

## CHAP. XVIII.

## OF LITHONTRIPTICS.

LITHONTRIPTICS are medicines supposed to have the power of dissolving urinary calculi: their operation, it is obvious, must be purely chemical.

The alkalis, it has been long known, relieve the painful symptoms arising from these calculi; and it was found by experiment, that they are capable of dissolving these concretions out of the body; hence it was concluded, apparently with justice, that their efficacy depends on their solvent power.

The discoveries of Modern Chemistry have thrown farther light on this subject; it has been proved that these urinary concretions consist frequently of a peculiar animal acid, the lithic or uric acid, either nearly pure, or in a state of intermixture. With this acid, the alkalis, in their pure state, are capable of combining, forming a compound soluble in water.

It has been ascertained too, that from the internal administration of the fixed alkalis, either potash or soda, the urine becomes impregnated with them so as to be sensibly alkaline. Experiments have farther proved, that either of them may be given to such an extent, as to enable the urine applied to a calculus out of the body to dissolve part of it; and it appears therefore to follow, that the same solvent

power may be exerted on a concretion in the bladder or kidney. Their use, however, to this extent cannot long be persisted in, from the irritation they occasion in the stomach and the bladder; and we have scarcely, perhaps, any decisive proof of a urinary calculus of any considerable size being dissolved, nor is the practice now frequently employed.

The use of these agents in a moderate quantity may, however, it has been supposed, prevent the increase of a calculus; and, as it may be at length covered by matter deposited from the urine, by which its surface is rendered more smooth, this practice may alleviate the symptoms. When the alkalis are used in this manner merely as palliatives, they are generally employed in the form of carbonate, or super-carbonate, as in that state they are more mild and pleasant. Their solvent power is thus impaired; but still in this mild form they retain the power of preventing the increase of the urinary concretion. The deposition of uric acid, to which that increase is owing, depends in a great measure on the generation of acidity in the primæ viæ. The acid which is there formed passes off by the kidneys, and causes the precipitation of the uric acid; the use of the alkaline carbonates, by correcting this acidity, prevents this deposition, and of course prevents the increase of the urinary concretion, and lessens the irritating quality of the urine. It has accordingly been found, that under a course of alkaline remedies, the deposition of uric acid, so frequently abundant from the urine of those who are liable to calculus, diminishes rapidly. With this intention, moderate doses of the alkali in its mildest form, saturated or super-saturated with carbonic acid, are taken as they are required.

These were the views generally entertained of the operation of lithontriptic medicines, after the discoveries of Scheele and Bergman had made known the properties of uric acid.

More recent investigations have extended our knowledge of this subject, and preclude still more the hope of the alkaline lithontriptics being employed with advantage as actual solvents.

It had always been known, that urinary calculi are not of uniform appearance and qualities. Dr Wollaston's researches proved, that they are of very different chemical constitution, and his experiments were confirmed by those of Fourcroy and Vauquelin.

Besides the uric acid calculus, which is generally of a brown or yellowish colour, of a compact or radiated structure, smooth on the surface, and perfectly soluble in alkaline solutions, another had been observed, composed principally of a matter frequently disposed in layers, white, of a lamellated structure, soft and smooth to the touch, and giving a light powder of a brilliant whiteness. This, the fusible calculus, as it has been named, is not soluble in alkaline solutions, but dissolves very easily in diluted acids, and it melts before the blowpipe into an enamel. The substance composing it is phosphate of magnesia and ammonia, and though it seldom forms an entire calculus in its pure state, it is often intermixed with the other usual ingredients, or disposed with these in alternate layers.

Phosphate of lime forms another variety of calculus, sometimes alone, but more generally mixed with uric acid, or with phosphate of magnesia and ammonia. Calculi of this kind have usually no great induration, feel dry and rough, and are without any lamellated or spathose structure; they are not dissolved by the alkalis, but are soluble more or less in diluted acids.

Lastly, a calculus had been known to surgeons, under the name of Mulberry Calculus, derived from its purplish colour, and its rough irregular surface. This is composed princi-

pally of oxalate of lime, with portions of uric acid, phosphate of lime, and animal matter. It is harder and heavier than any of the others; and is less affected by the usual solvents, alkaline solutions having no effect upon it, and acids dissolving it with great difficulty; the alkaline carbonates slowly decompose it.

