

Gray. (W. B.)

DIAGNOSTIC VALUE

OF THE

Phosphates in Pregnancy.

(ILLUSTRATED.)*

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Mr. President and Gentlemen: On the 15th of January, 1883, I had the honor of writing and reading a paper on the Phosphates—generally considered—before the Richmond Academy of Medicine. This was published in the *Virginia Medical Monthly* for March of that year. I then incidentally referred to these salts as an aid in the diagnosis of conception.

In compliance with your request, by which I am again further honored, I now ask your attention to the special consideration of the *Diagnostic Value of the Phosphates in Pregnancy.*

As preliminary and pertinent to my subject, I remark that phosphorus is the great cerebro-spinal food or fuel. When combined with the alkaline bases found in the body, such as lime, soda, etc., phosphoric acid forms the salts known as phosphates. Now, as the kidneys constitute the great sewer

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of the body, we naturally turn to their excreta, the urine, to ascertain the normal and abnormal elimination of these salts. Thus appealing, we ascertain that about $\frac{1}{8}$ of a grain to the drachm, or about 59 grains per day of 24 hours, may be regarded as a fair average in the urine of healthy persons, free from extraordinary physiological influences. It may be well here to state that our plan of analysis and ascertainment is that advised by Dr. Tyson, of Philadelphia, which consists in the use of his magnesian fluid (composed of one part each of aqua ammonia, muriate ammonia, and sulphate magnesia, and eight parts of water). About $\frac{1}{3}$ as much of this chemical as you have of urine will precipitate all the phosphates found in urine, both alkaline and earthy, in twenty or thirty minutes. For convenience, I place in the smallest size test tube $\frac{1}{8}$ or $1\frac{1}{4}$ inch of urine, add the chemical, and set aside for subsidence. By repeated experiments, I have ascertained that each $\frac{1}{8}$ of an inch of precipitate is equal to $\frac{1}{3}$ of a grain of these triple phosphates to one drachm of urine.

Now, I suppose no one will deny that the amount of fuel consumed will necessarily determine the amount of resultant ashes consequent thereupon, whether the same be wood, urea, or phosphates. The amount of phosphates found in urine determines the amount of fuel consumed by cerebro-spinal activities. Hence, we find them largely increased in all hyper-taxations of this system, whether the same be due to diseased conditions of these centres or their unusual physiological exercise. It is well known that almost all neurasthenias and many cerebral troubles are examples, on the one hand, while on the other, most, if not all, under tense mental strain, such as lawyers, clergymen, doctors, etc., will be demonstrative. The greater the demand for fuel, the larger the results, *pari passu*, from such consumption of pabulum. When the expenditure exceeds the daily replenishing, then cerebro-spinal hunger is necessarily inaugurated. We are all painfully familiar with the decaying teeth, odontalgia, otalgia, and a host of other nervous manifestations so common in pregnancy. Why are these almost invariable concomitants? They are but the voice of neurasthenia, hydro-headed and physiological, and due to the large deflec-

tion of phosphorus from the mother's wants, and its appropriation to, and consumption in, the maturation and manufacture of an entirely new creature. Hence, the parent furnaces are starving for food and fuel, and raise their multitudinous voices for sustenance—support—pabulum.

After all I have said and tried to demonstrate, you will not be surprised for me to claim that the excreted phosphates are always increased in the urine of gestating women. In further testimony of this truth, I appeal to the test tube, and submit fifty-four analyses of the urine of pregnant women, without selection of cases, from my large collection. Of these, the smallest amount of the phosphates found in one drachm of urine was $\frac{1}{3}$ of a grain, and the largest $2\frac{1}{2}$ grains. The latter sample was from a consumptive patient.

Twenty-four patients are embraced in the fifty-four analyses; and from eight patients more than one analysis was made, at different stages of gestation. Thus, in patient No. 1, eight analyses were made with an average of $\frac{5}{8}$ of a grain of the phosphates to 1 drachm of urine; in No. 2, two analyses, with an average of $1\frac{1}{4}$ grain to the drachm. Samples from this patient contained albumen. In No. 3, three analyses were made, and gave an average of $1\frac{1}{2}$ grain to the drachm. This patient had pulmonary tuberculosis. No. 4 gave an average of $1\frac{1}{8}$ grain to the drachm. No. 5, seven analyses, with an average product of $\frac{5}{7}$ of a grain to 1 drachm of urine. This patient uniformly passed an excessive daily amount of urine, though on two days it measured $2\frac{1}{2}$ pints each a day, and on two others 2 pints a day. No. 6, with six analyses, gave an average of $\frac{1}{2}$ grain to the drachm. This patient, on the ninetieth day of gestation, voided 6 pints of urine, which yielded $\frac{1}{3}$ of a grain to the drachm. She afterwards excreted $2\frac{1}{2}$ and 2 pints urine a day. No. 7 had five analyses made, with an average of $\frac{5}{9}$ of a grain to 1 drachm of urine. In No. 8, five analyses were made, with an average of $1\frac{3}{8}$ of a grain of the phosphates to the drachm. This patient voided 2 pints urine one day, and 3 pints each on two other days. The $2\frac{1}{2}$ pints were voided on the 150th day of gestation, and on this day the phosphates measured 1 grain to the drachm. The 2 pints were excreted on the

