

Survey of Serum Lipid Levels in Children From Parents with Premature Coronary Artery Disease

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Abstract

Background- Lipid factors are currently considered to be the main agent responsible for cardiovascular risk in young individuals. Several epidemiological studies have shown that atherosclerosis begins in childhood. Therefore, there is a general consensus that the earlier the control begins, the better the results will be. Now there are many controversies regarding the early diagnosis of hyperlipidemia in children. The aim of this study was to evaluate serum lipid levels in children whose parents suffer from premature coronary artery disease (CAD).

Methods- In this cross sectional study, 76 children between 2-10 years old (38 children, whose parents had premature CAD, and 38 healthy, age and sex-matched controls, whose parents did not have premature CAD) were studied. The height, weight and body mass indices were similar in both groups. Serum lipid levels [total cholesterol, triglyceride, high density lipoprotein (HDL) and low density lipoprotein (LDL)] were measured after 10 hours fasting for 2 times, one week apart, and the mean of the two values was considered as the amount of each variable. Data were analyzed with Epi 6, and $p < 0.05$ was considered as significant.

Results- Results showed that mean total cholesterol and LDL were 167 ± 20 and 135 ± 30 mg/dL in the case group and 121 ± 20 mg/dL and 101 ± 20 mg/dL in the control group and that these differences were significant statistically. There were no differences between the two groups for triglycerides and HDL. In the case group, six cases had LDL levels greater than 160 mg/dL, while there were no such cases in the control group.

Conclusion- We therefore concluded that total cholesterol and LDL levels were higher in children of parents with premature CAD. This necessitates evaluation of serum lipid levels in children of parents with premature CAD (*Iranian Heart Journal 2005; 6 (1,2): 6-10*).

Key words: lipid level ■ children ■ premature coronary artery disease

Several epidemiologic studies and clinical and pathological reports have shown that atherosclerosis begins in childhood. In several studies, the fatty streak has been seen in the aorta of most children under 10 years and also fibrous plaques in teenagers.¹¹ Atherosclerosis is the main cause of CAD in adults. Symptomatic CAD in men under 55 and women under 65 is called premature CAD.

The known risk factors of this disease include lipid disorders, diabetes, smoking, hypertension and genetic factors.

Several studies have shown that there is a relation between the serum cholesterol level of young adults and premature CAD.^{3,9,13}

Measuring serum lipids of children is therefore quite important in predicting the level of serum lipids in the future.

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Several studies have shown that serum lipids have a fixed trend up to the maturity period, but this is not complete and some children, considered as high risk, after some years, may have a trend to average level.^{4,5,9} National Cholesterol Education Program (NCEP) recommendations for detection and treatment of lipid disorders in children include a combined strategy of both population and individualized approaches. The population approach is aimed to affect lipid levels by population-wide changes in nutrient intake and eating patterns. The purpose of the individualized approach is to identify children who are at greatest risk by selective screening on the basis of family history of CAD or dyslipidemia. Universal serum lipid screening measures are not recommended in children, because the predictiveness of serum lipid values in children with respect to adult values is not considered adequate enough. Several authors have suggested some serious methods for primary prevention of CAD and evaluation of children's serum lipid values.^{6,8,12} This study was carried out both to evaluate the importance of the relationship between lipid disorders in the children and CAD in adults and to screen high risk children. Its purpose was to find the incidence of lipid disorders in children of parents with premature CAD.

Methods

In this cross-sectional study, 76 children (38 children aged 2-10 years old, whose parents suffered from premature coronary artery disease, and 38 healthy children as controls with the same age and sex as the first group) were studied.

They were selected from patients with acute myocardial infarction (men under 55 and women under 65) hospitalized in CCU ward of Ali-ibn Abitaleb Hospital.

The patients were asked to fill out questionnaires, and their 2-10 year-old

children, if any, were selected voluntarily for lipid tests.

The control group were selected from the children of healthy families (not having CAD) with the same sex and age.