From these diversities in chemical constitution, among the urinary concretions, it is obvious, that we cannot expect uniform advantage from the use of any active solvent as a lithontriptic, since what dissolves one calculus will have no effect upon another; and cases have accordingly occurred, where, instead of relief being obtained, as it frequently is, from the use of alkalis, it has been obtained from weak acids, while in many cases they have been productive of no benefit whatever.

A particular source of difficulty has farther been pointed out by Mr Brande, attending the attempt to exhibit lithontriptics as solvents. The phosphates of lime and magnesia, which exist in the urine, are retained in solution principally by its excess of acid: if, therefore, with the view of dissolving a uric acid calculus, or preventing its increase, alkalis be given so as to neutralize this acid, the deposition of these phosphates may be favoured, and a layer of them may even form on the existing calculus. And there is reason to believe, that the softness and sponginess which have been observed not unfrequently on the surface of calculi, in patients who have continued for a long period the use of alkalis, and which have been regarded as proofs of at least partial solution, have arisen from a deposition of this kind. If, on the other hand, from the state of the urine, or from the information afforded by a small calculus being discharged, there were reason to believe that a calculus in the bladder consisted chiefly of phosphate of ammonia and magnesia, if we

attempted the solution of this by the administration of weak acids, we run the hazard of causing the deposition of uric acid. It is accordingly found, that these effects take place. In different cases it has been remarked, that when alkalis have been given to correct the deposition of uric acid, or the *red* sediment or gravel from the urine, they have, when continued too long after having produced this effect, caused the deposition of the *white* sediment or gravel,—the phosphate of ammonia and magnesia; and on the other hand, Mr. Brande has remarked, that when acids were given with the view of removing the deposition of the phosphates, they have, after some time, caused a separation of uric acid. These circumstances render it necessary to employ these remedies with caution, and with a strict attention to their operation even as palliatives, and seem in a great measure to preclude their use as solvents, since we can scarcely hope, even by an alternation of acids and alkalis, so to adjust them as to obtain to any extent their solvent effects, without these counteracting results.

There is another mode, in which it has been supposed that lithontriptics may exert a solvent power. In all urinary calculi, there exists a quantity of animal matter, supposed to be of the nature of albumen, which has been regarded as the cementing ingredient, giving induration to the calculus. On this it has been conceived solvents may act, so as to destroy the cohesion of the aggregate. The experiments of Dr Egan confirm this, he having found that lime-water is more effectual in destroying the cohesion of a urinary calculus, than an alkaline solution,—a result which, on repeating his experiments, I have likewise obtained. Now, this superiority cannot be ascribed to any action of the lime on the saline ingredients of the calculus, but must arise rather from its chemical action on the albumen or animal mucus, of

which it is known to be the solvent; and it may therefore be supposed that lime-water, from this operation, might be used with advantage as a lithontriptic. It would of course require to be given in combination with alkalis, the latter neutralizing the excess of acid in the urine, which would otherwise combine with the lime, and render it inert. But it may be doubted if this could be managed, so as to obtain any important effect, or that lime could be secreted in its pure form by the kidneys.

From these observations, the advantages to be expected from lithontriptics, it is obvious, must be very limited. They probably cannot be given with greater benefit than simply to correct the excess of acidity in the urine, so frequent in those who labour under calculus, and thus diminish or remove that deposition of gravel as it is named, or small crystalline grains, which often proves a source of irritation. They may even thus perhaps prevent the increase in the size of a concretion. Or it is possible, in cases of the mulberry calculus, which produces much pain from its rough and pointed surface, that pushing the use of them even a little farther might prove useful, by giving rise to the formation of a layer of the phosphate of ammonia and magnesia, which would at least render the surface of the calculus soft and smooth. But we can never hope, by even the most careful administration of them, to dissolve a calculus of any size. In their administration, it may be of advantage to attend to the state of the urine, so far as regards its chemical constitution, and to suspend or vary the remedies as this may change. And in all cases the continuance of the remedies, and the length to which they are carried, ought to be regulated principally by the relief from pain which the patient receives.

