Cholesterol screening of children at high risk: behavioural and psychological effects

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Abstract

Objective: To assess the behavioural and psychosocial effects of screening asymptomatic children at high risk for hyperlipidemia.

Design: Observational study involving prospective longitudinal and cross-sectional portions.

Setting: Two tertiary care pediatric lipid clinics in Montreal.

Subjects: Longitudinal portion: all children aged 4 to 17 years who presented for screening at the lipid clinics between April 1990 and June 1991. Of the 56 eligible children 52 (93%) (and their mothers) agreed to participate, 34 with hyperlipidemia (case subjects) and 18 without hyperlipidemia (control subjects). Thirty-five children (67%) completed 3 assessments over 12 months. Cross-sectional portion: all children aged 4 to 17 years in whom hyperlipidemia had been diagnosed 2 to 5 years earlier at one of the lipid clinics. Of the 58 eligible children 48 (83%) (and their mothers) participated.

Outcome measures: For children, mean scores on the Child Behavior Checklist (Behavior Problems subscale) (CBCL), the Children's Depression Inventory (CDI) and the State–Trait Anxiety Inventory for Children (STAIC); for mothers, mean scores on the Beck Depression Inventory (BDI) and the State–Trait Anxiety Inventory (STAI).

Results: In the longitudinal portion of the study, there was no significant difference between the case and control subjects in the mean CDI or STAIC scores at 1 or 12 months. At 1 month after diagnosis the case subjects in the longitudinal portion had a significantly higher mean CBCL score than the children in the cross-sectional component ($p = 0.01$). With the control group as the reference group, the adjusted odds ratios for a high CBCL score (greater than 62) for the case subjects were 15.5 (95% confidence interval [CI] 2.4 to 99.8) at 1 month and 15.8 (95% CI 1.1 to 223.4) at 12 months. The corresponding values for the children in the cross-sectional component were 1.3 (95% CI 0.3 to 6.2) and 5.0 (95% CI 0.5 to 50.9).

Conclusions: The observed behavioural problems in children with a recent diagnosis of hyperlipidemia were independent of other risk factors, such as age and sex of child and mother's age and BDI score. Our results suggest that identification of hyperlipidemia in children may have harmful psychological effects in the families involved. This evidence strengthens arguments for the exclusion of cholesterol measurement from the periodic health examination of children at moderately high risk.

Résumé

Objectif : Évaluer les effets comportementaux et psychosociaux du dépistage des enfants asymptomatiques à risque élevé d'hyperlipidémie.

Conception : Étude par observation portant sur des groupes longitudinaux et transversaux prospectifs.

Contexte : Deux cliniques de soins tertiaires et de traitement de la lipidémie pédiatrique à Montréal.

Evidence

Études

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Sujets : Groupe longitudinal : tous les enfants âgés de 4 à 17 ans qui se sont présentés pour dépistage aux cliniques de traitement de la lipidémie entre avril 1990 et juin 1991. Sur les 56 enfants admissibles, 52 (93 %) (et leurs mères) ont consenti à participer à l'étude : 34 présentaient de l'hyperlipidémie (sujets cas) et 18 n'en avaient pas (sujets témoins). Trente-cinq enfants (67 %) ont subi 3 évaluations en 12 mois. Groupe transversal : tous les enfants âgés de 4 à 17 ans chez lesquels on avait diagnostiqué une hyperlipidémie de 2 à 5 ans plus tôt à une des cliniques de traitement de la lipidémie. Sur les 58 enfants admissibles, 48 (83 %) (et leurs mères) ont participé à l'étude.

Mesures des résultats : Dans le cas des enfants, le résultat moyen obtenu à la suite de l'établissement d'une liste de contrôle du comportement des enfants (sous-échelle des problèmes de comportement) («Child Behavior Checklist [Behavior Problems subscale]», CBCL), d'un inventaire de dépression des enfants («Children's Depression Inventory», CDI) et d'un questionnaire sur l'anxiété chronique et réactionnelle pour les enfants («State–Trait Anxiety Inventory for Children», STAIC). Pour les mères, les résultats moyens obtenus à la suite d'un inventaire de dépression («Beck Depression Inventory», BDI) et d'un questionnaire sur l'anxiété chronique et réactionnelle («State–Trait Anxiety Inventory», STAI).

