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BENZOL POISONING AS A POSSIBLE HAZARD IN CHEMICAL LABORATORIES

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The hazard attending the use of benzol in industry has been well established by the recent studies conducted by the United States Public Health Service in cooperation with the National Safety Council.¹ As a result, of these studies it was concluded that "The use of benzol (except in inclosed mechanical systems), even when the workers are protected by the most complete and effective system of exhaust ventilation, keeping the average concentration of benzol in the workroom air below 100 parts per million, involves a substantial hazard. Every possible effort should, therefore, be made to develop the use of substitute solvents of a less toxic nature wherever this is possible."

Quite recently the writer's attention has been called to the fact that benzol is used to a considerable extent in chemical laboratories. This is especially true in those laboratories where tests are conducted in connection with rubber, paint, varnish, and oil products. Such tests usually involve the determination of the solubility of compounds in various solvents such as benzol, carbon disulfide, and acetone. Several such laboratory workrooms were recently investigated by the writer with the purpose of determining whether or not the use of benzol in these workrooms constituted a source of ill health. In these laboratories from 3 to 5 gallons of benzol were used weekly, mainly in the extraction of fuel oils and in certain solubility determinations. In certain tests the procedure called for centrifuging with benzol the material to be tested, a practice evolving considerable benzol vapor in the air. Air analyses made in three laboratory rooms where benzol was being used showed a concentration of vapor varying from 28 parts per million in one room to 223 parts per million in another. In the latter room two centrifuges were used intermittently in the manner just described.

Besides using benzol for experimental purposes it was observed that this solvent was also employed in cleaning apparatus and in washing the hands and arms free from stains. This practice is quite

¹ Greenburg, Leonard: Benzol Poisoning as an Industrial Hazard. Reprint No. 1096 from the Public Health Reports, July 2, 9, 23, 1925.

common, since many of the materials tested contain asphalt, coal tar, and varnishes, substances difficult to remove from glassware and the skin with ordinary cleansing agents. It is quite obvious that such practice on the part of chemists tends to add to the amount of benzol vapor in the laboratory air and should be abolished. Even though the use of benzol for experimental purposes may be justified in certain instances, certainly by some less toxic solvent, such as xylol, should be substituted for use in cleaning apparatus and for a skin wash. In one laboratory room as much as 3 gallons of benzol per week was used as a cleansing agent.

As stated earlier, the study of benzol poisoning in industry disclosed the fact that the exposure to benzol vapor of concentrations even as low as 100 parts per million involves a substantial hazard. Conditions in chemical laboratories differ from those in industry in that the use of benzol is usually intermittent. So that it does not seem practical to apply the standards of vapor concentrations evolved for industrial establishments to those laboratories not using benzol constantly throughout the workday. A better criterion for evaluating the extent of benzol poisoning is a blood examination of the worker exposed, since the most characteristic pathological effect of benzol is its destructive influence upon the cells of the blood and the blood-forming organs. In chronic benzol poisoning the white-blood cell count is reduced to a considerable extent. Hence, in attempting to fix a standard for the white-cell count which would, along with a history of exposure, be indicative of benzol poisoning, the investigators of United States Public Health Service decided that a fall in the count below 3,600 per cubic millimeter might be accepted as reasonably clear evidence of the condition in question. Chronic benzol poisoning produces also a marked change in the relationship between the various types of white-blood cells present. In benzol poisoning the percentage of lymphocyte cells is relatively increased and that of the polymorphonuclear leucocytes is markedly decreased. In making a diagnosis of benzol poisoning these aspects of the differential count must be carefully considered.

- Blood examinations of the workers exposed to benzol vapor in the chemical laboratories visited by the writer did not show an abnormal white-blood cell count. However, the blood of three of the men showed a departure in the relationship between the various types of white-blood cells. Such a blood picture, coupled with a definite exposure to solvent vapors of a concentration considered toxic, according to present-day standards, tends to indicate that the possibility of benzol poisoning in chemical laboratories must be considered.

Many industrial plants the cost of suitable chemical laboratories considered as a potential hazard to justify its retention. Usually all chemical laboratories solvent known to be less. It is recommended that chemical laboratories testing of materials only agent. Also, in order when its effects can be benzol fumes should be employment, and reexamine every month or two on reexamination, should (obtained from a previous from benzol exposure.

SUMMARY OF FRC MORTALITY FIG AREA, 1927¹

The Department of were lower than for the two years are shown 1927 birth rate (28.8 line and the lowest (1

Death rates for 192 shown for both years population) is shown

Infant mortality in the 33 States shown infant mortality rate (47.5) for Oregon.

