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SUPERVISOR MEDICAL SECTION

WORKMEN'S COMPENSATION
THE INDUSTRIAL COMMISSION OF OHIO
MEDICAL SECTION
COLUMBUS

IN RE CLAIM NO._____

February 18th, 1943.

Dr. Robt. A. Kehoe,
University of Cincinnati,
College of Medicine,
Cincinnati, Ohio.

Dear Doctor Kehoe: -

In accordance with our recent conversation, I am enclosing a copy of the laboratory procedure used by Dr. Davidson's Laboratory, and we would appreciate your comments on this procedure.

I am at the present time working on a proposed list of approved laboratories for the determination of quantitative blood and urine leads.

I wish to again extend my appreciation for your kind cooperation.

Very truly yours,

Ben Arnoff, M. D.,
Chief, Occupational Diseases.

BA/MMW.

Enc.

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Myers, Gustafson, and Throne describe emthods which are based upon Fairhall's volumetric and colorimetric estimations.

Determination of Lead in Biologic Material.--

I. Preparation of Samples.

A. Urine: A liter of urine is used whenever possible. The urine must be fresh or preserved, preferably, with thymol. It is made ammoniacal by the addition of 50 c.c. of concentrated ammonium hydroxide and allowed to stand overnight. The lead is carried down by entrainment in the phosphate precipitate. Most of the supernatant fluid may be siphoned off and the rest of the sample is filtered through 12.5 cm. No. 40 Whatman filter paper. The specimen is dried in the oven and is then ready for ashing and extraction.

B. Blood: Whenever possible, 10 c.c. of oxalated blood are measured into a weighed Coors porcelain crucible and dried in oven. Clot may be used. When the specimen is dry it is weighed before ashing to determine dry weight.

C. Feces: The sample is placed in a weighed Coors porcelain crucible, dried, and weighed before ashing.

D. Spinal Fluid: A measured volume is placed in a crucible, weighed and dried in the oven before ashing.

E. Hair and Nails: Weigh and ash.

F. Tissue: Dry, weigh, and ash.

II. Ashing and Extraction.

The samples are ashed as completely as possible at red heat over a Bunsen flame. About 1 c.c. of fuming nitric acid may be added to the urine, feces, and blood samples to complete the ashing. This is not necessary with spinal fluid, hair, nails, and tissue.

The crucibles are cooled and 7 c.c. of 1:2 hydrochloric acid are added. The acid is boiled gently in the crucibles, cooled, and filtered through 7 cm. No. 40 Whatman filter paper into a 250 c.c. Pyrex Erlenmeyer flask. The crucibles are washed four or fives times with approximately 5 c.c. of cold distilled water for each washing. The washings are added to the filtrate and the final volume is about 35 c.c.

The filtrate is made just alkaline with approximately 5 c.c. of 25 per cent sodium hydroxide, then just acid with 1:2 hydrochloric acid and 1 c.c. of acid is added in excess. Methyl orange is used as an indicator. The solution is diluted to about 150 c.c. and hydrogen sulphide is passed into the cold solution for thirty minutes. The sample is then allowed to stand overnight to insure complete precipitation of lead sulphide.

The sulphide solution is filtered through 12.5 cm. No. 40 Whatman filter paper. The flasks and filters are washed three times. About 15 c.c. of distilled water are used for each washing. Fifteen cubic centimeters of hot 1:1 nitric acid are used to dissolve the lead sulphide precipitate and this is caught in the precipitation flasks. The filters are washed with hot water until the total volume in the flasks is about 50 c.c. This solution is evaporated to about 5 c.c. and transferred quantitatively to a 150 c.c. Pyrex beaker. The total volume of solution and washings should be about 50 c.c. Three drops of phenolphthalein are added and the sample made just alkaline with 25 per cent sodium hydroxide, just acis with 10 per cent acetic acid, and 1 c.c. of acid is added

in excess. The contents of the beaker are boiled, then 1 c.c. of 1 per cent potassium chromate is added and then heated on the water-bath for one hour, then allowed to stand overnight.

The chromate is filtered hot through 7 cm. No. 40 Whatman filter paper, then both beaker and filter are washed three times, each with hot water using about 10 c.c. for each washing. The chromate precipitate is dissolved off the filter paper with 2 c.c. 1:2 hydrochloric acid which is caught in the precipitation beaker. The filter is washed with 40 c.c. of water added in small portions. Five cubic centimeters of 10 per cent potassium iodide are added to each sample and after three minutes they are titrated with 0.005 N sodium thiosulphate, using starch as an indicator. One cubic centimeter of 0.005 N sodium thiosulphate equals 0.3451 mg. lead. A microburet used for the titration is graduated in 1/100 c.c. graduations. The 10 per cent potassium iodide solution is made up fresh each time. The sodium thiosulphate solution is made up fresh each time from a stock solution of 0.1 N thiosulphate.

Example:

Calculations and Results.
1.53 c.c. of 0.0049 normal sodium thiosulphate were used in the titration.
0.34441 x 1.53=0.5269473 mg. of lead per 860 c.c. of urine (original sample).

$$\frac{0.5269473}{860} \times 1000 = 0.6127 \text{ mg. of lead per 1000 c.c. of urine.}$$

According to the Journal of Industrial Hygiene, 15: No. 5, September, 1933, the normal volume is 0.017-0.026 mg. of lead per liter.

SUMMARY OF URINARY CHANGES IN LEAD POISONING

The urinary changes in lead poisoning are as follows: albumin; granular casts; red cells; abnormal amounts of lead (see above tests); hematoporphyrin.

SUMMARY OF BLOOD CHANGES IN LEAD POISONING

The blood changes in lead poisoning are as follows: low red cell count; low hemoglobin; high blood platelet count; presence of nucleated red cells; changes in the morphology of the red blood cells; basophilia; polychromasia.

(For fuller details, see Hematology of Lead Poisoning in Chapter on Hematology, page 506.)