Résultats : Dans le groupe longitudinal, on n'a constaté aucune différence significative entre les patients et les sujets témoins quant aux résultats moyens CDI ou STAIC à 1 ou 12 mois. Un mois après le diagnostic, les patients du groupe longitudinal présentaient un résultat CBCL moyen beaucoup plus élevé que les enfants du groupe transversal (p = 0,01). Si l'on utilise le groupe de sujets témoins comme groupe de référence, les risques relatifs corrigés pour un résultat CBCL élevé (plus de 62) chez les patients étaient de 15,5 (intervalle de confiance [IC] à 95 % de 2,4 à 99,8) à 1 mois et de 15,8 (IC à 95 %, 1,1 à 223,4) à 12 mois. Les valeurs correspondantes dans le cas des enfants du groupe transversal étaient de 1,3 (IC à 95 %, 0,3 à 6,2) et 5,0 (IC à 95 %, 0,5 à 50,9).

Conclusions : Les problèmes de comportement observés chez les enfants chez lesquels on a diagnostiqué récemment une hyperlipidémie n'avaient aucun lien avec d'autres facteurs de risque comme l'âge et le sexe de l'enfant et l'âge et le résultat BDI de la mère. Nos résultats indiquent que le diagnostic d'hyperlipidémie chez des enfants peut avoir des répercussions psychologiques nuisibles chez les membres de leur famille. Ces données probantes donnent du poids aux arguments de ceux qui préconisent d'exclure la mesure du cholestérol de l'examen médical périodique des enfants à risque moyen.

Atherosclerotic cardiovascular disease is an important cause of sickness and death. People with hyperlipidemia, particularly elevated levels of low-density lipoprotein cholesterol, are at higher risk for cardiovascular disease. Moreover, there is evidence that the disease process begins in childhood. Therefore, the Canadian Consensus Conference on Cholesterol[1] and the US National Cholesterol Education Program Coordinating Committee[2] have recommended cholesterol screening for all children at high risk over 2 years of age. People at high risk are those with a parent or grandparent with symptomatic coronary artery disease before the age of 55 years or a parent with hypercholesterolemia (cholesterol level greater than 6.16 mmol/L). In contrast, the Canadian Task Force on the Periodic Health Examination[3] concluded that there is insufficient evidence to include measurement of the total cholesterol level in, or exclude it from, the periodic health examination.

With the proliferation of health screening programs, a growing number of articles have addressed the possible adverse consequences of informing an asymptomatic person that he or she has a disease, especially if no immediate benefit follows from revealing the diagnosis.[4–13] Two studies showed that workers who were informed that they were hypertensive experienced greater absenteeism from work than their coworkers.[14,15] Unfavourable economic[16] and psychosocial[17–23] effects of hypertension labelling have also been reported. A smaller number of studies, including one involving children,[24] have, however, failed to demonstrate a labelling effect of hypertension screening.[23–28] In addition, a recent study showed no harmful psychological effects of a diagnosis of hypercholesterolemia made in a screening program.[29] Interestingly, 1 year after diagnosis, only half of those with hypercholes-

terolemia believed that their cholesterol level was high. Two groups found no evidence of adverse psychological effects associated with the identification of hyperlipidemia in children.[30,31]

Children with hyperlipidemia may demonstrate some of the same psychosocial disturbances as those with other asymptomatic conditions or chronic illnesses. Children with benign cardiac murmurs[32] and sickle-cell trait[33] are treated differently by their parents than are healthy children. Chronically ill children have been found to have 1.5 to 2 times more psychological problems than healthy children.[34] Rates of risk for psychological problems among chronically ill children range from 13% (parent questionnaire) to 39% (teacher rating), as compared with 6.8% and 31% among healthy children.[35] McAnarney and colleagues[36] compared children who had juvenile arthritis with healthy control subjects using 15 measures of psychological and behavioural functioning. The rates of psychological and behavioural problems among those with arthritis ranged from 15% to 76%, depending on the instrument used, as compared with 6% to 62% among the control subjects. In a study of 169 children with a variety of chronic illnesses 24.1% were found to have behavioural problems.[37]