Blood samples were obtained from these groups after 10 hours' fasting.

Serum lipids, including total cholesterol, triglycerides and HDL levels of all the samples were measured by one trained technician, and LDL was obtained by the calculation method.

The serum lipids of all the samples were measured twice at a one-week interval. When the difference between the two samples was more than 30 mg/dL, sampling was repeated at a one-week interval.

The average level of two or three samples was considered as that person's lipid level.

The independent T-test was used to analyze the data for comparing individualized values between the two groups.

The two-tailed test was used to compare the averages of the two groups, and chi-square test was utilized for sex comparison between the two groups.

Results

In this cross-sectional study, 76 children between 2 and 10 years of age (38 children of parents with premature CAD and 38 healthy children of healthy families) were studied.

The mean age of the case group was 5.7 ± 2.1 years, and that of the control group was 5.4 ± 2.4 years. In each group, there were 16 females (42.1%) and 22 males (57.9%).

In the case group, there were 25 children of fathers with CAD and 10 children of mothers with CAD, and 3 children had both parents with premature CAD.

The average of total cholesterol, triglycerides, LDL and HDL levels is shown in Table I.

Table. I. The mean and standard deviation of serum lipid levels in case and control groups

| Variables | groups | No | Mean+ standard deviation | Std. Error Mean |
|---------------|---------|----|--------------------------|-----------------|
| Triglycerides | Case | 38 | 177.8+ 35.3 | 5.8 |
| | Control | 38 | 176.1+ 35.7 | 6.06 |
| Cholesterol | Case | 38 | 167.2+ 30.1 | 5.74 |
| | Control | 38 | 121.6+ 30.7 | 5.72 |
| HDL | Case | 38 | 44.3+ 11.6 | 1.85 |
| | Control | 38 | 46.5+ 19.4 | 3.16 |
| LDL | Case | 38 | 135.8+ 23.1 | 5.88 |
| | Control | 38 | 101.1+ 20.3 | 5.69 |

Table II. Statistical analysis of the mean of variables in two groups

| Variables | T | df | Sig 2- Tail | Mean difference |
|---------------|-------|----|-------------|-----------------|
| Triglycerides | 2.253 | 74 | 0.10 | 10.9 |
| Cholesterol | 8.831 | 74 | 0.000 | 45.6 |
| HDL | 2.253 | 74 | 0.07 | 1.2 |
| LDL | 3.188 | 74 | 0.02 | 34.7 |

The mean total cholesterol and LDL in the case group was 167.2 ± 30.1 and 135.8 ± 23.1 mg/dL, and in the control group (121.6 ± 30.7 and 101.1 ± 20.3 mg/dL, respectively). There was a meaningful difference between the levels in the two groups. In the case group, 6 subjects (15.7%) had LDL levels higher than 160 mg/dL, but in the control group, none of them had LDL higher than 160 mg/dL. In the case group, 12 (31.5%) persons had cholesterol higher than 170 mg/dL, and 6 subjects (15.7%) had levels higher than 200 mg/dL. In the control group, 6 cases (15.7%) had cholesterol higher than 170, and 2 persons (5.2%) had levels higher than 200mg/dL.

The total cholesterol in the case group was higher than that in the control group in both females and males; that is, in the males, the levels were 158.8 and 102.5mg/dL, and in the females, 171.2 and 121.8 mg/dL, respectively ($p=0.001$). This difference was statistically meaningful, but there were no gender-related differences between the means of triglycerides, LDL and HDL in the two groups.

Discussion

The results of this study showed that the level of total cholesterol and LDL in the children of parents with premature CAD was higher than levels in the children of parents without CAD, such that 15.7% of the children from parents with CAD had LDL levels higher than 160 mg/dL; 31.4% had cholesterol levels higher than 170; and 15.7% had cholesterol more than 200 mg/dL, which required treatment measures.

