The Solvent Properties of the Buffalo Lithia Waters of Virginia.

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It has been said that "if we wish to ameliorate the human race, it is in medicine that we must seek the means."

Time has amply demonstrated the truth of these words, and in no department of therapeutics have so great services been rendered as in the treatment of disease by mineral waters. Experience has permitted us to add as a corollary to this, that if we wish to dissolve concretions from the blood and different viscera and prevent their reformation in the sanguineous fluid, as well as their deposit in the organs of the body, it is the Buffalo lithia waters of Virginia that we must prescribe.

The Great Physician has provided for the sons and daughters of men a remedy so subtle in its composition and so sure in its working as to excite the wonder of the most profound chemist and the most skillful practitioner. Let these waters be analyzed and the component parts be used in precisely the same proportions, as regards

weight and chemical purity, in compounding an artificial water, presenting an exact reproduction of the natural water taken from the spring, and, by some mysterious process of Nature that we know not of, their solvent power is diminished or reduced to zero. Still more inexplicable is the fact that the salts composing the Buffalo lithia waters of Virginia act with considerable rapidity in dissolving uric acid and other calculi, whether hepatic, renal, or vesical, in very weak solutions, while stronger ones are less active or fail altogether. Dr. Roberts, of London, has given us very valuable data on this subject (*vide Archives of Medicine*, vol. iii). He placed fragments of uric-acid calculi, weighing from forty to a hundred and twelve grains each, in ten-ounce phials of carbonate solutions, analogous to that found in Spring No. 2 of the Buffalo lithia waters, these solutions being of various strengths. The experiments were continued day and night for some time, the daily flow of water varying between six and fifteen pints. Operating in this way, he found that above a strength of a hundred and twenty grains to the pint no solvent action was exerted, and even with eighty grains to the pint there was only a little; but in solutions of sixty grains to the pint the solvent action was more noticeable, but began to act decidedly at fifty grains to the pint; at forty grains to the pint the activity was further increased, and so on down, the solvent action being stronger and more speedy as the strength of the solution was diminished and approached the quantities contained in the analysis of Spring No. 2, which is justly considered to be the most powerful and perfect solvent of the various forms of calculi known to science, and not of calculi only, whether of the red lithic or uric acid or the triple phosphate of ammonium-

magnesium variety, but also of morbid concretions in general, such as albumin, sugar, cholesterin crystals, etc.

Many years ago, while I was resident physician at these world-renowned springs, a patient suffering from renal calculi of red uric-acid composition, wishing to assure himself of the potency of the Buffalo lithia waters as a solvent, placed a small bit of calculus passed by himself, and of about the size of the head of a large pin, in a goblet filled with the water of Spring No. 2, leaving the same covered on a shelf in his bedroom. Two weeks later he brought us the intelligence that the bit of calculus had entirely disappeared in solution with the water. Wishing in turn to verify the accuracy of a statement of such scientific importance and value, I at once undertook the following experiments: Ten grains of a red lithic-acid calculus and an equal quantity of a triple phosphatic deposit of the whitish ammonium-magnesium formation were placed side by side in separate glass receptacles of Buffalo lithia water, Spring No. 2, containing each thirty ounces, and left standing. These vessels were not moved or touched in the slightest manner throughout the whole duration of the experiment, but remained covered with glass slabs high out of reach, for it was desired to test the solvent power exercised by the chemical action of the water upon these two typical varieties of calculi.

At the end of two weeks disintegration had already begun, and at the end of the third week the calculus had separated into three smaller fragments, which in another eight days presented a clean, water-worn appearance, with a few loose flakes floating on the surface of the water. At the end of six weeks all traces of the

stone had disappeared, solution being complete. This was with the red uric or lithic-acid formation. With the other, the whitish-gray triple phosphate of ammonium-magnesium deposit, the process was somewhat different, but accomplished in the same lapse of time. Here, a whitish coating seemed to form around the original calculus, which softened it, causing it to break into many pieces resembling very coarse sand, and finally to dissipate itself and vanish altogether. The same experiment was then made with flowing water; that is, the water of Spring No. 2 was so arranged by means of a spigot and retort as to be continually renewed and to constantly wash the same amount of pebbles and of the same two varieties in the bottom of the retorts. It was found that exactly the same solvent process took place, but instead of six weeks, thirty days had sufficed to cause all traces of either stone to disappear. Analogous experiments were then undertaken with the waters of Springs Nos. 1 and 3; with the result that the water of Spring No. 1 acted a little more promptly in dissolving calculi of the triple phosphate of ammonium-magnesium than those of uric-acid concretion. Nevertheless, at the end of the thirty days dissolution was complete in both, the experiments having been carried out in every detail like those made with the water of Spring No. 2.

