triacylglycerol (TAG) levels was measured by glycerol kinase – peroxidase method. HDL-cholesterol was measured by divalent cation precipitation method using reagent kits adapted to an automated blood analyzer. VLDL cholesterol level was calculated by dividing the triacyl glycerol concentration by 5. LDL-cholesterol was calculated using Friedwald’s formulæ [TC-(VLDL+HDL)]. Serum glucose wasmeasured by glucose oxidase - peroxidase method.

2.3 Statistical Analysis

Statistical analysis was performed by SPSS 13.0 software. Results are expressed as mean ± standard deviation. Correlation analysis of risk factors to develop IHD was done using Karl Pearson’s method. A p value of less than 0.05 is considered as significant for all statistical tests.

3. Results

A total of one hundred subjects (53 males: 47 females) attending OPD of medicine were included in our study after excluding the history of IHD symptoms and related drug intake. On analysis of subjects based on Minnesota criteria in Electrocardiogram, 13 subjects were found to have Asymptomatic Ischemic Heart Disease (AIHD).

Table 1 and 2 displays the comparison of baseline anthropometric and biochemical parameters between males and females of study population. Mean age and height were lower in females significantly than males. HC, WC and BMI were significantly increased in females than males. No significant difference was noticed in lipid levels and serum glucose levels between males and females.
In table 3, AIHD subjects were shown to have higher proportion of hypertension and diabetes mellitus but central obesity was found to be evenly distributed in both the groups. Family history of hypertension, diabetes mellitus and even ischemic heart disease were lesser in proportion among AIHD subgroup compared to non-ischemic group.

Table 4 shows comparison of variables between non-ischemic (NIS) and asymptomatic ischemic heart disease (AIHD) subjects. AIHD subjects were having higher age than NIS significantly. Age was significantly higher among AIHD subjects than NIS subgroup. Among lipids, triglycerides and VLDL were significantly increased in AIHD subjects.

Correlation analysis of CVD risk factors among the study subjects revealed that BMI, WC and WHR were positively associated with both SBP and DBP. Binary logistic regression analysis (table 6) revealed that age and TAG are the independent risk factors associated with AIHD subjects.

**Table 1: Comparison of study variables between males and females.**

|                  | Males (n=57) | Females (n=43) | Total (n=100) |
|------------------|--------------|----------------|--------------|
| Age (years)      | 56 ±11       | 50 ± 10*       | 53 ± 11      |
| Height (cm)      | 163 ± 6      | 151 ± 6*       | 157 ± 8      |
| Weight (kg)      | 64 ± 11      | 66 ± 13        | 65 ± 12      |
| BMI (kg/m²)      | 24 ± 3.5     | 28.8 ± 5.7*    | 26.2 ± 5.2   |
| Hip Circumference (cm) | 92 ± 8 | 98 ± 11*       | 95 ± 10      |
| Waist Circumference (cm) | 93 ± 8 | 103 ± 11*     | 100 ± 12     |
| Waist-Hip Ratio  | 1.0 ± 0.06   | 1.04 ± 0.11    | 1.02 ± 0.9   |
| Systolic BP (mm Hg) | 128 ± 18 | 130 ± 16       | 129 ± 17     |
| Diastolic BP (mm Hg) | 80 ± 12 | 81 ± 12        | 80 ± 12      |

* p value less than 0.05 calculated by student ‘t’ test. BMI – body mass index.

**Table 2: Comparison of lipid risk factors of ischemic heart disease between males and females.**

|                  | Males (n=57) | Females (n=43) |
|------------------|--------------|----------------|
| Total cholesterol (mg/dl) | 196 ± 38   | 207 ± 35       |
| LDL cholesterol (mg/dl)    | 133 ± 28    | 138 ± 27       |
| HDL cholesterol (mg/dl)    | 45 ± 11     | 48 ± 13        |
| VLDL cholesterol (mg/dl)   | 28 ± 8      | 25 ± 6         |
| Triglycerides (mg/dl)      | 166 ± 42    | 136 ± 30       |
| TAG/HDL                   | 4.22 ± 1.2  | 3.32 ± 0.8     |
| LDL/HDL                   | 3.52 ± 1.4  | 3.27 ± 1.1     |
| Fasting blood glucose (mg/dl) | 130 ± 31 | 129 ± 32       |
| PPBG (mg/dl)               | 222 ± 38    | 227 ± 37       |