In one study on 250 children (6-12 years) of parents with premature CAD, the mean total cholesterol, LDL and TG in these children was considerably higher than that in the control group, but the absolute total cholesterol level and LDL in the children of parents with CAD was in the normal range. There was increased TG levels in 22.5% of the children of parents with premature CAD.¹⁵ Also in the study of Azizi et al. in Tehran, 23% of the children (3-19 years old) had cholesterol levels of 170-179mg/dL, and 16% had cholesterol levels higher than 200mg/dL. However, in their study, a more extensive range of age had been considered (compared to our study), and the level of LDL had not been evaluated.¹

Nevertheless, in a study by Sarrafzadegan et al., 23% of the children (2-6 years old) had cholesterol levels more than the 95th percentile, and in this study, 31% had high cholesterol.²

The difference may be due to the selection of high risk children in our study.

In the Prieto-Albino et al. study on 2150 children (2-6years) in the province of Caceres, Spain, 27.9% of the children had cholesterol higher than 200 mg/dL, and this incidence was higher in females before maturity.⁷

In the Yamata et al. study on 2626 children (7-15 years old) in Japan, there was an increase in the mean cholesterol of the boys (7-10 years old), and after schools encouraged physical exercise, the levels of

cholesterol and triglycerides were lower and HDL was higher.¹⁴

The results of Resinco and colleagues' study on 6568 children showed that 28.2% of them had LDL levels qualified for treatment, and these results were similar to those of our study, in which 31.4% of the children had cholesterol levels higher than 170 mg/dL.¹⁰ But in our study, the lipid levels in the children who were at greatest risk (from parents with premature CAD) were compared to this level in the children with less risk, and we showed that the cholesterol levels higher than 170mg/dL and LDL higher than 160mg/dL in the children with the greatest risk were much higher than those in the control group.

A study on 165 children (15-18years) of parents with hypercholesterolemia or premature CAD showed that 57.3% of them had cholesterol levels higher than 200 mg/dL and that 66.7% had LDL higher than 130 and 12% HDL less than 35mg/dl. The authors concluded that there was a high incidence of lipid disorders in this group.¹⁶ Although in this study the incidence of lipid disorders was higher than that in our study, the results of both studies showed a high incidence of lipid disorders in the children of parents having premature CAD, which emphasized the necessity of evaluating the serum lipids in these children. The higher incidence of lipid disorders in the above study can be due to the subjects' different nutritional habits and different daily activities.

In a study by Dennison et al. on 331 children (4-17 years) of parents with CAD, the incidence of high cholesterol was 1.4 times, and high LDL level was twice that of the control group. Also 40% of the white children and 21% of black children with high LDL had parents with CAD. The results showed that the screening of children for high LDL, only on the basis of the presence of CAD in their parents, was questionable.¹⁷

The results of this study conforms to the results of our study; that is, their level of total cholesterol was considerably higher than that in the control group, which emphasizes the high incidence of lipid disorders in the children of parents with premature CAD.

Another study on 806 Israeli children (6-14 years) showed that 49% of the children with hypercholesterolemia had parents with hypercholesterolemia and that 13% of them had history of premature CAD in their family. The results, therefore, showed that population screening was the most effective method in specifying the children having hypercholesterolemia.¹⁸

This study suggests a population screening for identifying lipid disorders in children with the purpose of knowing that children having hyperlipidemia implicates the presence of CAD and lipid disorders in their parents. It is different from our results, which advocate screening for lipid disorders in children with high-risk parents. Since the former method involves heavy expenses, it seems that the results of our study, recommending screening for hyperlipidemia based on high-risk parents, is more suitable.

Conclusions

In respect to higher cholesterol and LDL levels in the children of parents with premature CAD, it is necessary to study the serum lipids in these children and treat them, if they are qualified for treatment, so that this primary prevention strategy for CAD can be useful from childhood.

