Lead Screening by Family Physicians

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Blood lead level tests, by the finger-prick micromethod, were given to 333 children in a primary care practice. On initial testing, 18.6 percent of children had lead levels between 30 and 39 μg/100 ml and ten percent had lead levels of 40 μg/100 ml or greater. In the latter group, only 2.7 percent had levels in that range when retested with venous blood samples. Socioeconomic status, as determined by census tract residence, correlated with evidence of undue lead absorption. Of the children tested from socioeconomic Group I (I is highest), 3.4 percent were affected, as opposed to 60.0 percent of the children residing in Group V census tracts.

The incidence of undue lead absorption among children from inner-city areas as defined by blood lead levels of 40 μg/100 ml or greater is reported to vary between 8.8 percent and 32.9 percent. An additional 17.0 percent to 33.7 percent of children are affected, if a lead level of 30 μg/100 ml or greater is used to define abnormal levels.[1] Although several reports indicate that children in urban slums have higher mean blood lead levels than do suburban children,[2,3] recent studies suggest that the problem is not limited to residents of "lead belts." Of children screened in Baltimore, 43.3 percent with blood lead levels of at least 60 μg/100 ml came from areas outside the inner city.[4] Furthermore, children in small communities also may be at risk for this problem.[5]

Ingestion of small lead-containing paint chips from walls of dilapidated houses is considered the primary source of increased lead absorption in affected children. If children who live in newer housing are also affected, other sources of lead intake need to be identified. Some of these could be: house and hand dust,[6] newspaper ingestion,[7] pencil chewing,[8] canned infant food,[9] and ambient air.[10,11] Preschool children, who tend to put small objects into their mouths, are the group at highest risk for lead intoxication. Adults, except for those who have an occupational exposure, do not appear to be part of this high-risk group.[12]

The adverse consequences of untreated lead poisoning include serious central nervous injury or renal damage.[13,14] Subclinical lead poisoning is thought to be a factor in the etiology of mental retardation,[15] susceptibility to infection,[16] and behavioral disorders.[17] Therapy by chelating agents[18] and prevention, by reduced exposure to environmental sources of lead, are available for affected children.

Blood lead levels may be determined by both macromethods and micromethods. The micromethod, used on blood obtained by a finger stick, requires careful collection technique, usually through a colloidin film, to prevent contamination from lead on the skin. Elevated levels should be confirmed with tests on venous blood samples.

The entity of lead poisoning, therefore, is suitable for routine screening, because the ages of the population at risk have been defined; the presymptomatic state can be diagnosed with a simple, inexpensive, and acceptable capillary blood test; and both therapy and prevention are available.

This article reports the results of lead screening given to a portion of the at-risk population in a family practice. The tests were offered to all children between the ages of one and six, because the prevalence of toxicity within the different socioeconomic groups is not known with certainty. This study is therefore intended to further define the at-risk population requiring lead screening.

Method

The Rochester Family Medicine Training Program consists of five full-time faculty members and 36 residents in training, who give medical care to approximately 10,000 patients in an ambulatory care facility. The demographic characteristics of the patient population are similar to those of the greater Rochester area. The study covers the period of May 1, 1975, to September 12, 1975, during which all children born between May 1, 1968, and May 1, 1974, were offered a finger-prick blood lead level test when they visited the health center for any medical purpose (including accompanying a sibling who was receiving treatment). Also treated were those children from the practice who responded to an outreach program.[19] There was no charge to the patient for the procedure.

All patients with blood lead levels between 40 and 45 μg/100 ml had repeat finger-stick tests. Those with blood lead levels of 45 μg or greater received confirmatory tests by venous blood samples. Levels between 30 and 39 μg/100 ml were not confirmed with additional tests. (Confirmatory erythrocyte protoporphyrin tests were not available until the study was almost completed.)

Assessment of socioeconomic status was based on census tract residence using a five-part composite index which included: median value of owned homes; median rental value; percentage of skilled, semiskilled, and unskilled workers; median years of

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Table 1 Children (1,197) in the Practice		
	Number	%
Sex		
Male	650	54.3
Female	547	45.7
Age		
1	134	11.2
2	161	13.5
3	188	15.7
4	216	18.0
5	223	18.6
6	275	23.0
Socioeconomic Status (I is highest)		
I	112	9.4
II	222	18.5
III	578	48.3
IV	216	18.0
V	69	5.8

education (of adults); and percentage of sound dwelling units. Five socioeconomic areas were delineated with Area V designated as the lowest.