LDL: low density lipoprotein; VLDL: very low density lipoprotein; HDL: high density lipoprotein; PPBG: post prandial blood glucose

**Table 3: Comparison of percentage of risk factors among study population, non-ischemic and asymptomatic ischemic heart disease subjects.**

|                  | Study population (n=100) | Non-ischemic (n=87) | AIHD(n=13) |
|------------------|--------------------------|---------------------|------------|
| Hypertension (%) | 35                       | 28                  | 53         |
| Diabetes mellitus (%) | 71            | 60                  | 84         |
| Obesity (%)      | 35                       | 32                  | 23         |
| Central obesity (%) | 99                 | 88                  | 90         |
| Family h/o SHT (%) | 22                  | 18                  | 4          |
| Family h/o DM (%) | 38                       | 32                  | 6          |
| Family h/o IHD (%) | 3                     | 1                   | 2          |

h/o : history of; SHT : systemic hypertension; DM: diabetes mellitus; IHD: ischemic heart disease; AIHD: Asymptomatic Ischemic Heart Disease.

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Table 4: Comparison of age, anthropometric variables and biochemical variables between non-ischemic and asymptomatic ischemic heart disease subjects

| Characteristics       | NIS (n=87)    | AIHD (n=13)   | ‘p’ value |
|-----------------------|---------------|---------------|-----------|
| Age (years)           | 52.17 ± 10.47 | 64.54 ± 10.30*| 0.001     |
| Height (cm)           | 157.55 ± 8.66 | 156.92 ± 6.46 | 0.800     |
| Weight (Kg)           | 65.48 ± 11.95 | 60.46 ± 11.58 | 0.159     |
| BMI                   | 26.49 ± 5.24  | 24.58 ± 4.93  | 0.214     |
| Waist Circumference (cm) | 96.84 ± 12.19 | 98.00 ± 10.93 | 0.730     |
| Hip Circumference (cm) | 95.43 ± 10.32 | 92.46 ± 7.45  | 0.321     |
| Waist Hip ratio       | 1.02 ± 0.09   | 1.03 ± 0.06   | 0.573     |
| Total Cholesterol (mg/dl) | 201.08 ± 53.18 | 202.15 ± 78.96 | 0.963     |
| Triglyceride (mg/dl)  | 144.39 ± 46.30| 210.62 ± 62.30*| 0.040     |
| HDL-C (mg/dl)         | 44.70 ± 12.03 | 58.92 ± 16.23 | 0.192     |
| LDL-C (mg/dl)         | 132.63 ± 28.69| 156.38 ± 45.29| 0.180     |
| VLDL (mg/dl)          | 26.00 ± 8.61  | 36.62 ± 10.09*| 0.018     |

NIS: non-ischemic subjects; AIHD: Asymptomatic Ischemic Heart Disease.

Table 5: Correlation analysis between anthropometric parameters and blood pressure among study subjects.

| Parameter           | r – value | Systolic BP | Diastolic BP |
|---------------------|-----------|-------------|--------------|
| Body Mass Index     | 0.227*    | 0.16        |
| Waist Circumference | 0.248*    | 0.262*      |
| Waist Hip Ratio     | 0.09      | 0.190*      |

* ‘p’ value < 0.05. Pearson Correlation Analysis was used to calculate ‘r’ value.

Table 6: Binary regression analysis of risk factors associated with asymptomatic ischemic heart disease subjects.

|          | odds ratio (OR) (95% CI) | p-value |
|----------|--------------------------|---------|
| Age      | (1.049 – 1.272)          | 0       |
| Triacyl glycerol (TAG) | (0.928 – 22.35) | 0.05 |