At present, most practitioners in Canada do not do routine lipid screening of children at high risk.[38] Therefore, this was an opportune time to evaluate the behavioural and psychosocial effects of screening children for hyperlipidemia. Because of our concerns about possible harmful labelling effects, we studied children who were already being seen in tertiary care lipid clinics rather than subjecting other children to screening.

Methods

Design

The study included longitudinal and cross-sectional components. In the longitudinal portion a cohort of screened children at high risk, including both hyperlipidemic (case) children and nonhyperlipidemic (control) children and their mothers, were followed for 12 months. In the cross-sectional portion children whose hyperlipidemia had been diagnosed 2 to 5 years earlier and their mothers were studied once.

Subjects

For the longitudinal portion, all children aged 4 to 17 years who presented for screening at the lipid clinics of the 2 pediatric hospitals in Montreal between April 1990 and June 1991 and who had not yet received a definitive diagnosis of hyperlipidemia were eligible. Children who did not live with at least 1 parent and families in which the mother or the child could not communicate in English or French were excluded.

A diagnosis of hyperlipidemia was based on the results of at least 2 complete lipid profile measurements. Hyperlipidemia was defined as 1 or more of total cholesterol level, level of low-density lipoprotein cholesterol or triglyceride level at or above the 90th percentile for age. Control subjects were similarly tested children who were not found to be hyperlipidemic.

For the cross-sectional portion, all children 4 to 17 years in whom hyperlipidemia had been diagnosed 2 to 5 years earlier, identified from the files of the lipid clinic of one of the participating hospitals, were eligible to participate.

Procedures

The project was approved by the research ethics committees of both hospitals. The parents and the children over 7 years old provided written consent. The study was described to the younger children, who gave verbal assent.

For the longitudinal portion of the study, subjects were recruited in the waiting room of the lipid clinic before their encounter with the physician during the visit at which the family was given the definitive diagnosis. At this time we obtained sociodemographic information for the children and mothers and administered the Children's Depression Inventory (CDI)[39] and the State–Trait Anxiety Inventory for Children (STAIC)[40] to the children and the Beck Depression Inventory (BDI)[41] and the State–Trait Anxiety Inventory (STAI)[42] to the mothers. Assessments were also done 1 and 12 months after screening, in the subjects' homes, and involved the same psychological measures as well as the Child Behavior Checklist (CBCL).[43]

For the cross-sectional portion, the parents of all eligible children received a letter from the physician in charge of the lipid clinic describing the study. Recruitment and data collection occurred between April 1990 and June 1991. The project director telephoned those who returned a written agreement to have their names released to the researchers. The various measures (CDI, STAIC, BDI, STAI and CBCL) were administered in the subjects' homes, and sociodemographic information was obtained for the children and mothers.

Measures and determinants

The CBCL was selected as the primary measure for 2 reasons. First, it has been used in research involving hyperlipidemic children[30,31] and children with other chronic illnesses.[31,44] Second, it can be used with children 4 to 17 years old. The CBCL contains 2 subscales, Social Com-

petence (20 items) and Behavior Problems (118 items), both of which are completed by parents. We used only the latter scale because it has better validity[45] and measures the disturbances most relevant to our subjects. The reliability and validity of the CBCL have been established in several studies.[43]

The CDI is a self-report depression scale for children that has well-established reliability and validity.[39] In studies involving healthy schoolchildren aged 7 to 16 years mean scores ranged from 9.27 to 9.72 with the English-language version,[46,47] and the mean score was 8.29 with the French-language version.[48]

The STAIC is a self-report anxiety inventory for children that has good reliability and validity.[40] It consists of 2 separate 20-item scales for measuring trait and state anxiety. Normative data for the STAIC, based on 1554 elementary schoolchildren, indicate mean STAIC state scores of 30 to 37 for boys and 30 to 38 for girls.[40]

Maternal depression and anxiety were assessed with the BDI and the state scale of the STAI respectively.