As regards those made with the water of Spring No. 3, the results obtained in the same manner and at the end of the same period of time, other things being equal, were as follows: Neither of the calculi was dissolved. Both, however, were carefully examined after the time prescribed by the first experiments had elapsed, and both were found to be coated with a whitish layer of about the consistence of pulp; then a second layer of

the stones had become softer, the interior being slightly more friable. Neither was there any breaking into fragments, as was the case with the waters of Springs Nos. 1 and 2, and the condition of the two specimens was much the same. From this it was concluded that while the waters of Springs Nos. 1 and 2 possessed a solvent power superior to any other known mineral waters, that of Spring No. 3 had also a solvent potency, but in a comparatively feeble degree, which furnishes a valuable therapeutic indication that will be referred to later on.

But let us come to the solvent action of the Buffalo lithia waters of Virginia inside the human body.

A chemical analysis of the waters, made by Professor William P. Tonry, of the Maryland Institute, Baltimore, gives the following results (expressed in grains to the imperial gallon):

	Spring No. 1.	Spring No. 2.	Spring No. 3.
Sulphate of magnesium	1·530	0·885	0·150
" aluminum	8·180	9·067	3·035
" potassium	0·463	.....	.....
" calcium	19·251	33·067	2·353
Carbonate of potassium	.....	29·300	1·852
Bicarbonate of calcium	39·277	14·963	2·524
" lithium	1·484	2·250	traces.
" iron	0·500	0·300	3·774
" barium	.....	1·750	.....
Chloride of sodium	1·256	4·921	0·21
" silicon	1·725	1·873	0·57
Phosphoric acid	traces.	traces.	traces.
Iodine	traces.	traces.	.....
Organic matter	small am't.	small am't.	small am't.
Total grains to the gallon	73·666	98·376	14·47
Sulphureted hydrogen (cubic in.)	5·9	8·3	3·4
Carbonic-acid gas (cubic in.)	69·1	59·2	11·6

It will be observed from the analyses here appended that Spring No. 2 contains 29,300 grains of carbonate

of potassium, 2,250 grains of the bicarbonate of lithium, and 4,921 grains of the chloride of sodium, a mixture made in such exact proportions when combined with the other ingredients as to surpass the most ingenious formulæ of materia medica.

Our friend and *confrère* the late Dr. J. Milner Fothergill, of London, whose authority in such matters is recognized all over the world, said: In all cases of affections of the liver and kidneys, but more especially where uric acid and lithæmia are the prominent symptoms, "soda and lithia for the liver, lithia and potash for the kidneys" (*vide* Fothergill's *Handbook of Treatment*) are the sovereign remedies.

My own experience covers at this late day many thousand cases in which we have prescribed and observed the solvent effects of the Buffalo lithia waters, not only at the springs themselves but in different parts of the United States and on the Continent of Europe, and I can only repeat what I have already said regarding their action when taken internally: that in the class of cases in which lithia, soda, and potash are regarded as most specially indicated I have obtained far better results from the Buffalo lithia waters than from any of the preparations of the lithium salts of the pharmacopœia; furthermore, I am satisfied that there is no other mineral water either in America or in Europe so singularly adapted to such a large number and variety of maladies.

The solvent properties of all three springs on grape sugar is immediate (as can be readily proved by placing ten or twenty grains in a test tube and adding half an ounce of water), and their great value in the treatment of diabetes mellitus is attested by numerous cases. Although the solvent properties of these waters may be

less evident *in vitro* as regards albumin, that exercised upon the albumin *in corpore* and in the blood in albuminuria and icteric fever, which it dissolves as it does the biliary elements and cholesterin crystals contained therein in the latter disease, is as remarkable as it is in lithæmia, lithiasis, and the different forms of hepatic, renal, and vesical calculi. Albumin, biliary constituents, such as cholesterine crystals and gallstones, sugar, uric acid, and phosphatic calculi are characteristic of so great a variety of diseases that they may be said to dominate all pathology; and it is because of the active solvent potency upon these different morbid concretions that the Buffalo lithia waters of Virginia are unrivaled in the treatment of so wide a range of pathological process.

It will be impossible to do more than narrate briefly one or two cases at most of each variety, from among the thousands treated by ourselves and others by these waters; the limits of a single article forbidding the introduction of long lists of cases in detail. Cases Nos. I and II are selected as typical of their class of calculi:

Case I.—Mr. A. came to the springs with the following symptoms: constant pain in the lumbar region, being obliged to walk with his right arm across his loins as a support, of florid sanguineous temperament, nodosities of Heberden on the fingers, tongue heavily furred, passing quantities of red uric-acid gravel varying in size from the head of a pin to that of a large pea, and having had frequent attacks of nephritic colic. After a six weeks' course of the water of Spring No. 2, he returned home cured.