4. Discussion

Ischemic heart disease is the leading cause of death in economically developed countries and is rapidly assuming serious dimensions in developing countries. There is a steep increase in prevalence of IHD in urban areas in India. It is expected to be the single most important cause of death in India by the year 2015 A.D. Recent estimates suggest that 80 per cent of CVD deaths occur in developing countries with substantial contribution from India. The prevalence of CAD was detected as 11.6% in urban males of West Bengal, 12.6% among Tirupathy population and 11% in Chennai urban population. There is a paucity of data related to prevalence of CAD in asymptomatic subjects. The prevalence of asymptomatic IHD was detected to be 5% among the urban population of Siliguri, West Bengal. In another study by Dakshina Murthy et al, 10 out of 29 CAD subjects were asymptomatic implying that around 33% of CAD will be asymptomatic. Gopinath et al have reported the prevalence of asymptomatic IHD as 6.7% among urban population of New Delhi with 5.6 % affecting males and 7.6 % females. The prevalence of silent CAD in our study population was found to be 13%, This prevalence is higher than other studies. This is probably due to the nature of study population. In this study, we had selected subjects who were visiting our hospital situated in outskirts of Puducherry, where the patients come from low socio-economic status. The ignorance and illiteracy about the symptoms of CAD among this population might be one of the reasons for such a high prevalence of unreported or silent CAD. Silent IHD is more associated with diabetes mellitus. Since 71 % of our study population were diabetics, this may also be one of the reasons for higher prevalence of AIHD in this study.
Diabetes is one of the major risk factors for CAD which increases the risk to three fold. Silent myocardial ischemia was detected in 50% of asymptomatic diabetics in North Indian population. In this study, the prevalence of hypertension and dyslipidemia were increased in silent ischemic subjects compared to non-ischemic asymptomatic diabetics. Agarwal et al had reported the prevalence of silent ischemia among asymptomatic diabetics as 29% and identified that high LDL (above 140 mg%) and increased carotid IMT can be used to predict the development of CAD among diabetics. The prevalence of AIHD among diabetics had shown different results in different populations, 46%, 23% and 23%.

In our study, among known diabetics (n=71) of study population, 11 (15.5%) were found to have AIHD. Surprisingly, among AIHD subjects, 85% (n=11) were diabetic and 6 had family history of diabetes. The low prevalence of AIHD in diabetics may be either due to smaller sample size or due to differences in the prevalence AIHD among diabetics in different populations.

Among anthropometric parameters, WC, BMI and WHR are known risk factors for the development of CVD. In our study, we observed increased values for BMI, WC and WHR, compared to reference values for Indian population. But we did not observe significant difference between non-ischemic subjects and AIHD subjects. It may be due to either low sample size among AIHD group or these risk factors are uniformly distributed among all hospital visiting patients. Moreover, BMI was observed to have positive association with SBP. This finding is in accordance with a study conducted in north Indian population where obesity markers such as BMI, WC and WHR were detected to have positive correlation with CVD risk factors SBP, DBP, fasting blood glucose and LDL cholesterol.

In our study WC showed positive association with SBP and DBP. The prevalence of silent CAD was seen higher among the subjects with high WC and the same WC can be used as an independent predictor of silent CAD.

TC, LDL, LDL/HDL are the known risk factors to develop IHD. In our study, we found 45% of subjects were having increased TC and LDL above the desired levels as per ATP III classification and 41% of study subjects showed low HDL levels. There was a significant increase in TAG and VLDL levels among AIHD subjects compared to non ischemic subjects in our study. Subsequent analysis revealed that TAG had significant positive correlation with TC, LDL and LDL/HDL. TAG was also found as the significant factor associated with AIHD. This implies that TAG is one of the significant risk factor to develop AIHD in our study subjects. VLDL was found to have positive association with DBP, TC, LDL, LDL/HDL, FBS and PPBS. This strongly signifies that TAG and VLDL are the potential risk factor to develop AIHD in this population.

On comparison analysis between AIHD and non-ischemic group, age and TAG were significantly increased. On analysis of CAD risk factors with respect to age, Arnab Ghosh et at have identified that age modulates them. Another study conducted in urban population also had detected age as the possible risk factor to develop CAD. Moreover age and TAG were also found as the independent risk factors to develop AIHD.

To conclude, the prevalence of AIHD among hospital visiting patients is 13%. Among the study subjects, 71% were diabetics, 35% were hypertensives and 55% of them were found to be dyslipidemic. Age, TAG and VLDL were significantly increased in AIHD subjects compared to controls. Further regression analysis revealed age and TAG as associated risk factors to develop AIHD in this study population.

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