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, not unjustly, 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 sometimes combined with ammonia, and animal matter apparently albumen. With this acid, the alkalis, in their pure state, are capable of combining, forming a compound soluble in water.

It has been ascertained, 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 too have proved that either of

these alkalis 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 will be exerted on a concretion in the bladder or kidney. Unfortunately, however, the use of the alkalis 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 actually dissolved. The use of these agents in a moderate quantity, however, may prevent its increase; and, as it is often at length covered by matter deposited from the urine, by which its surface is rendered more smooth, this practice frequently alleviates 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 however thus impaired. Still the alkalis in this mild form 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 of by the kidneys, and causes the precipitation of the uric acid; the use of the mild alkalis, 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.

The administration, then, of these substances is different, according to the object of the practitioner. If he attempt the solution of the calculus, the pure alkali must be given in as large doses, and for as long a time as the patient can bear it: if he seek merely to palliate the symptoms, the continued use of moderate doses of the alkali saturated, or super-saturated with carbonic acid is sufficient, and is even preferable, as less hurtful to the stomach or general system. In both cases, it is proper that diluents should be freely used; and the pure alkali, when employed, ought always to be mixed with some mucilaginous or gelatinous fluid.

These were the views generally given 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 still farther extended our knowledge of this subject, and unfortunately preclude still more the hope of 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 have proved, that they are of very different chemical constitution, and his experiments have been 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 struc-

ture, 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 calculus is not soluble in alkaline solutions, but dissolves very easily in diluted acids: 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 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 principally 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.

Now, from these diversities, in chemical constitution,

among 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 was obtained from weak acids. There is also a peculiar source of difficulty, which has been pointed out by Mr Brande, attending the attempt to exhibit lithontriptics as solvents, which must probably render it impracticable. 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 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. Nor can we hope, by an alternate use 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, and which has also 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 render it less irritating, and 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 a little farther might prove useful, even 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. 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.

LITHONTRIPTICS.

Potassa.
Soda.
Sapo albus.
Calx.

Potassa. Potash. (Page 466.)

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 alkali 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 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 466.), 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 irritable. From half-a-pound to a pound is taken 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.

SODA. Soda. (Page 467.)

SODA, like potash, is used as a lithontriptic, seldom, however, in its pure form. 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 it may be administered, so as to give at least the advantages of a palliative, and which is less expensive than any other. It is 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 alkalies 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 it is combined with the mildest vegetable expressed oil. 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.

CALX. Lime. (Page 236.)

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.

BITTERS and astringents 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.