Cardiovascular risk factors in adolescents with a family history of cardiovascular disease

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Abstract
Background: Although cardiovascular disease (CVD) is mainly seen in adults, atherosclerosis may commence in children.

Objectives: To assess the frequency of hypertension and diabetes and to study the lipid profile among adolescents who have a family history of CVD.

Method: A tertiary hospital based, observational prospective study was carried out from 1st May, 2013 to 30th April, 2014. Adolescents (11-18 years) with a history of coronary artery disease, cerebrovascular disease, diabetes, hypertension or peripheral vascular disease in one or both parents or siblings were included in the study. Adolescents with diseases associated with accelerated atherosclerosis or premature CVD or on pharmacological agents leading to obesity or dyslipidaemia or interfering with glucose tolerance test were excluded from the study. The subjects were screened for obesity, hypertension, dyslipidaemia and diabetes by physical examination and relevant investigations.

Results: The study group comprised 127 children aged 11-18 years. History of CVD was present in a single family member in 123 adolescents while 4 adolescents had more than 1 family member suffering from CVD. Of these, hypertension was the most common CVD (53%) followed by diabetes (23%) and coronary artery disease (12%). Around 6% adolescents had more than one CVD present in their families. One or more cardiovascular risk factors were seen in around 38% and no risk factors were present in around 62% adolescents. Around 13% had dyslipidaemia, 11% had reported increased blood pressure records followed by 9% with increased fasting blood sugar. Body mass index was increased in 9.5% of adolescents.

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Conclusions: A positive correlation (P <0.05) was seen between presence of hypertension, diabetes and dyslipidaemias in adolescents with a family history of cardiovascular disease.

Introduction
Although cardiovascular disease (CVD) is mainly seen in adults, atherosclerosis may commence in children[1]. CVD is the foremost cause of death in Indians[2]. Risk factors of CVD are modifiable or non-modifiable. Cigarette smoking; dyslipidaemias, hypertension, diabetes mellitus, obesity and sedentary lifestyle are modifiable risk factors whereas age, heredity and the male sex are non-modifiable[3]. A positive family history is associated with an increased risk of CVD in men, women and siblings of different races and ethnicities[4-10].

Method
This was a tertiary hospital based, observational prospective study done over a period of one year from 1st May, 2013 to 30th April, 2014, in adolescents in the Department of Paediatrics at the Indira Gandhi Medical College, Shimla. Adolescents (11-18 years) with a history of coronary artery disease, cerebrovascular disease, diabetes, hypertension or peripheral vascular disease in either one or both parents and siblings were included in the study. Adolescents suffering from diseases associated with accelerated atherosclerosis or premature CVD such as Kawasaki disease, childhood cancers, chronic inflammatory diseases etc. or on any pharmacological agents leading to obesity or dyslipidaemia (e.g. corticosteroids, sodium valproate etc.) or interfering with glucose tolerance test were excluded from the study. The subjects of the study were enrolled randomly from adolescents of age group 11-18 years attending the outpatient department (OPD) or admitted in the indoor unit of the Department of Paediatrics. Informed consent was obtained from the parents or caregivers. The subjects were screened for obesity, hypertension, dyslipidaemia and diabetes by doing physical examination and relevant investigations.

Weight of the child was recorded on an electronic type of weighing scale, with minimal clothing and

weight was measured to ±0.1 kg. Height was measured using a stadiometer to ±0.1 cm. Body mass index or Quetelet index was measured by dividing the weight in kilograms by square of height in metres. After a thorough physical and systemic examination, the subjects thus enrolled were subjected to venepuncture under aseptic conditions for estimating fasting blood sugar and lipid profile after overnight fasting for a minimum of 6 hours.

The data thus collected was analysed using SPSS version 17.0. Continuous variables are presented as mean ± SD, and categorical variables as absolute numbers and percentages. A *p* value less than 0.05 was taken as significant.