Statistical analysis

We calculated mean scores for all the measures. For the longitudinal component the scores at 1 and 12 months on the measures assessing depression and anxiety were subtracted from the values at baseline. SPSS (version 5.0; SPSS Inc., Chicago) and MULTLR (Ludwig Institute for Cancer Research, Sao Paulo, Brazil) programs were used to generate frequencies and to perform statistical analyses. We tested differences in proportions using the χ^2 test; for differences in mean values unpaired *t*-tests were used and 95% confidence intervals (CIs) reported.

To examine the influence of sociodemographic and maternal mental health factors on CBCL scores, we first calculated odds ratios for each factor separately. The same single set of data from the cross-sectional component was used in the 2 analyses. We calculated adjusted odds ratios using multiple logistic regression models. Factors were included in this analysis if the crude odds ratios for having a high CBCL score (greater than 62) were significantly different for different values of the factor.

Results

Of the 56 eligible children invited to participate in the longitudinal portion of the study 52 (93%) agreed to participate. Forty-nine (94%) of the children and 50 mothers actually completed at least one of the baseline measures. At the 1-month assessment 7 subjects (13%) dropped out, and by the 12-month assessment 7 further subjects dropped out, leaving 35 subjects (67%). The numbers of subjects who completed each measure are listed in Table 1. Of the 18 control subjects 6 had hyperlipidemic siblings.

Of the 58 children invited to participate in the cross-sectional portion 48 (83%) agreed.

Table 1: Number of hyperlipidemic and nonhyperlipidemic children participating at various points, by study group

Study group	No. eligible	No. who agreed to participate	Measures completed*	Time; no. of subjects			
				Baseline	1 mo	12 mo	2–5 yr earlier
Longitudinal							
Case	36	34	CBCL	–	26	21	–
			CDI	33	29	24	–
			STAIC	32	29	26	–
			BDI	28	26	19	–
			STAI	29	26	21	–
Control	20	18	CBCL	–	13	8	–
			CDI	15	11	9	–
			STAIC	16	11	9	–
			BDI	15	8	8	–
			STAI	17	13	13	–
Cross-sectional	58	48	CBCL	–	–	–	46
			CDI	–	–	–	44
			STAIC	–	–	–	44
			BDI	–	–	–	48
			STAI	–	–	–	48

*CBCL = Child Behavior Checklist (Behavior Problems scale); CDI = Children's Depression Inventory; STAIC = State–Trait Anxiety Inventory for Children; BDI = Beck Depression Inventory; STAI = State–Trait Anxiety Inventory.

Table 2 shows the sociodemographic characteristics of the subjects by study group. There was a higher proportion of nonhyperlipidemic and English-speaking subjects among those who dropped out of the study than among those who completed it, and the mothers of dropouts were, on average, 18 months older than the mothers of those who completed the study.

In the longitudinal portion of the study, there were no significant differences between the case and control subjects in mean CBCL score at 1 and 12 months. Similarly, there were no significant differences between the two groups in mean CDI, STAIC, BDI or STAI scores (minus baseline value) at 1 month or 12 months.

The mean CBCL score for the children in the cross-sectional portion of the study was significantly lower than the mean score at 1 month for the case subjects in the longitudinal component (p = 0.01) (95% CI –11.2 to –1.5). The mean BDI score for the mothers of the children in the cross-sectional portion was significantly higher than that at 12 months for the mothers of the case subjects (p = 0.03) (95% CI 0.3 to 4.6).

The proportions of case and control subjects at 1 month and of subjects in the cross-sectional component with high CBCL scores were 61.5%, 30.8% and 34.8% respectively. At 12 months the proportions of case and control subjects with high CBCL scores were 42.9% and 12.5% respectively.