Case II.—Mr. G.'s was a case of the triple phosphate of ammonium-magnesium variety. This patient was small in stature, emaciated, and pale, pasing almost continuously and to a considerable amount calculi, accom-

panied by pain in vesical region and tenesmus of the sphincter, the urine being mixed with blood and mucus. He began upon three glasses a day of Spring No. 1, which were increased gradually to six and then to eight. At the end of ten days a decided improvement had taken place; the pain was much alleviated, the blood and mucus having entirely disappeared from the urine. In another week the calculi had taken the consistence of sand and at the end of four weeks all symptoms of disease had vanished. It was now that he was put upon the water of Spring No. 3, three glasses a day, in order to prevent the reformation of calculi and to overcome the anæmic condition.

CASE III.—Mrs. L., gallstones. This patient, like almost all others that visited the springs, had been under treatment for some time previous, having exhausted the customary remedies, such as chloroform, morphine, lithia in powders, ether in capsules, etc., without relief. The attacks had been succeeding each other every few days at the time she consulted us at the springs. Owing to some existing gastritis, the water, that of Spring No. 2, had to be begun in very small quantities, half a glass four times a day. In forty-eight hours the gastric symptoms were already alleviated and the quantity of water could be rapidly increased. This patient only had one subsequent attack, and that shortly after her arrival at the springs, which she left at the close of the eighth week; the jaundiced color of the skin habitual with her having given place to a healthy whiteness with pink cheeks.

CASE IV. *Suppressed Gout.*—Uric acid in excess was found in the urine; there was a scarcely perceptible tophous roughness here and there along the border of the helix of the right ear, but that was all. Some emaciation. Four glasses a day of Spring No. 2, for twenty-eight days, rendered his urine perfectly normal and gave him a gain of ten pounds in weight.

CASE V. *Gout.*—This was a large, plethoric woman, weighing about two hundred pounds, who left the

springs after a five weeks' course of Spring No. 2 very much benefited and having lost twenty pounds, much to her satisfaction. Repeated examinations of the urine showed it to be free from uric acid, and no crystals could be obtained after the second week; the chalky deposits and tophi in the joints had been considerably reduced in size, the smaller ones having been resorbed completely.

Unfortunately, this patient was unable to finish her course, being obliged for family reasons to return home, otherwise we should have had a *restitutio ad integrum*. By exerting their solvent power these waters accelerate the exchanges, promoting at the same time nutrition and assimilation, thereby regulating the proportion of adipose to muscular tissue.

Now follow a number of cases of lithæmia and lithiasis, which ought really to be classed as cases of uric-acid and phosphatic dyscrasiæ. Lithæmia, properly defined, is the dyscrasia of calculus or gravel, and lithiasis the complication of calculi themselves, and the term may be practically applied to all cases of spurious or abortive gout, hepatic, renal, and vesical disease characterized by mixed lithic formations not described in pathological nomenclature nor belonging to any regular pathological anatomical class. In such cases, the waters of Springs Nos. 1 and 2 act with equal promptness, purifying the blood by dissolution of the lithic elements contained therein; preventing their reformation in lithæmia and dissolving the calculi in lithiasis. In this series of cases all the calculi were of the uric-acid and triple phosphate of ammonium-magnesium varieties combined.

Stone in the bladder, whether of renal or vesical origin, and whether of oxalic, uric, or phosphatic formation,

is an indication *par excellence* for the exhibition of the Buffalo lithia waters. Of the cases cured by them, perhaps the most striking is that of Mr. C., of North Carolina, who came to the springs with a large single stone in the bladder. This case places beyond all doubt the wonderful solvent power of these waters. Mr. C.'s stone, which was a triple phosphatic one, became first disintegrated into smaller fragments, these in turn into gravel, and that eventually into fine sand, until finally there was no discharge of calculous concretion in any form, and the urine, from having been strongly ammoniacal, had become perfectly normal. I received news of this patient one year later and there had been no return of the disease.

Jaundice, which is quite a common complication in hepatic disease of almost every form and characterized by the retention in the blood of the biliary constituents, chief among which are cholesterin crystals, is quickly relieved by these waters, which dissolve the crystals and alkalize the blood.

Albuminuria.—These cases count by hundreds. There is no remedy so absolutely specific in all forms of albuminuria and Bright's disease, whether acute or chronic, as Buffalo lithia water, Spring No. 2, accompanied by a milk diet. In all cases of pregnancy where albumin is found in the urine as late as the last week before confinement, if this water and a milk diet are prescribed, the albumin disappears rapidly from the urine and the patient has a positive guarantee against puerperal convulsions.