Results
All adolescents (11-18 years) attending the OPD or admitted in the indoor unit were asked for a history of hypertension, diabetes, coronary artery disease, cerebrovascular disease or peripheral artery disease in parents and siblings. Those adolescents who had a family history of one or more of above mentioned diseases were enrolled in the study. Overall 141 children aged 11-18 years were screened for inclusion in the study. Out of these 14 were removed due to refusal to complete evaluation. The final study group comprised 127 children aged 11-18

years. The mean age of the entire study group aged 11-18 years was 14.37 years ± 1.94 years and comprised of 78 boys (61.4%) and 49 girls (38.5%).

History of cardiovascular disease in family
There was a history of CVD in a single member of the family in 123 adolescents. Four adolescents had more than one family member suffering from CVD. CVD was seen in father in 52.7% of cases, in the mother in 36.2% of cases and in a sibling in 7.9% of cases. In 3.1% of cases both mother and father had been diagnosed with a CVD. Hypertension 68 (53.5%) was the most common CVD present in family members followed by diabetes in 29 (22.8%) cases. Coronary artery disease, cerebrovascular disease and peripheral vascular disease were seen in 11.8%, 4.7% and 0.8% respectively.

Cardiovascular risk factors in study group
In our study group comprising 127 adolescents, no risk factor was seen in 81 (63.8%) adolescents, increased blood pressure (pre-hypertension and hypertension) in 12 (9.4%) adolescents, increased fasting blood sugar (in pre-diabetic and diabetic range) in 07 (5.5%) adolescents, dyslipidaemia in 11% and increased body mass index in 7.1%. Of the adolescents 4.7% had more than 1 CVD risk factor. Detailed results are given in tables 1, 2, 3 and 4

Table 1: *Correlation of family history of cardiovascular disease and blood pressure of study population*

| Family history of | Total | Blood pressure | | | *p* value |
		Normal No. (%)	Pre-hypertension No. (%)	Hypertension No. (%)	
Hypertension	68	56 (82.4)	09 (13.2)	03 (04.4)	***0.033***
Diabetes	29	29 (100.0)	0 (0)	0 (0)	0.141
Coronary artery disease	15	14 (93.3)	01 (06.7)	0 (0)	0.758
Cerebrovascular disease	06	06 (100.0)	0 (0)	0 (0)	0.720
Peripheral vascular disease	01	01 (100.0)	0 (0)	0 (0)	0.949
Multiple risk factors	08	07 (87.5)	0 (0)	01 (12.5)	0.233
Total	**127**	**113 (89.0)**	**10 (07.9)**	**04 (03.1)**	

Table 2: *Correlation of family history of cardiovascular disease and fasting blood sugar of study population*

| Family history of | Total | Fasting blood sugar | | | *p* value |
		Normal No. (%)	Pre-diabetic No. (%)	Diabetic No. (%)	
Hypertension	68	68 (100.0)	0 (0)	0 (0)	
Diabetes	29	23 (79.3)	06 (20.7)	0 (0)	
Coronary artery disease	15	14 (93.3)	01 (06.7)	0 (0)	
Cerebrovascular disease	06	05 (83.3)	0 1(16.7)	0 (0)	<0.001
Peripheral vascular disease	01	01 (100.0)	0 (0)	0 (0)	
Multiple risk factors	08	05 (62.5)	02 (25.0)	01 (12.5)	
Total	**127**	**116 (91.3)**	**10 (07.9)**	**01 (0.8)**	

Table 3: *Correlation of family history of cardiovascular disease and body mass index of study population*

Family history of	Total	Body mass index			p value
		Normal Frequency (%)	Overweight Frequency (%)	Obesity Frequency (%)	
Hypertension	68	61 (89.7)	06 (08.8)	01 (01.5)	
Diabetes	29	25 (86.2)	03 (10.3)	01 (03.4)	
Coronary artery disease	15	15 (100.0)	0 (0)	0 (0)	0.676
Cerebrovascular disease	06	06 (100.0)	0 (0)	0 (0)	
Peripheral vascular disease	01	01 (100.0)	0 (0)	0 (0)	
Multiple risk factors	08	07 (87.5)	0 (0)	01 (12.5)	
Total	**127**	**115 (90.6)**	**09 (07.1)**	**03 (02.4)**	

Table 4: *Correlation of family history of cardiovascular disease and fasting lipid profile of study population*