180th day, and gave $\frac{1}{2}$ grain of the phosphates to the drachm of urine.

The increase in these salts does not seem to be regularly progressive as gestation advances, though always in excess of the normal. For example, at fifty-one days of gestation we find 1 grain of phosphates to the drachm, while at 273 days, only $\frac{2}{3}$ of a grain was obtainable. Once more: from the same patient on the 75th day we find $\frac{1}{2}$ grain to the drachm, while on the 263d day we precipitated $\frac{1}{8}$ of a grain to the drachm. Mrs. —, on the 150th day, voided $2\frac{1}{2}$ pints urine, containing 1 grain of these salts to the drachm, while on the 180th day, although passing precisely the same amount of urine, only $\frac{1}{2}$ a grain could be made out.

Believing that the foregoing constitutes a sufficient array of testimony, both hypothetic and analytic, to warrant my



Fig. 1.



Fig. 2.

deductions in the premises, I turn now to consider corresponding changes in the microscopy of these salts.

The *normal triple phosphate* (Fig. 1) is more or less a stellate figure, and *markedly feathery*. Sometimes the stella is segmented, and one leaflet stands alone to itself. Whether we see it in bold relief as a star, or dismembered as a solitary leaflet of the same, the feathery character is always to be remarked on both sides of the centre fibre of each leaflet. To know and *thoroughly understand* this will properly prepare us for the better appreciation and comprehension of the abnormal phosphate.

Now, as soon as conception occurs, or within twenty days thereafter certainly, the *feathery* portion of the stella, or segment thereof, begins to disintegrate (Fig. 2). This decay,

so to speak, may progress from the apex towards the base of the crystal, or may declare itself by destroying progressively the feathery contribution of one-half the leaflet, the centre fibre of the same determining and defining its boundaries. If a stella is found in comparative integrity, it will be seen shrunken, and withered and distorted, as a tender plant withdrawn from its bed in the earth, and exposed to the heat and wilt of the unfriendly sunshine.

Please refer to the slide (Fig. 2) of Mrs. R's case, at twenty days of gestation, and contrast it with that of Mrs. A., at



Fig. 3.



Fig. 4.



Fig. 5.



Fig.

sixty days (Fig. 3). Now, with the latter study, by contrast the slide of Mrs. T., at ninety days (Fig. 4). Notice how much more distorted and irregular the phosphates are becoming. But perhaps the metamorphic changes will be made more apparent and satisfactory by confining and restricting my remarks to the seven slides furnished by Mrs. A. at different stages of the same gestation (134 days, Fig. 5; 150 days, Fig. 6;

182 days, Fig. 7; 212 days, Fig. 8; 242 days, Fig. 9; 272 days, Fig. 10). Please study them after the explanation already attempted to be supplied you in this paper. Note



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.

their almost complete dismemberment and scarcely recognizable identity as phosphates.

(By way of parenthesis, I remark the frequent appearance of the urate soda about the third month. It rarely appears after about the seventh month.)

Past the middle of the seventh month, the phosphates begin somewhat to approximate their pristine form and general character, and at the *accouchement* can scarcely be differentiated from the normal. It is likewise true that when the fœtus perishes during the gestation, the phosphates at once recover their normal character in all respects. To complete compari-

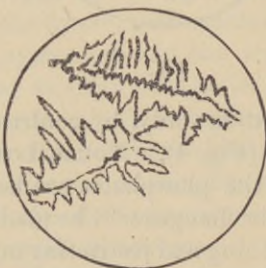


Fig. 11.

son, see Fig. 11 (page 834), from the same patient thirty days after delivery, while she is nursing.

In conclusion, if I have made myself well understood, and interested you in further pursuing the important, profitable and instructive subject, my object and aim have been served to the best of my ability, and my highest wishes are attained.

