two grains of arsenic, is reported as having proved fatal. Hahne-mann thinks one or two grains may prove fatal in a few days. Dr. Christison agrees with this. Professor Taylor thinks two or three grains a fatal dose. On the other hand, Pereira gives a case where half an ounce was swallowed after a full meal without any effect.

In this case of mine, did not the soot exercise a very powerful, in fact a saving influence? I remember having read somewhere that a French chemist thought charcoal an effectual antidote for this poison, and took several grains at one dose without any ill effect. Orfila, in his *Toxicologie Générale*, also alludes to it, adding that other insoluble powders have the same effect, forming a coating in which the poison is enveloped. It seems to me that this adulteration of arsenic deserves some consideration and inquiry, not only in regard to medico-legal cases, but also in relation to its effect upon wheat dressings and other agricultural appliances; for if the effect of the arsenic is thus neutralised, it is a matter of some importance to the farmer.

Another question that the case seems to open up, is, can the constitution of a person be familiarised to the use of arsenic? Here this young woman for three months had been dosing herself with no inconsiderable quantity. One is naturally led to think that if she had taken smaller doses, she might have gone on with impunity. I do not believe all the absurd stories of the reputed Styrian arsenic eaters, as related in *Chambers' Journal*, nor the enchanting description of the effects of arsenic eating, given by Professor Johnston in his *Chemistry of Common Life*; but it seems warranted by the facts that certain states of the system, or certain peculiarities of constitution, do render this deadly drug occasionally almost harmless. Further experiments seem required to set this question at rest.

THE APPLICATION OF CARBONIC ACID GAS TO THE INTERIOR OF THE BLADDER.

By T. SKINNER, M.D., Liverpool.

[Concluded from page 628.]

v. *Alleged disagreeable, dangerous, and poisonous Results.* So far as disagreeableness is concerned, the application in some few cases, even the introduction of the catheter, is painful. I have marked this as being very much so in the *phosphatic* diathesis, which state ought first to be subdued or mitigated by appropriate means. There are some cases, doubtless, where the application may not suit at all: but why "ride the hobby to death"; because the means will not suit every case, why even find fault? The error lies in our own inexperience of the agent in such cases: we must improve our diagnosis as to the cases most likely to be benefited by it. Besides, in the use of this gas or of any other means, it is necessary to take everything into account—the condition of the whole system, particularly the digestive and assimilative powers; and the pathological condition of the urine, as also the state of the kidney and pelvic viscera. It is only an *auxiliary* to our therapeutics of the urinary bladder; and it is our duty, if certain conditions exist, demanding or more likely to yield to other means, that they should be adopted before having recourse to the injection of the gas. To expect that it is to work miracles, and do everything in every case, is downright absurdity.

Dr. Johns alludes to "dangerous and poisonous" results as having been observed by M. Charles Bernard, and as recorded by the latter in the *Archives Générales de Médecine*, x, pp. 529-548, referred to in the *Medical Times and Gazette* of April 10th, 1858, p. 380. M. Bernard does not mention the number of the cases in which he has tried the simple injection of carbonic acid into the *vagina*, according to Professor Simpson's method; but he says, "In all the patients, besides the local anæsthetic effect, more or less of general accidents were observed, these being usually very slight, but in one case so considerable as to compel the discontinuance of the remedy." Dr. Bernard continues: "The symptoms consisted in cephalalgia, giddiness, weakness, or confusion of vision, nausea, general lassitude, and more or less complete somnolence. . . . They entirely resembled those of incomplete asphyxia from carbonic acid gas. These symptoms are, no doubt, due to the absorption of the gas."

This is indeed an isolated case. I am sure there is no medical practitioner in the world who has prescribed the injection of carbonic acid into the vagina on such an extensive

scale as Professor Simpson. Thousands have used it, at his dictum, thrice a day; some for months at a time; and it is strange that he has never observed such formidable symptoms. I administered it to hundreds in his practice myself, and I never witnessed a single head symptom, or any symptom approaching narcotism. I have *breathed* the gas diluted myself, and have made dozens breathe it for half an hour at a time, without observing any such phenomena. I have injected the bladder with it at least one hundred times, and only once observed lethargy and drowsiness; and even in this case (No. 4) I had before, and have many times since, injected the bladder without the slightest symptom of carbonic acid or any other poisoning. The cause of the lethargy and somnolence in this case was the approach of an ordinary *cold*, which developed itself next day. I would not have noticed it, had it not been for the remarks of Dr. Johns and Dr. Bernard.

Dr. Bernard attributes the symptoms in his case to "absorption of the gas by the mucous membrane". We have good reason to believe that the pulmonary, alimentary, and vesical mucous surfaces do not absorb carbonic acid to any extent; but it is certain that the former two excrete it, or throw it off by exosmosis, in no small quantity. In the large intestines, from 40 to 70 per cent. of carbonic acid alone had been observed. In the small intestines, from 20 to 40 per cent. has been measured in cases of tympanitis, without narcotic symptoms from absorption. (Bostock's *Physiology*, vol. ii, p. 491; Magendie's *Physiologie*, tome ii, p. 85.)

The uterine mucous surface itself is subject, in disease, to secrete gases—whether carbonic acid or not, it would be difficult to say; but in physometra complicated with pregnancy, M. Leduc, in the *Dict. de Médecine*, states that he has seen, after the passage of a dead fetus, an impetuous rush of gas escape from the uterus, having a sulphureous smell, which burnt with a violet-coloured flame. (*Cyclopædia of Practical Medicine*, vol. iv, p. 383.) This was not carbonic acid, at all events; but it only corroborates what I have attempted to prove—that mucous surfaces generally do not absorb gases, but rather secrete them, and convey them out of the system, such as the carbonic acid and sulphuretted and carburetted hydrogen gases of the alimentary canal. Why the vaginal mucous surface should be the only exception, is a puzzle. Dr. Bernard may have driven the gas into the peritoneal cavity through the Fallopian tubes. This cavity would be much more likely to absorb it than a mucous surface; but such an awkward mistake is impossible by my method.

