

Studies of Morbidity Near a Copper Smelter

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Children living near a copper smelter in Tacoma, Washington, have been shown to have increased levels of urinary and hair arsenic. Studies of hearing, blood status and school attendance in exposed and nonexposed children failed to detect any differences in these parameters.

In 1972, children living near a copper smelter in Tacoma, Washington, were shown to have elevated hair and urinary arsenic levels (1). This smelter specializes in processing ores rich in arsenic and is a major producer of arsenic trioxide. In a search for morbidity in children exposed in the community around the smelter, a number of studies were done. These included a search for anemia and hearing loss, since other investigators (2, 3) had reported these abnormalities in children who were exposed to arsenic near coal-fired power plants. Additionally, school absenteeism was examined as a crude index of possible morbidity.

Method

Attendance and enrollment records, and records of hearing screening, were obtained from the Tacoma public schools. Pure tone audiometry was done on 7 children with high average urinary arsenic levels. Blood was drawn from 33 case group and 25 control group children for complete blood counts.

Results

Attendance

Table 1 shows attendance and enrollment at seven Tacoma elementary schools. The Ruston school is less than 100 yd from smelter property, and the other schools are up to 8 miles away.

Nearly all Ruston school children reside within a mile of the smelter. The ratio of attendance to enrollment is remarkably similar for all schools over the period 1969-1974, varying less than 3% between highest and lowest comparative attendance. There is no evidence for this time period that attendance was any different at Ruston school than at other comparable Tacoma schools.

Table 1. 1969-74 average annual attendance.

School	Attendance A	Enrollment B	A/B
Ruston	134	141	0.95
Sherman	591	637	0.93
Point Defiance	451	477	0.95
Truman	578	605	0.96
Fern Hill	650	688	0.94
Larchmont	342	362	0.94
Oakland	189	201	0.94

Hearing

Records of pure tone hearing screening for Tacoma elementary schools for the years 1967-1968 showed that of 566 Ruston school children screened, eight (1.4%) failed the testing. This compares quite favorably with a failure prevalence of 5.7% for all schools combined (17,623 children tested). As an added test, six children with elevated urinary arsenic levels (> 0.2 ppm on two or more sample days, normal = < 0.02 ppm) were referred to the school audiologist for pure tone threshold audiometry. One child had a previously known unilateral hearing loss. No high frequency hearing loss was detected in this group of children. One child had a 10 dB loss at 8000 Hz. and 5 had 0 dB loss at 8000 Hz.

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Hematology

In May, 1976, blood was drawn from 33 Ruston and 25 Fern Hill school children. Fern Hill school was selected as a control school and is about 8 miles away from the smelter. Urine arsenic levels in Fern Hill school children were normal when tested in 1972.

The age distribution of the children studied is given in Table 2. Table 3 presents the results of the hematology study.

Table 2. Age distribution of children.

Age	No. of children	
	Ruston	Fern Hill
8-9	4	1
9-10	7	2
10-11	14	7
11-12	8	12
12-13	0	3
Total	33	25

Table 3. Average Blood Values, Ruston and Fern Hill Schools, Grades 3-5 (May, 1975).

	Ruston	Fern Hill	Normal values ^a	
			Age 6-10	Age 11-15
Red blood count, millions/mm ³	4.48	4.71	4.7	4.8
Hemoglobin, g/100 ml	13.0	13.6	12.9	13.4
Hematocrit, volume of packed RBC/100 ml	37.2	38.8	37.5	39.0
Mean corpuscular volume, μ^3	82.4	81.8	80	82
Mean corpuscular hemoglobin, μg	28.9	29.9	27	28
Mean corpuscular hemoglobin concentration, (%)	35.3	36.7	34	34
White blood count/mm ³	5,720	6,080	8,100	8,000
Granulocytes, %	46.3	49.0	50	51
Lymphocytes, %	47.6	43.6	39	38

^aData of Wintrobe (4).

The Ruston and Fern Hill blood counts are very similar. The slight difference in counts between the schools could be accounted for on the basis of the

Fern Hill children being an average of 9 months older than the Ruston children. Surprisingly, children at both schools had low white counts and an increase in the proportion of lymphocytes. This may be due to an error in counting white blood cells or may be explained by the fact that the blood sampling was done at the time of an Asian influenza outbreak in the community. This is the blood pattern seen in active or convalescent viral infections.

Since the hemoglobin values are similar at the case and control schools and agree well with published normal values for these age groups, it was concluded that arsenic exposure in the Ruston children is not having a demonstrable effect on the blood hemoglobin concentrations. This is in contrast to data from Czechoslovakia (3), which show low hemoglobin in children exposed to arsenic from a power plant.

Summary

Children living near a copper smelter in Tacoma, Washington, are exposed to and excrete elevated levels of arsenic. This study indicates that school attendance, hearing and the hematologic indices in these children are within normal limits and do not seem to be adversely affected by chronic, low dose exposure to arsenic.

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