

June 20, 1944

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Dr. James J. Badal,
Willard Storage Battery Company,
246 E. 131st Street,
Cleveland, Ohio.

Dear Dr. Badal:

I have delayed replying to your letter of May 26, with its full information on [REDACTED] and [REDACTED], because of a great deal of urgent work. I also wanted to comment as fully as possible on your remarks, and that required some study of the data that has come in from your plant from time to time.

I sent in such interpretation as I could on the analytical results on the two men at an earlier date. With respect to [REDACTED] I might say in addition that it is a little difficult to determine the precise significance of the analytical data by reason of the fact that the sample on this man was obtained almost a month after the discontinuance of his exposure. Under these circumstances one analytical result on a small sample of urine does not permit us to say anything much of importance about the magnitude of his lead exposure. It would have been very different if we had had an initial sample at the time of the onset of his illness, for under these circumstances we would have known something of the rate at which the urinary lead excretion decreased. The rate of decrease is an important factor in determining the severity of the previous exposure. Also the results would have been much more certain in their significance if we had had blood samples.

Coming now to your statements and your tentative conclusions, let me say that in my opinion you are trying to draw much too definite conclusions from fragmentary data. All that we have in the way of analytical data on any of your men is just enough to permit us to make certain tentative conclusions as to the nature of their lead exposure. In a number of instances we have nothing but a single result on a spot sample of urine. Such information is too little to enable us to draw anything more than the most tentative of conclusions, and we should have to have a great deal more information to justify any such conclusions as you have drawn.

I think also I should point out to you that you are taking the results on the microscopic examination of the blood much too seriously. There is no quantitative relationship between the lead exposure in the individual case and the level of stippling. It

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is true that there is a strong tendency for an abrupt change to high levels of stippling at the onset of acute plumbism. The small variations that occur in between are of little consequence, and have almost nothing to do with the trend in lead absorption. We have followed quite a number of cases day after day for many months under conditions of exposure, and we would certainly not attempt to make any such interpretation of the results as you are trying to make.

On this above I think you will probably get the impression that I tend to discount your feeling that men have an increase in symptomatology after removal from lead exposure. Generally speaking the elevated stippling drops off fairly rapidly after the cessation of exposure. It does this somewhat irregularly, and there are sometimes recurrences of high figures. Nevertheless the trend is definitely downward. The lead excretion on the other hand may not drop off very much for a number of months. This all depends on the quantity of lead that is available and the length of time over which it has accumulated. Here too there is a definite tendency for a decrease in the urinary lead excretion, but the urinary lead concentration may remain at a standstill, or very nearly so for several months. If the decrease is very gradual, one can be quite certain that the lead absorption occurred over a long period. If it drops off sharply, one could be sure that there was a very recent exposure.

I am not quite sure what you mean in the next to the last paragraph in your letter, in saying that we know little about the partition of lead in the body. On the contrary, we know a great deal, and I think it is fair at the present time to say that if we have an opportunity to follow the lead output daily for a period of time, we can come fairly close to determining the facts with respect to the previous absorption of lead. Actually from the observations we have made it is quite clear that the discontinuance of lead exposure is followed by a fairly steady loss of lead from the body. The blood lead concentrations are slow to decrease, and we have never seen any evidence of serious fluctuations up and down. There are slight variations to be sure, but the trend of events is quite predictable. I think, therefore, we can say that there are no important shifts of the lead in and out of the circulation and in and out of the other soft tissue. All of this apparently has very little influence on the course of stippling. Every observation makes it quite clear that stippling does not parallel in any way the lead concentration in the blood or in the soft tissues.

Finally, I think the explanation of your clinical findings is found in the fact that within certain limits of activity your men

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with early lead poisoning do better when they have something to occupy their time and attention than they do when they are on sick leave. Under the latter conditions they have too much time on their hands, they become very anxious and they think too much about how they feel. If they are acutely ill, obviously they have to be taken care of, but if they are not disabled, they feel worse when they have plenty of time to think about themselves. Moreover, their habits are likely to be quite irregular during such a period, and the results of this are not good. An additional trouble is the fact that their symptoms do not abate promptly, but they remain in substantially the same condition over a period of weeks or months until they have time to excrete most of the lead that has been absorbed. One can usually recognize a very great change in them, beginning on some particular day or within a few days of that time. It often happens that they seem to be well almost suddenly after having felt bad for a long time. Certainly the ones who have important neuromuscular disturbances do badly. This is because the lead exposure of these men has always been intense and second because the neuromuscular lesion is almost always slow in mending.

You will gather from the above that I do not know precisely how to explain many of the facts associated with the problem of lead poisoning. On the other hand, I would make no attempt to explain the possibilities in any such simple fashion as you have suggested. I think we are approaching a fairly sound understanding of the metabolism of lead in the body. On the other hand, we are a long way from an understanding of what happens in a cell or in a tissue that contains abnormal quantities of lead. I think our clinical information is fairly satisfactory, but the underlying and physiological mechanisms leave much to be desired before they are clear.

Sincerely yours,

Robert A. Kende, M. D.

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