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**LITHONTRIPTICS.**

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**POTASSA.****SODA.****SAPD ALBUS.****CALX.****MAGNESIA.****ACIDA.**

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**POTASSA.** Potash. (Page 372.)

THIS alkali is used as a lithontriptic, either pure or combined with carbonic acid. The pure alkali in the state of solution (Aq. Potassæ) has been given in a dose of 15 or 20 drops, morning and evening, increasing this gradually as far as the stomach can bear it, until the urine is rendered alkaline; and at the same time diminishing the irritation it is liable to produce, by the free use of diluents, and of any mucilaginous or gelatinous liquid. The action of the pure potash being more powerful than that of the carbonate on uric acid calculi, it is under this form that it has been employed when the actual solution of the calculus has been attempted.

Independent, however, of the difficulties which attend this, from the circumstances which have been pointed out under the general observations on the action of lithontriptics, it is scarcely possible to continue the use of the pure alkali to the requisite extent, from the irritation it occasions both in the stomach and bladder; and when it is to be used as a palliative, it is better to employ it under the form of the super-carbonate.

The super-carbonated potash water, already noticed, (page 455.), affords the most effectual palliative in cases of urinary calculi; the relief obtained from it appears to arise from its neutralizing the free acid in the urine, and thus rendering it less irritating. From half a pound to a pound is given in the course of the day; and it has the important advantage, that, from its mildness, it can be continued for any length of time without reluctance. There is another advantage perhaps belonging to the super-carbonated alkalis compared with the pure alkalis. The latter, if pushed too far, are liable to occasion the separation of the earthy phosphates from the urine; and where the urine is in that state in which these predominate, they must prove injurious. But when super-saturated with carbonic acid, the excess of acid will retain the phosphates dissolved, for this effect is obtained even from water impregnated with carbonic acid alone; and thus all the advantage that can be derived from the alkali will be obtained, without the injurious consequences that may arise from the use of it in its pure form.

SODA. Soda. (Page 455.)

SODA, like potash, is used as a lithontriptic, seldom, however, in its pure state. The carbonate, or rather sub-carbonate, is obtained from the barilla of commerce by solution



in water and crystallization. The crystals contain half their weight of water of crystallization, and are soluble in two parts of cold, and in an equal part of boiling water. This crystallized salt affords a very excellent form under which the alkali may be administered, so as to give the advantages of a palliative, and which is less expensive than any other. This forms what has been named the Soda Pill. The crystals are exposed to a very gentle heat, until they lose their water of crystallization, and the dry powder is made into pills with soap. Of these, half a drachm or a drachm are taken in the course of the day.

Soda is likewise employed under the form of the super-carbonated soda water, the powers of which are similar to those of the super-carbonated potash water, and which is taken in the same manner.

**SAPO ALBUS.**—Soap is a form under which the fixed alkalis have been administered in calculous affections. It is a chemical combination of expressed oil with potash, or soda. Potash forms only a soft soap, soda gives one that becomes hard; and to form the purer soap which is fit for medicinal use, it is combined with the mildest vegetable expressed oil, as that of the olive. The soap is white, but sometimes is designedly coloured by the addition to it, while soft, of a solution of sulphate of iron.

The acrimony of the alkali is much diminished by its combination with the oil, and on this account soap has been preferred as a lithontriptic, one or two ounces being taken in the course of the day. From the oil it contains, however, it is nauseous, and in such large doses generally offensive to the stomach, and the super-saturation with carbonic acid affords a much better method of rendering the alkali mild.

Soap is sometimes used in pharmacy, to give consistence to powders when they are to be formed into pills.

CALX. Lime. (Page 229.)

LIME, in the form of lime-water, has been used in calculus, in the quantity of a quart or more daily: it may prove useful by correcting acidity; but in the small quantity in which it can be taken, it can scarcely be supposed, that any of it will be secreted by the kidneys, so as to change the composition of the urine. Were it secreted, indeed, it would be rendered insoluble by the free phosphoric and uric acids. The only method in which it could be brought to act on a calculus, would be by conjoining its administration with that of the alkalis, so that the urine should be rendered alkaline. This combination constituted the celebrated remedies of Stephens; but even with every precaution, it may be doubted if the lime could be made to exert any real lithontriptic power.