The crude and adjusted odds ratios for having a high CBCL score at 1 month and 12 months are shown in Tables 3 and 4 respectively. Crude odds ratios were adjusted for study group, age and sex of the child, and mother's age and BDI score at 1 month. Older children and boys were more likely to have high CBCL scores. In addition, the children of women with even moderately high BDI scores (4 to 7) were more likely to have high CBCL scores than the children of women with lower BDI scores. The case subjects were much more likely than the control subjects to have a high CBCL score (adjusted odds ratio 15.5 at 1 month and 15.8 at 12 months). The 95% CI was wide because of the small number of subjects, but the lower limit was above 1 at both times.

Discussion

In our study, children with a recent diagnosis of hyperlipidemia were much more likely than those with negative results of testing to have reported behaviour disturbances, up to 12 months after screening.

We also compared the CBCL scores with those for healthy populations. This measure has been widely used and has been proven to discriminate well between children referred for psychiatric services and healthy children.[43] Ten percent of healthy children have high CBCL scores (greater than 62).[43] Among children with a recent diagnosis of hyperlipidemia in our study the rate was 61.5% 1 month after diagnosis and 42.9% 12 months after diagnosis. Among children in whom the disorder had been diagnosed 2 to 5 years earlier the rate was 34.8%, the same order of magnitude as that observed for children with other chronic illnesses.[35] At 12 months 12.5% of our nonhyperlipidemic subjects had high CBCL scores. Although our sample of control subjects was small, this finding suggests that testing itself may have negative effects of short duration.

To assess how many of the observed behavioural problems were due to the screening, how many to the diagnosis and how many to being in a family at risk for cardiovascular disease would require a comparison of rates of high CBCL scores for children with a positive result of screening, those with a negative result of screening and unscreened children with a family history of cardiovascular disease. Because we were unable to recruit unscreened children from high-risk families, we are unable to separate the effects of family history from the effects of screening. However, the decline in CBCL scores for both our case subjects and control subjects between 1 and 12 months suggests that the screening itself is partly responsible for the behavioural problems reported.

Our findings also illuminate some important questions

Table 2: Sociodemographic characteristics of the children and their mothers, by study group

	Study group; no. (and %) of subjects		
	Longitudinal		
Characteristic	Case	Control	Cross-sectional
Children			
Sex			
Female	22 (65)	9 (50)	21 (44)
Male	12 (35)	9 (50)	27 (56)
Age, yr			
Mean (and SD*)	10.0 (3.1)	9.7 (4.0)	12.1 (3.2)
Range	5–17	5–17	4–17
Language			
French	21 (62)	10 (56)	22 (46)
English	13 (38)	8 (44)	26 (54)
Mothers			
Marital status			
Married	29 (85)	14 (78)	40 (83)
Single	4 (12)	4 (22)	8 (17)
Unknown	1 (3)	0 (0)	0 (0)
Age, yr			
Mean (and SD)	36.1 (3.6)	37.5 (7.7)	39.7 (4.9)
Range	28–44	31–50	30–50

*SD = standard deviation.

about the usefulness of various measures in detecting psychological and behavioural problems in this population. We chose a behaviour-based instrument, the CBCL, as our primary measure but were also interested in determining the sensitivity of self-report measures (the CDI and the STAIC) to the hypothesized effects of screening. Although the 3 constructs measured by these instruments (behavioural problems, depression and anxiety) are conceptually related, the instruments did not show the expected correlations. Surprisingly, the CBCL scores were not consistently correlated with the scores on the child self-report measures, but they were correlated with the mothers' depression and anxiety scores. There are 2 possible interpretations of these findings. First, the CBCL may be a more sensitive measure of outcome than self-report measures of mood. Second, the CBCL may be measuring a construct that is unrelated to depression or anxiety in children but is, in fact, closely related to depression and anxiety in mothers. It may be that the negative effects of screening are manifested more through mothers' perceptions of their children's behaviour than through children's self-reported mood. Therefore, although screening does not appear to be associated with dysphoric mood in either children or mothers, it is related to mothers' reporting more behavioural problems in their children. It is possible that mothers come to see their screened offspring as vulnerable.[49] The fact that problems were manifest only on the measures completed by mothers raises questions about where the problem lies: in the child or in the parent's perception of the child.