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References

1. Azizi F, Rahmani M, Salehi P, Majidi M, Allahverdi S. The serum lipid levels in Tehrani children and teenagers. Survey on sugar and lipids in Tehran. *J I R I MC (Iranian Medical Council)* 2002; 20: 109-116.
2. Hashemipour M, Sarrafzadegan N. Is it necessary to determine the cholesterol in the children. *J Research of Isfahan University of Medical Sciences* 1996;1(2): 63-68.
3. Behrman RE, Kliegman RM, Arvin RM. Metabolic diseases. In: Nelson Textbook of Pediatrics. 17th edition. Philadelphia, W. B. Saunders Co., 2004, pp. 398-400.
4. Bistrizter T, Batash D, Barr J, Rappaport MJ, Tamir D, Zaidman JL, et al. Routine childhood screening for hyperlipidemia in Israel. *Isr J Med Sci* 1996; 32(9): 725-9.
5. Chotivittaya Jarakom P, Chewatawon A, Sathapodeju R, Sirimonkol P. Hyperlipidemia in children at risk for coronary artery disease. *J Med Assoc Thai* 2003; 86 (suppl 2): 195-200.
6. Culati S, Saxena A. Study of lipid profile in children of patients with premature coronary artery disease. *Indian Pediatr* 2003; 40(6): 556-60.
7. Dennison BA, Kikuchi DA, Srinivasan SR, Webber IS, Berenson GS. Parental history of cardiovascular disease as an indication for screening for lipoprotein abnormalities in children. *J Pediatr* 1989; 115(2): 186-94.
8. McGill HE, McMahan CA, Malcom GT. Effects of serum lipoproteins and smoking on atherosclerosis in young men and women. *Arterioscler Thromb Vasc Biol* 1995; 17: 95-106.
9. Porkka KV, Viikari JS. Tracking of serum lipids in children; association with the absolute lipid level - the cardiovascular risk in young Finns study. *J Clin Epidemiol* 1995; 48(2): 221-228.
10. Porkka KV, Viikari JS, Akerblom HK. Short-term intra-individual variation and long-term tracking of serum lipid level, the cardiovascular risk in young Finns study. *Atherosclerosis* 1994; 105(1): 63-9.
11. Prieto-Albino L, Arroyo Diez J, Vadillo Machota JM, Mateos Muntero C, Galan-Rebollo A. Prevalence of hyperlipidemia in children in the province of Caceres. *Revista Espanola de salud publica.* 1998; 72(4):343-355.
12. Rackley CE, Schlant RC. Prevention of coronary artery disease. In: Hurst, The Heart. A Textbook of Heart Disease, 9th edition, 1997, New York, McGraw-Hill, Inc. 1213-1221.
13. Radomycka B. Screening programme for hyperlipidemia in children 13-adolescents. prophylactic-aspects of atherosclerosis. *Med Wieku Rozwoj* 2001; 5(1): 27-34.
14. Resnicow K, Cross D. Are parents' self-reported total cholesterol levels useful for identifying children with hyperlipidemia? An examination of current guidelines. *Pediatrics* 1993; 92(3): 347-53
15. Resnicow K, Kotches M, Wynder E. Plasma cholesterol levels of 6585 children in the United States. Results of the know your body screening in five states. *Pediatrics* 1989; 84: 969-76.
16. Russel P. The pathogenesis of artherosclerosis. In: Braunwald Heart disease . A textbook of cardiovascular disease , 6th Edition , 2001 W. B. Saunders Company , page 1105- 1106.
17. Starc TY. Management of hyperlipidemia in children. *Prog Pediatr Cardiol* 2001; 12(2): 205-213.
18. Vaccaro P. The effects of exercise on coronary heart disease, risk factors in children. *Sports Med* 1989; 8(3): 139-530.
19. Yamamoto A, Horibe H, Sawada S, Uyamn M, Masusawu Y, Yamamura T, et al. Serum lipid levels in elementary and junior high school children and their relationship to relative weight. *Prev Med* 1988; 17(1): 93-108.