minutes in the direction just described. By this application, the base of the brain, the spinal cord, and the coeliac plexus of nerves, are simultaneously brought under the influence of the current.

2. *Want of sleep* is one of the chief complaints of patients suffering from rheumatic gout. This arises partly from want of exercise in the open air, and partly from the circumstance that the pain is apt to get worse at night. The patient keeps tossing about in bed from being unable to find a really comfortable position. "Nature's sweet restorer" thus flees the pillow of the sufferer, who generally dreads the night as his worst time. Opium and morphia are rarely applicable in these cases, as they generally excite rather than soothe, and impair the action of the stomach and the liver still more. Hydrate of chloral often steps in as the right thing in the right place; but I believe you will agree with me when I say that the more ample our experience of that remedy becomes, the more frequently do we find cases in which the system does not tolerate it, either in small or large doses. Where morphia and chloral fail to procure sleep, few other drugs will succeed in doing so; and it must, therefore, be looked upon as a considerable advantage connected with the use of the constant current, that under its influence sleep soon becomes prolonged and refreshing. No special application is necessary for attaining this end, the one I have just mentioned being quite sufficient.

3. *Pain* is another invariable symptom of rheumatic gout, and one which frequently resists the administration of sedatives and counter-irritants. Even subcutaneous injections of morphia and atropia have only a temporary effect, which rarely extends beyond twelve or twenty-four hours. The pain is generally most severe in the deformed joints, but is likewise felt in many other parts of the body. For the alleviation of the pain, the constant current is the most useful remedy with which I am acquainted. It must in this instance be applied to the suffering parts, so that the positive pole, armed with a small electrode, is made to touch the sore points; while the negative, connected with a large electrode, is placed in the neighbourhood. The current used may in this instance be somewhat more powerful than where it is employed for general tonic effects; and if a short application, say of one or two minutes, be not successful, this may be extended to four or five minutes. The effect is, in many instances, almost magical, inasmuch as pain, which has been fixed in some particular spot for months and years, is, as it were, charmed away by one or two applications.

4. The *deformities* which rheumatic gout produces, more especially in the interphalangeal joints of the hands and feet, resist the use of the current more obstinately than the other symptoms which have been mentioned; and it requires much patience and perseverance on the part of the practitioner and the patient to reduce them to any extent. Provided, however, that the galvanic treatment is followed up for a sufficient length of time, even extensive deformities may be improved, which is a matter of considerable importance, as most patients belong to the female sex. No one who has not seen it can have any idea of the beneficial effects which the current will produce in the long run on these deformities, even where they are extensive, and where the patients are not very old. It seems as if the action of the vasomotor nerves were gradually directed back into its proper channel. Unfortunately, many patients want to be cured in a week of a disease which is essentially chronic in its progress; and some practitioners are inclined to discontinue a special treatment too soon, unless immediate effects are produced by it. In this as in many other complaints the ultimate success of a particular plan of therapeutics depends not alone on the remedies which are used, but also very materially upon the more or less systematic use made by the practitioner of his remedies; and last, not least, upon the intelligent co-operation of the patient. In order to reduce deformities, galvanisation of the cervical sympathetic nerve must be had recourse to.

By what I have said I do not by any means wish to imply that the use of internal remedies should be altogether eschewed in the treatment of rheumatic gout. If we were, for some reason or another, to abstain completely from their use, we should only deprive ourselves of many chances to do good to our patients. Although in the system of therapeutics which I have pursued for rheumatic gout, I have given the first place to the constant current, I have frequently prescribed medicines which I thought would prove beneficial for removing certain complications which were present. Thus where there was an excess of acidity in the system, as evidenced by a highly acid condition of the mucous membrane of the tongue, the perspiration, and the urine, I have given alkalies or bismuth; for constipation, I have ordered Marienbad or Frederickshall mineral water; where the blood appeared to be very much impoverished, the *ferrum redactum* of the *L'harma* copoeia, or Spa water, was prescribed. All these and some other remedies I have used were, however, only auxiliaries of the galvanic treatment,

and could not of themselves have exerted any decided influence upon the progress of the disease.