Results

The population at risk contained 1,197 children from 904 families. The demographic characteristics of these children are detailed in Table 1. A total of 333 children received blood lead tests. Their ages, sexes, and socioeconomic status are given in Table 2. The distribution of the initial blood lead levels is given in Table 3. On initial screening, 62 children (18.6 percent of the tested group) had blood lead levels between 30 and 39 μg/100 ml, and 33 children (10 percent) had levels of 40 μg/100 ml or greater. However, on retesting those children in the latter group (Table 4), only nine (2.7 percent) had levels in that range. After confirmatory tests on the group with levels of 40 μg/100 ml or greater, a total of 83 children (24.9 percent) (levels between 30-39 μg/100 ml were not confirmed) had evidence of undue lead absorption (Table 5). No children had either clinical or laboratory evidence of lead poisoning.

Discussion

In our population, the incidence of children with elevated blood lead levels on initial testing was in the same range as that reported by other surveys. Our rate of false positives, however, was somewhat higher than expected. The New York State Department of Health reported 11.4 percent of 2,244 children screened had lead levels of 40 μg/100 ml or greater. A sample of these children was retested with venous blood, and 29 percent had lead levels equal to or more than 12 μg/100 ml below the initial screening value (15 of 51 cases).[20] In our series, this was true of eight of 13 (61 percent) cases retested with venous blood. We were not able to explain these differences, but both our series and that of New York State indicate a high false-positive rate on initial

Table 2 Children (333) Receiving Lead Tests		
	Number	% of Total in Each Group
Sex		
Male	188	28.9
Female	145	26.5
Age		
1	56	41.8
2	48	29.8
3	54	28.7
4	72	33.3
5	51	22.9
6	52	18.9
Socioeconomic Status (I is highest)		
I	29	25.9
II	44	19.8
III	181	33.3
IV	64	29.6
V	15	21.7

Table 3. Lead Levels on Initial Testing of 333 Children

	<30 μg/100 ml	30-39 μg/100 ml	40-79 μg/100 ml	>80
Sex				
Male	128	35	20	1
Female	106	27	12	0
Age				
1	37	15	4	0
2	29	10	6	0
3	37	11	7	0
4	49	12	9	1
5	39	8	3	0
6	43	6	3	0
Socioeconomic Status (I is highest)				
I	27	1	0	0
II	39	3	0	1
III	135	30	14	0
IV	28	21	15	0
V	5	7	3	0

Note: Four blood samples were unsatisfactory for testing.

Table 4. Retests of Children (33) with Blood Levels of 40 μg/100 ml or Greater

	Lead Levels		
	<30 μg/100 ml 12 Children	30-39 μg/100 ml 12 Children	40-79 μg/100 ml 9 Children
Sex			
Male	7	9	5
Female	5	3	4
Age			
1	2	1	1
2	0	4	2
3	4	2	1
4	6	2	2
5	0	1	2
6	0	2	1
Socioeconomic Status (I is highest)			
I	0	0	0
II	1	0	0
III	6	4	4
IV	4	6	5
V	1	2	0

Table 5
Children with Confirmed Levels of 40 μg/100 ml or Greater and Unconfirmed Levels of 30 μg/100 ml to 39 μg/100 ml

	Number	% of Each Tested Group
Sex		
Male	49	26.1
Female	34	23.4
Age		
1	17	30.4
2	16	33.3
3	14	25.9
4	16	22.2
5	11	21.6
6	9	17.3
Socioeconomic Status (I is highest)		
I	1	3.4
II	3	6.8
III	38	21.0
IV	32	50.0
V	9	60.0

screening with finger-prick samples. The use of these and other similar survey data can grossly overestimate the prevalence of lead poisoning. The consequence of this overestimation could be improper allocation of resources (particularly from government agencies) for attacking this problem.

Neither age (ages one through six), nor sex was a good predictor of elevated blood lead levels, but socioeconomic status, as determined by census tract residence, was useful. A marked increase in cases is observed between each of the socioeconomic groups, from 3.4 percent in Group I to 60 percent in Group V (Table 5). Based on these data, we believe that lead screening should be offered selectively, only to children who reside in the lower socioeconomic census tracts. Parents of these children should be informed of the high false positive rate and of the possible need for retesting with venous blood samples.

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