	Total	HTN n=68	DM n=29	CAD n=01	CVD n=06	PVD n=01	Multiple CVD n=08	p value
Cholesterol >90th centile	07	01	0	04	01	0	01	*0.002*
		1.5%	0%	26.7%	16.7%	0%	12.5%	
Cholesterol >95th centile	04	0	01	01	0	0	02	*0.008*
		0%	3.4%	6.7%	0%	0%	25.0%	
Triglycerides>90th centile	05	01	0	01	01	0	02	*0.012*
		1.5%	0%	6.7%	16.7%	0%	25.0%	
Triglycerides>95th centile	03	0	01	01	0	0	01	0/241
		0%	3.4%	6.7%	0%	0%	12.5%	
LDL>90th centile	0	0	0	0	0	0	0	-
		0%	0%	0%	0%	0%	0%	
LDL>95th centile	01	0	0	0	0	0	01	*0.010*
		0%	0%	0%	0%	0%	12.5%	
HDL<10th centile	03	02	0	01	0	0	0	0.796
		2.9%	0%	6.7%	0%	0%	0%	
HDL<5th centile	02	0	0	0	0	0	02	*<0/001*
		0%	0%	0%	0%	0%	25.0%	

Discussion

CVD is an important cause of mortality and morbidly worldwide. Children with a history of CVD in the family are prone to develop CVD in the future. In our study, pre-hypertension was seen in 7.9% and hypertension in 3.1% of adolescents. Hansel *et al* studied around 14,000 children and adolescents 3 to 18 years of age from June 1999 to September 2006 and found pre-hypertension in 3.4% and hypertension in 3.6% [11]. Hypertension was more common in adolescents who had a history of hypertension in the family. Out of 67 adolescents with a history of hypertension in the family, prehypertension was seen in 13.2% whereas hypertension was seen in 4.4% of adolescents (*P* <0.05). Shear *et al* and Blonde *et al* also reported that children with hypertensive parents have higher blood pressure recordings[12,13].

Out of 127 adolescents in our study, 10 (7.3%) had their fasting blood sugar (FBS) in the pre-diabetic range while 01 (0.8%) had his FBS in the diabetic range. In a study conducted by Mamtani *et al* on 1694 students, aged from 11 to 18 years in Quatar, 4.2% of students were found pre-diabetic[14]. Narayanappa *et al* studied 726 children between 5 to 10 years in Mysore and found the prevalence of pre-

diabetes and diabetes was 3.7% and 0.6% respectively[15]. Out of 29 adolescents who had a family history of diabetes 06 (20.7%) had pre-diabetes (P = 0.013). Blonde *et al* also found higher FBS in children with parental history of diabetes[13]. Mamtani *et al* also reported a positive family history of diabetes as predictive of prediabetes in children[14].

In our study, 7.1% of adolescents were found to be overweight and 2.4% to be obese. Goyal et al studied 5664 children of 12-18 years of age and found a 14.3% prevalence of overweight in boys and a 9.2% prevalence of overweight in girls whereas prevalence of obesity was 2.9% in boys and 1.5% in girls[16]. Out of 29 adolescents who had a history of diabetes in the family 10.3% were overweight and 3.4% were obese. (p = 0.661). These finding were similar to those found by Blonde *et al* who found significantly greater weight and thicker triceps skinfolds in children with a positive parental history of diabetes[13]. Goyal *et al* also found a strong independent association with a family history of diabetes and increased body mass index (BMI)[16].

Deranged lipid profile was seen in 16 out if 127 adolescent in our study population. The adolescents with a history of cerebrovascular disease in the

family had a higher prevalence of hypercholesterolemia (16.7%) (*p*=0.002) and hypertriglyceridemia (16.7%) (*p*=0.012). Similarly, adolescents with a history of CAD had a higher prevalence of hypercholesterolemia (cholesterol >90th percentile, 26.7%, *p*=0.002, cholesterol > 95th percentile, 6.7%, *p*=0.008) and hypertriglyceridemia (triglycerides >90th percentile, 6.7%, *p*=0.012, triglycerides >95th percentile, 6.7%, *p*=0.241). Blonde *et al* also reported that children with history of heart attack & stroke in family had higher levels of cholesterol and triglycerides[13].

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