We have treated quite a considerable number of diabetic and glycosuric cases with the waters of Springs Nos. 1, 2, and 3, and, where the patient persevered in the

treatment to the end, with a perfect cure for a result; in others, with marked benefit; always relying upon Springs Nos. 1 and 2, at times singly and at others in combination, for the main treatment, and on Spring No. 3 as an adjuvant and chalybeate to overcome the anæmic condition usually attending such cases. The solvent action is here most marked, not only as regards the glycogen in the blood, but also the hippuric acid contained therein, and which Prout and Garrod first found in diabetic urine. (See Beale on *Urinary Deposits.*)

The two following cases of diabetes mellitus are taken from our notebook as typical of the two great classes into which all diabetic diseases are grouped—viz., *diabète gras*, fat diabetes, and thin or pancreatic diabetes.

Mr. B. was addressed to me by the late Dr. Van Bibber, of Baltimore, and when first seen by me at the springs his urine contained large quantities of sugar, three drachms to the quart, with a density of 1.045. He had marked polyphagia, polydipsia, and polyuria, being a large, fat man of the whitish type, the increase in weight coinciding with the development of the diabetic symptoms. He remained ten weeks at the springs, the quantity of sugar diminishing from the very beginning of the treatment, the appetite and abnormal thirst growing less *pari passu* until at the end of the eighth week all diabetic symptoms had entirely disappeared, he being completely restored to health; it was nevertheless considered advisable to continue the treatment two weeks longer, but in diminished quantities; four glasses of water, two of Spring No. 1 and two of Spring No. 3, were drunk during the day. This patient drank during four weeks the water of Spring No. 2 and during the second four weeks that of Spring No. 1.

The other case was that of a young lady, seventeen years of age, suffering from nervous crises, pain in the

lumbar region, wasting, the urine loaded with sugar, and the patient presenting all the symptoms of pancreatic diabetes. The waters of Spring No. 2 were ordered, and fourteen days after she began to take them there was a great diminution in the quantity of sugar observable; the nervous crises had ceased, also the pain in the lumbar region. To my regret, this young lady was now obliged to leave the springs and the case was lost sight of.

The number of cases of simple accidental glycosuria without diabetic symptoms cured by the Buffalo lithia waters is much more considerable; such cases are generally promptly relieved in a few days, sometimes in twenty-four hours.

Appendicitis.—Where appendicitis is dependent upon the formation of phosphatic deposit in the appendix vermiformis, the waters of Springs Nos. 1 and 2 will prevent a reformation of calculus after the operation. It is in this way that the best results will be obtained, unless it be as a prophylactic, for phosphatic appendicitis is a danger that patients with the lithic diathesis always run. During my last year as resident physician at the Buffalo lithia springs, one case of appendicitis that came under my care made a very good recovery without operation, drinking the water of Spring No. 1 throughout the entire duration of the disease.

It will be observed from the foregoing, which must be considered rather in the light of a *résumé*, that Springs Nos. 1 and 2 possess to an equal degree the solvent power which makes these waters superior to all others, not excepting the famous waters of Carlsbad. I should, however, give the preference to Spring No. 2 in all cases of the red lithic- or uric-acid dyscrasia,

and to Spring No. 1 in the triple phosphate of ammonia-magnesia variety, although perhaps as many cases of the latter have been as successfully treated with the water of Spring No. 2, which is at the present day the more known to fame. I can not, in closing, insist too strongly upon the value of Spring No. 3 as an adjuvant in cases where anæmia is a symptom, not only in lithic cases but in albuminuria, diabetes, and general pathology as well. A peculiarity of the first of the two diabetic cases mentioned above was a certain proportion of inosite or muscular sugar contained in the urine. Professor Bouchard and Professor Potain, of Paris, have recently reported each a similar case.

Springs Nos. 1 and 2 hold in solution the same mineral constituents, and it is doubtless the change in their composite quantities that makes the difference in indication for their exhibition. These waters we have found equally active and efficacious in our hospital and private practice remote from the springs; the only advantages derived from drinking them *in loco* are those of change of air, scenery, and cooking, which, although valuable adjuvants, are by no means essential. Of course, it must be understood that a proper diet was prescribed, and must be in every individual case while using the waters; this certainly aids their curative action, and although they are not a panacea they are at least a specific in a very large category of diseases.

Finally, were I called upon to state what mineral waters were applicable to the greatest variety of cases in which lithia, potash, and soda are especially indicated, and what mineral waters prescribed by themselves alone, leaving medicines and diet entirely out of the question, will effect the most speedy, radical, and permanent cure

in such, I should unhesitatingly answer, "The Buffalo lithia waters of Virginia." I consider the salts of lithium, as held in natural solution in these waters, far more efficacious than any pharmaceutical preparations of those salts.

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