In conclusion, let me impress upon you once more the necessity of persevering with the use of the galvanic current, if it is to be used at all. The circumstance that most of our patients will be above 45, and not a few above 60 years of age, in connection with the obstinate character of the malady itself, must prepare us for slow results, more especially as far as the improvement of the deformities is concerned. Pain, indeed, is often relieved at once, but it is very apt to return: the patient often becomes rapidly stronger, but at times the old debility will again be felt, more especially if he undertake to do more, either in business or pleasure, than he is able to do; and a sleepless night may again occur after many good nights in succession. It is therefore necessary to tell the patient at once that a rapid cure is quite out of the question. The current should be used, either daily or three or four times a week, for at least a month or six weeks; and if the patient continue to improve, we may go on with it much longer than that. If, however, after that time he does not seem to make any further decided progress, it is better to discontinue the treatment for a month or longer, and then to recommence it. Those who will not shirk the sometimes rather tedious labour involved in carrying out such a treatment perseveringly, will ultimately be amply rewarded for their trouble by an amount of success which, in some forms of the disease, could not have been obtained by any other line of treatment.

ON THE INFLUENCE OF LIME AND MAGNESIA IN DRINKING-WATER IN THE PRODUCTION OF DISEASE.*

By JOHN C. MURRAY, M.D., Newcastle-upon-Tyne.

THE subject of my paper is of great importance to every one who, like ourselves, resides in a magnesian limestone district. It therefore well deserves to occupy a portion of our time, especially in this progressive age, when preventative medicine is engrossing so much attention. What I am about to advance is founded upon a few cases only; not, however, in consequence of a paucity of such cases, but rather the difficulty of fully testing the indicated plan of treatment, from inability hitherto of obtaining soft water in a town and region where every sample of drinking-water is saturated with lime and magnesia.

Last March, I read, in *The Urine and its Derangements*, by Dr. George Harley, that "oxalate of lime and phosphatic calculi are the two most common forms of stone met with in districts where the water is impregnated with large quantities of lime;" and that "the lime must be got rid of from the drinking-water; for, should it by any chance contain an excess of lime, its habitual employment will completely frustrate our best efforts at treatment." On perusing this, a previously dim and uncertain light became to me fixed and clear; not as yet, however, to attain the brilliancy of the lime or magnesian light, but perhaps sufficient by which to indicate other cases in which soft water, or water freed from lime and magnesia, would be of service in the prevention or cure of disease.

On referring to older works on urinary pathology, I find that in 1844 Dr. Golding Bird was the first to bring under notice the frequent presence of oxalate of lime in the urine of inhabitants of towns. In 1849, Dr. James Begbie pointed out the connection between oxaluria and imperfect digestion with sequent mental despondency. In 1850, Dr. Bence Jones said distilled water instead of spring water will lessen the quantity of lime passing through the body, and hence oxalate of lime in the urine. He also states that lime-water will cause phosphatic deposit. Sir Thomas Watson points out the risk from drinking water containing lime in oxaluria; and Dr. Atkin recommends, when oxalates appear in the urine, to avoid water containing lime. Dr. Harley, in the second volume of the *Medical Times and Gazette* for 1864, is, I believe, the first to show the imminent danger of lime in drinking-water in what was wont to be termed the phosphatic diathesis. My experience in the action of solvent remedies in gravel and calculi has not been so satisfactory as I could have wished; but, following the light shed by Dr. Harley, and acting by it whenever practicable, I am enabled to support the doctor's statements.

One patient, *e.g.*, with ammoniaco-magnesian phosphate and carbonate of lime sediment in his urine, has since been relieved by mineral acids and the use of soft water from Hamburgh, he fortunately being a sailor. Two others, by the same treatment and distilled water, are now passing acid urine, the physical signs of renal calculi are less urgent,

* Read before the Northern Branch.

and they are already happily free from deposits. A fourth has been relieved by acids and rain-water brought from the country. Two cases of oxaluria have been relieved: one by going for a short time to Glasgow and drinking copiously of Loch Katrine water, which only contains one grain of lime per gallon; the other by taking a holiday westward, where the water is soft. Two more cases have altogether recovered from their previously painful, depressed, and almost hopeless condition—one by removing to the south; the other, after going by my advice, to Cumberland. I have seen this gentleman there since, and he said that his well-water was so soft as to feel oily, and that it suited both his cuticle and mucous membrane.