MAGNESIA. Magnesia. (Page 340.)

THE advantage derived from lithontriptics being in a great measure confined to their neutralizing acidity in the stomach, as above explained, magnesia has been employed for this purpose as equally effectual, and as possessed of some peculiar advantage over the alkalis. From its insolubility it will remain longer in the stomach, and from this, it has been supposed, will more certainly neutralize the acid; it has accordingly been affirmed on the authority of Mr Home, that it diminishes more effectually the deposition of uric acid from the urine; and some cases have been stated by Mr Brande, in which magnesia had proved effectual, where

the alkalis previously given had failed to relieve the too abundant secretion of this acid. It has also been supposed, that even if it be taken in excess, it will not, from its insolubility, be secreted by the kidneys, and hence will be less liable than the alkalis, to cause a deposition of the urinary phosphates; and its mildness admits of its continued use. The dose in which it has been given, is from a scruple to half a drachm twice a-day. In some cases in which it was employed, in which gout was connected with gravel, the symptoms of the former disease were at the same time alleviated.

**ACIDA.** ACIDS have sometimes been employed as lithon-  
triptics. In those cases where the state of the urinary secretion is such that there is a separation of phosphate of lime, or phosphate of ammonia and magnesia, they prevent this by their solvent power; but this is comparatively rare. Where there is a too copious secretion of uric acid, they must increase it, and prove prejudicial, and in such cases accordingly they almost uniformly occasion irritation and pain. It is singular, however, that in some cases they have afforded relief, even when they caused a deposition of matter from the urine. If this consisted of phosphate of magnesia and ammonia, it might be supposed that the acid had acted on a calculus composed of this, and by its solvent power had so far weakened its aggregation, as to cause it to fall down. In some cases, however, even where relief was obtained, the sediment has been found to be uric acid; and scarcely any other supposition can be made with regard to this, to account for the relief received, than that it had formed part of a concretion, of which the phosphates had been the principal ingredients; and that the latter being dissolved

by the acid secreted with the urine, the former had been evacuated in a state of suspension. But this occurrence must be rare; and the use of acids as lithontriptics, must be in a great measure limited to those cases in which the earthy phosphates are too abundantly secreted. And in employing them even in these cases, care must always be taken to guard against the separation of uric acid by their too free or long continued use. The obvious rule is, to give the acid to that extent which shall afford relief from irritation, and remove the deposit of phosphate of lime, or the more common one of phosphate of magnesia and lime, easily recognized by its white colour, and to diminish the dose, or rather intermit the use of them, whenever any deposit of uric acid appears.

Different acids have been employed. Much relief has been obtained from some of the vegetable acids, particularly the citric acid, under the form of lemon juice, taken to the extent of half an ounce daily. The muriatic acid has been used with advantage in a dose of from 30 to 50 drops twice or thrice a-day, and the diluted nitric acid of the usual strength, in a dose of 40 drops. According to Mr Brande's observations, the vegetable acids, particularly the citric and tartaric, are less liable than the mineral acids to produce the separation of uric acid, even when they are taken in large doses for a considerable time. Carbonic acid was at one time employed, but had fallen into disuse, probably from the belief of its action being too weak to produce any lithontriptic effect. It has been found, however, that water impregnated with it, taken as common beverage, diminishes the deposition of earthy phosphates, particularly the phosphate of ammonia and magnesia, rendering the urine transparent, which had before been turbid. Where

it does so far succeed, it must be preferable to any of the other acids, both as being less likely to cause any separation of uric acid, and as having the advantage that it can be taken for any length of time without any reluctance, has no injurious effect on the stomach, and admits of being used in that irritable state of the bladder which sometimes precludes the use of the others.

BITTERS and astringents, such as *Uva Ursi*, have been found of service in calculous cases, evidently by restoring the tone of the stomach, and thus preventing the generation of acid. But they cannot be considered as Lithontriptics.