Infant mortality 100,000 population infant mortality rate the lowest 1927 rate (87.1) for Norfolk.

¹ Exclusive of Louisiana. Material not received.

Many industrial plants still use benzol, since the claim is made that the cost of suitable substitute solvents is prohibitive. Certain chemical laboratories use a sufficient amount of benzol to be considered as a potential hazard, but not enough of this solvent is utilized to justify its retention on the above claim. It is felt that in practically all chemical laboratories benzol could be substituted by some solvent known to be less toxic, such as toluol, xylol, or highflash naphtha. It is recommended at this time that in case the use of benzol in chemical laboratories is continued, it should be confined to the testing of materials only, and should not be employed as a cleansing agent. Also, in order to detect incipient benzol poisoning at a stage when its effects can be minimized, all laboratory workers exposed to benzol fumes should be given a thorough medical examination before employment, and reexamined, with systematic blood counts, once every month or two thereafter. Any worker whose blood picture, on reexamination, shows a marked departure from the normal (obtained from a previous examination) should be promptly excluded from benzol exposure.

SUMMARY OF PROVISIONAL BIRTH, DEATH, AND INFANT MORTALITY FIGURES FOR THE BIRTH-REGISTRATION AREA, 1927¹

The Department of Commerce announces that birth rates for 1927 were lower than for 1926 in 23 of the 33 States for which figures for the two years are shown in the following summary. The highest 1927 birth rate (28.8 per 1,000 population) is shown for North Carolina and the lowest (13.6) is for Montana.

Death rates for 1927 were lower than for 1926 in 28 of the 33 States shown for both years. The highest 1927 death rate (13.9 per 1,000 population) is shown for Vermont and the lowest (7.1) for Idaho.

Infant mortality rates were lower for 1927 than for 1926 in 30 of the 33 States shown for both years. For States the highest 1927 infant mortality rate (125.8) appears for Arizona and the lowest (47.5) for Oregon.

Infant mortality rates are shown for both years for 48 cities of 100,000 population or more in 1920. For 42 of these cities the 1927 infant mortality rates were lower than those of the preceding year, the lowest 1927 rate (41.4) being for Seattle, Wash., and the highest (87.1) for Norfolk, Va.

¹ Exclusive of Louisiana, Massachusetts, and Utah, from which complete transcripts for 1927 have not been received.

at 4:30 p.m. The patient was found in bed, unconscious, with a pulse of 144 and respiration 22. The blood pressure was 144/90.

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Two months after leaving the hospital the patient returned at our request to check up on her progress. The blood observations at this time are given in Table I. During the first four months of her stay in the hospital she was generally at bed rest; the last six months she was up and about from four to six hours daily. She is doing well on almost exertion. One week ago she went from her home, at sea level, to an altitude of 4,500 feet and was there hysterical at bed rest and was forced to return home. Her appetite has been excessive and she has gained 15 pounds (6.8 Kg.). She has had no mental for two months.

The only changes in the physical observations are that the pallor, dyspnea and cyanosis which were noted before are gone, and that the heart area as determined by percussion has decreased. The left heart border is 10.5 cm. from the mid-sternal line, the right heart border is 2.5 cm., and the great vessels are 5.5 cm. in diameter. The blood pressure is 204 systolic and 110 diastolic.

The urine is entirely normal and has a specific gravity of 1.025. (This is the first urinalysis made during the past six months which has not shown a trace of albumin.)

The study of this case emphasizes the following principles which should be borne in mind when using phenylhydrazine:

1. Phenylhydrazine is a very potent agent in the destruction of red blood cells and hemoglobin.
2. It has a cumulative action. In this case the destruction of red cells and hemoglobin continued for ten days after medication was stopped.
3. The diagnosis of polycythemia vera should be definitely established before phenylhydrazine medication is started.
4. The drug should be used cautiously in all cases, and only when it is possible to observe its action by frequent blood counts.
5. The medication should be greatly reduced in amount or stopped as soon as the red blood count and hemoglobin approach the normal readings.