Some cases are still under treatment, of which I may mention one from Leith, who came to Newcastle only last November, and applied to me in May for white gravel. Under mineral acids and soft water brought from Leith, improvement has commenced. A case from Denmark is one of peculiar interest. While in Vienna, phosphatic deposits first appeared; on happening to remove to a soft water country they ceased. Since then, the patient has remarked that health and comfort varied according as the water proved to be hard or soft. In Newcastle the party is such a sufferer that another removal will be essential, unless soft water can conveniently be obtained. I might multiply cases, but will only add that of a traveller from Liverpool, where the water-supply indicates only three degrees of hardness. When on his eastern journey, he begins in the north of Yorkshire, where the water is very hard; as he travels northward, coming by Sunderland and Shields to Newcastle, he seems to surcharge his blood with urate of soda; for, while writing this article, I am attending him for the sixth time with rheumatic gout. When he reaches home, he feels as if it required some time to wash his system clear, for he does not at once recover his usual health and elasticity of body.

When phosphatic gravel is persistent, and there is no history of disease or injury to brain or spine, to paralysis, or disease of the urinary organs, I think it may justly be set down to a superalkaline state of the blood, which condition water holding in solution large quantities of lime and magnesia will undoubtedly tend to induce; these bases neutralising a portion of the acid of the gastric-juice, besides which they will interfere with the action of the mucus and albumen of that secretion, and thus exert a notable influence in bringing on indigestion, hence the local value of pepsin as a remedy in dyspepsia. A sufficient reason for the difficulty we find in relieving these troublesome cases is thus afforded; for I think it will accord with the experience of all of you that a patient rarely, if ever, continues remedies sufficiently long to be cured of phosphatic sediments. The fact is, he daily requires fully a drachm of dilute mineral acid merely to neutralise the lime and magnesia which he takes in his twenty-four hours' consumption of our hard water. Hence, in this district a patient may continue to take acids until his teeth are gone without being relieved of the so-called phosphatic diathesis. On the other hand, if he contract with his chemist for distilled water and continue the acid treatment for a short time, a change will soon become apparent. The patient has less frequent calls to urinate, can sleep longer at night, go again to church, feels more buoyant, suffers less or no pain, his urine becomes acid and remains so. All that is required, then, is to make distilled water palatable, so that it may be drunk freely as one would a mineral water, and thus, according to Drs. Prout, Beale, and Harley, wash the system well out, thereby freeing it of every kind of urinary or blood-deposit. Urate of ammonia, and even the urate of soda of gout and rheumatism by this means may be dissolved and removed from the body. Large draughts of pure water increase the elimination of effete material especially of phosphates; hence after a time the administration of acids may be discontinued, and, according to my experience in this mode of treatment, the cure will be complete.

Cases of oxaluria have likewise been unsatisfactory, inasmuch as oxalic acid is a constant ingredient in both the blood and urine. Acid fruits and rhubarb contain oxalic acid; and if there be indigestion from the worry of business, or, as I have ventured to advance, from the lime and magnesia of hard water, neutralising pepsin and mucus in the stomach; or, again, if the action of the lungs be impeded from disease or impure air,—then sparkling wine, beer, effervescing drinks, carbonated alkalies, carrots, cauliflower, asparagus, preserves, sugar, starch, and even the retrograde metamorphosis of the albuminoid and fatty tissues of the body may stop short at C^2O^3 instead of CO^2 . We all know that oxalic acid in an appreciable quantity is dangerous to the organism, but even in such minute proportions as would be incapable of producing melancholia, it may nevertheless in the presence of lime, form the nucleus of a calculus; hence a dyspeptic patient in a hard water district runs a daily risk of suffering—to use Sir Thomas Watson's words—"the pain and exceeding peril of a renal calculus."