Although our study provides some answers in a previously unexplored area of preventive pediatric care, it also raises many questions. Difficulties in recruiting screened control subjects and unscreened children at high risk make it impossible to determine how much of the observed problem behaviour is due to the process of screening and how much to the diagnosis of hyperlipidemia, or how much to being a member of a family with cardiovascular disease. Future research must include members of the groups not well represented in this study.

The Canadian Task Force on the Periodic Health Examination[3] concluded that there is insufficient evidence to include measurement of total cholesterol level in, or exclude it from, the periodic health examination. In spite of the limitations described, our results suggest that identification of hyperlipidemia in children may have harmful psychological effects in the families involved. Given the lack of strong

Table 3: Crude and adjusted* risk for high CBCL score (greater than 62) for children in cross-sectional portion and at 1 month for children in longitudinal portion

Variable	No. of subjects†	% with high CBCL score	Odds ratio (and 95% CI‡)	
			Crude	Adjusted
Study group				
Control subjects	13	30.8	1.0	1.0
Cross-sectional subjects	46	34.8	1.2 (0.3–4.5)	1.3 (0.3–6.2)
Case subjects	26	61.5	3.6(0.9–14.9)	15.5(2.4–99.8)
Age of child, yr				
4–9	32	31.3	1.0	1.0
10–14	34	52.9	2.5(0.9–6.8)	4.7(1.2–17.7)
15–17	18	44.4	1.8(0.5–5.8)	5.3(1.1–26.7)
Sex of child				
Male	42	45.2	1.0	1.0
Female	43	39.5	0.8(0.3–1.9)	0.2(0.1–0.8)
BDI score at 1 mo				
0–3	35	25.7	1.0	1.0
4–7	26	50.0	2.9(1.0–8.5)	9.0(2.1–38.4)
8–23	24	58.3	4.0(1.3–12.3)	9.6(2.3–40.2)
STAI score at 1 mo				
20–29	38	28.9	1.0	
30–37	25	44.0	1.9(0.7–5.5)	
38–63	22	63.6	4.3(1.4–13.1)	

*Adjusted for study group, age and sex of child, and mother's age and BDI score at 1 mo.
†Numbers may not total 85 because of missing data.
‡CI = confidence interval.

evidence of benefit of the treatment of hyperlipidemia in children,[50] our evidence of harmful effects strengthens arguments for the exclusion of cholesterol measurement from the periodic health examination of children. We conclude that the policy of screening children at moderately high risk, as defined by the Canadian Consensus Conference on Cholesterol[1] and the National Cholesterol Education Program Coordinating Committee,[2] is not justified at this time.

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Table 4: Crude and adjusted risk for high CBCL score for children in cross-sectional portion and at 12 months for children in longitudinal portion

Variable	No. of subjects*	% with high CBCL score	Odds ratio (and 95% CI) Crude	Adjusted
Study group				
Control subjects	8	12.5	1.0	1.0
Cross-sectional subjects	46	34.8	3.7 (0.4–33.1)	5.0 (0.5–50.9)
Case subjects	21	42.9	5.2(0.5–5.6)	15.8(1.1–223.4)
Age of child, yr				
4–9	26	19.2	1.0	1.0
10–14	29	48.3	3.9(1.2–13.2)	5.6(1.2–26.1)
15–17	19	36.8	2.4(0.6–9.4)	6.4(1.1–35.8)
BDI score at 12 mo				
0–3	17	17.6	1.0	1.0
4–7	28	25.0	1.6(0.3–7.1)	2.6(0.5–13.9)
8–23	28	50.0	4.7(1.1–19.9)	8.4(8.4–48.5)
STAI score at 12 mo				
20–29	34	29.4	1.0	
30–37	22	22.7	0.06(0.00–0.80)	
38–63	19	57.9	0.16(0.01–2.38)	

*Numbers may not total 75 because of missing data.

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