A CASE OF CHRONIC BENZENE POISONING

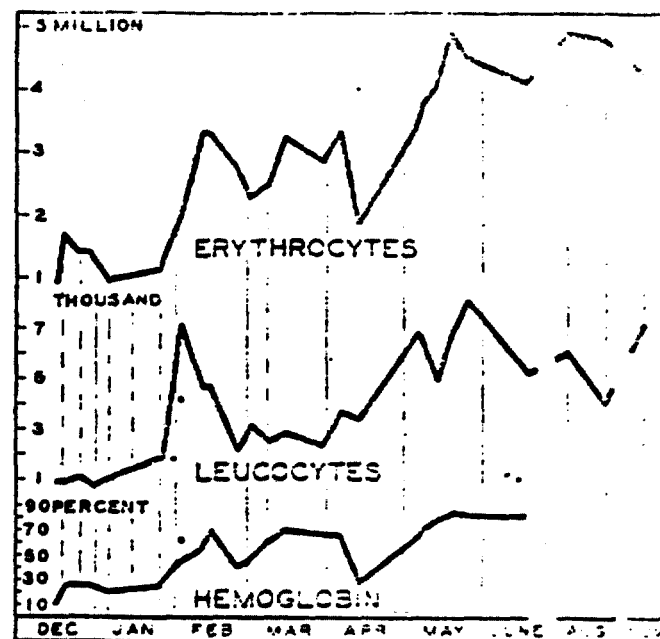
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A white man, aged 22, an American, married and father of two children, appeared at the Ohio State University, State Street Dispensary, Dec. 14, 1925, complaining of weakness and shortness of breath. He was told to report to the University Hospital the next day for study and diagnosis, where he was assigned to the general medical service of Dean J. H. J. Upham and to the immediate care of Dr. George I. Nelson, internist. We are indebted to both of these physicians for permission to abstract such parts of the history of the case as are taken from the hospital records made during the patient's six months' stay in the University Hospital.

When his history was taken he stated that about August 15 he first noticed a sallowness of the skin. About two months later, weakness, palpitation, dizziness and shortness of breath on exertion appeared. Headaches began about November 15, and at times were almost unbearable. His past and family history was negative.

His occupational history was of particular interest and proved to be important. He had worked in rubber factories off and on for about five years. February 12, he began buying inner tubes for a rubber company in Newark, Ohio. In the same room other workers were washing tube ends in gallon buckets of benzene and cementing them together. He was so placed that fumes from these operations were constantly being soaked

over his face and clothing. The patient was found in bed, unconscious, with a pulse of 144 and respiration 22. The blood pressure was 144/90. The patient was found in bed, unconscious, with a pulse of 144 and respiration 22. The blood pressure was 144/90.



Results of blood examinations. The percentage of reticulocytes and show dates of blood transfusions.

but the eye reactions were normal. Pallor of the conjunctiva was distinctly visible. The gums were bleeding and petechiae were found on the buccal mucosa. No physical abnormality of the chest or abdomen was found. The heart was apparently normal in size, but a blowing systolic murmur was heard over the entire precordia with maximum intensity in the second and interspace. A rough systolic bruit was heard over the carotids, and a definite "pistol shot" over the femoral arteries and a less extent over the brachials. The pulse was the regular in force and rhythm, but poorly sustained. Blood pressure was 122 systolic and 40 diastolic. Two Wassermann tests were negative, as were blood cultures. The bleeding time was more than twenty-five minutes; the prothrombin test was normal; the coagulation time, four minutes, while fragility was decreased to 0.06 per cent from a normal of 0.42 per cent. The red platelet count was 100,000 per cubic millimeter, the blood smear was nonreactive after twelve hours, and the tourniquet test was positive. The blood count showed 4,500,000 erythrocytes, 850 leukocytes and 10 per cent hemoglobin with slight anisocytosis. Urinalysis was negative.

Ophthalmoscopic examination of the right eye disclosed the margins blurred, especially nasally; considerable retinal edema, and many large and small flame-like hemorrhages in several layers of the retina, some of lower staining than others. The veins were tortuous, well filled but light in color; the arteries were very pale. The left eye was similar but also had a large subhyaloid hemorrhage temporally to the disk although not directly in the macular region. The periphery of the fundus were comparatively clear.

The diagnosis of chronic benzene poisoning was made during his stay in the hospital, the patient made few complaints except of weakness. He, however, was in a precarious condition and failed to show improvement for a long time. Blood analyses were made frequently. In all, 100 were made. He was put on a high protein diet and a course of iron

* The committee consists of: H. Sheldon Wells, M.D., chairman; Yvonne Henderson, Ph.D.; Paul N. Lewis Leech, Ph.D.; Carey McCon, M.D.; and J. R. Thompson, M.D.