The oxalic acid diathesis, when not confirmed, is more easy of cure

than the phosphatic. Air, exercise, ease of mind, mineral acids, and tonics, together with water free from lime, if no calculus have already formed, will soon remedy the state of system; but if there be one or more calculi, they are less easy of solution than the phosphatic. When one of these melancholy cases of hypochondriasis occurs in your practice, I would recommend aerated distilled water in addition to your other treatment.

If mankind, like insects, reptiles, and birds, could pass solid urine; if Northumberland and Durham were less populous, and like the aborigines we could be sufficiently supplied with surface-water pure, or if an unimpaired digestion and chemistry enabled us to keep the salts in the urine always in solution, we would not need to fear the effects of earthy salts; but when, as I have found by examination, the usual daily consumption of water contains twelve or thirteen grains of salts of lime and carbonate of magnesia, and we see that this quantity is a frequent cause of disease, I hope to be pardoned for specially drawing your attention to this subject. Young persons enjoying country air and a powerful digestion, may long resist the effects of the earthy carbonates; but to the crowded denizens of a town, anxiously struggling for position, or, it may be, for existence, whose nervous system must ever be generating excess of phosphoric acid, or whose pneumogastric nerves, like tired sentinels, unguardedly permit the formation of oxalic acid, much lime and magnesia must be a continual source of danger, and none the less so because unsuspected. The proverb where ignorance is bliss, etc., is, as I take it, somewhat at fault here.

If time permitted, I would endeavour to prove that, in every kind of calculus, water holding much lime in solution is attended with danger, that rare form the xanthic only excepted. For not only may lime be mixed with or coat other nuclei, but even in uric acid deposits, which have been thought to be benefited by lime in water, the lime, by uniting with the free hydrochloric acid in the stomach, will leave soda at liberty to unite with uric acid, causing rheumatic gout, and also the chalk-stones which we so frequently see. When property is at risk, man is often shrewder and more anxious about it than even about his own personal health. Surely human life and comfort are of more moment than the beauty and usefulness of cattle; yet we find that owners have been observant of, and learned from the instinct of horses, which they try to supply with soft water in order to prevent them having a "staring coat," or suffering from stone, chalk-stones, and gripes. If man does not experience the effects of hard water so much as horses in consequence of eating animal, as well as vegetable food, he nevertheless frequently shows the evils of excess of lime and magnesia by early baldness, boils, carbuncles, scurvy, purpura, erythema, urticaria, herpes, bullæ, impetigo, acne, lichen, psoriasis, eczema, a dry unpleasant state of cuticle or dandruff, by cretification of arteries and valves of the heart, a frequent cause of apoplexy, paralysis, aneurism, phlebolite of veins, exostosis, rheumatic arthritis, calcareous deposit upon, and cretification in, various organs, and, as life advances, ossification of cartilages of ribs, joints, larynx, and petrifications in pulmonary and even muscular tissue. Some of this formidable list, viz., the skin-diseases, are enumerated from my having observed them to improve under the use of soft water.

I will only further take up your time with goitre and cretinism—diseases which are seen only in limestone and magnesian limestone quarters. In Northumberland and Durham we have many cases of goitre, and a few of cretinism and semi-cretinism. It is fortunate that goitre is difficult of cure, for so long as the patient continues to live on a calcareous soil, to cure the goitre would be apt to bring on a worse disease; we should rather let the gland go on to the secretion of lime salts to save more vital organs, or, better still, give dilute mineral acids. I am glad to see that in the *JOURNAL* for June 15th, Dr. Spender recommends tincture of the perchloride of iron in conjunction with tincture of iodine for Derbyshire neck when the patient can neither procure soft water nor migrate to it. This rational treatment will serve to neutralise and remove the lime salts which are undoubtedly the cause of bronchocoele. The disease will be apt to return, however, on discontinuing the treatment. Cretinism, according to Kölliker, Virchow, and Aitken, is attributable to excess of lime in water, causing ossification and diminished diameter of the foramina at the base of the cranium; hence strangulation of vessels and nerves, and arrest of cerebral development.

I see in the *Lancet*, and in the *Food, Water, and Air Journal*, that the contamination of drinking-water with unoxidised animal excreta is being ventilated. The question is a most vital one; its importance has, however, been longer recognised, and it has also been more carefully studied, than the one which I have the honour of laying before you.