If absorption took place from the vagina, why did it occur in one case only among many thousands? If absorption was the rule, my cases had ample opportunity, having nine hours to absorb four ounces; whereas, in Drs. Johns's and Bernard's cases, I suppose fifteen minutes is the very utmost allowed. I had a case of a lady, a few days ago, Mrs. W., aged 23, who retained the gas all night and a considerable portion of the day before—say sixteen hours—during which time she passed urine only thrice: very little of the gas ever came away, most likely owing to its absorption by the urine.* In this case there was no narcotism, nor any bad symptom whatever. This lady labours under chronic inflammation of the cervix uteri, with ulceration of its cavity, and is being treated for the same. She had not been able to retain her urine for fifteen minutes or half an hour, sometimes not even for five minutes, for many months. I saw the patient again yesterday; and she informed me that, since the *single* injection, she has been a new being. Last night she had only to rise once, and during the day she had passed urine only three or four times at the most. Before the injection, she never could go out for a walk without requiring to go into a house every fifteen minutes or so. To-day, when I called, she had been out taking a long walk, and actually crossed the Mersey in a steamboat, occupying fully two hours and more, and never had the slightest call to micturate; and she had not had a call since 8 A.M.: it was

* In proof of the urine being the medium of absorption, I tried the following simple experiment. I got from a toy-shop an air-ball of India-rubber, fixed it to the end of D of my apparatus, and injected into its interior six ounces of fresh healthy urine. I then added four ounces of carbonic acid, shut the stop-cock, and immersed the whole in water kept at the temperature of 90° Fahr. or thereabout, now and again giving it a gentle agitation, to imitate the movements of the body. Within three hours, three ounces of the gas were absorbed by the urine, and not by the caoutchouc. This latter material is necessary by its elasticity to resemble the mechanism of the pressure afforded by the resistance of the muscular coats of the bladder, which pressure, I have no doubt, favours greatly the absorption of the gas. I do not think the gas is usually absorbed so rapidly as shown by this experiment; my anxiety for its success must have tempted me to agitate too much and too often. In itself, the fact of the absorption of the gas by the urine, militates against its absorption in poisonous doses by the mucous membrane.

now 1 p.m. In this case, its specific action is very manifest, however temporary the effect.*

I think I have said sufficient to prove the falsity of the fear entertained of any dangerous or poisonous result—at least, so far as my method is concerned.

VI. *Concluding Remarks.* I would not have it understood that I attribute every good which resulted, in the few cases I have given, to the simple injection of carbonic acid gas into the bladder. As I have said before, I look upon it only in the light of an *auxiliary*; and I do not believe we have an agent so powerful and so universally efficient and safe in such an intractable class of complaints as we have in this gas, used as I have described. I am well aware that many observations are still to be made regarding it in such cases. I would suggest the trial of it in spasmodic or irritable stricture in the male. Doubtless, if a catheter could pass the stricture, there would be no use in injecting the gas; but might not a little of the gas be injected into the urethra, with or without chloroform, by means of my instrument, and retained there, so as to allay the morbid irritability of the mucous and muscular tissues in front of the stricture? Some might possibly pass through it; and, when it had become dilatable, a small catheter might be passed, and the bladder injected. According to Abernethy's surgery of irritable surfaces, this would be put down as bad surgery; but, in his day, the use of carbonic acid gas as a local anæsthetic was unknown.

Again, I was led to the following subject by some observations I made while examining the urine of Case iv. I examined the urine passed *immediately before* the injection of the gas on two separate occasions, and I also examined the urine passed *immediately after* the injection on each of the same occasions (an interval of three hours having elapsed, the gas being retained, and no meal, medicine, or exercise being taken). All the examinations were made twenty-four hours after the water was passed, to allow any sediment to fall. The following brief analysis will show my point:

1. *Immediately before the Injection.* Specific gravity 1024; highly acid; clear straw colour; slight cloud of mucus, entangling large rhombic and other crystals of uric acid in great abundance; otherwise normal.

2. *Immediately after the Injection.* Specific gravity 1024; highly acid; hazy orange colour; thick cloud of mucus occupying a quarter of the bulk of the urine, with a copious admixture of urate of ammonia and epithelial scales, one or two crystals of oxalate of lime, but not a single crystal of uric acid; otherwise normal.

I only give one analysis of each, as the other was almost identical with the above.

Can the free carbonic acid so affect the urea or uric acid in solution in the bladder as to cause it to be precipitated as urate of ammonia when discharged from the organ? I would, *a priori*, have expected the uric acid precipitated from its solution, unless temperature and other causes modified this result. I feel myself not chemist enough to solve this difficulty; but, having twice observed the same phenomenon before and after injecting the gas in a patient with a marked lithic acid diathesis, I thought, if it was corroborated by future observations, the injection of the gas into the bladder might be used as an *auxiliary* in the litholysis, or a prophylactic in the treatment of uric acid, as well as of phosphatic calculi. It is a remarkable fact in connexion with this subject, that most of our solvents of calculi contain excess of carbonic acid gas, as is the case with the waters of Vichy (*grande grille*), Seltzer, Pyrmont, Carlsbad, etc.; and most of our artificial solvents, such as a solution of the bicarbonate of soda, saturated with carbonic acid gas, owe their efficiency in the phosphatic diathesis to this gas, and in the lithic acid to the alkali.

Whatever may be said about the solvent or decomposing (?) power of carbonic acid gas, in regard to uric acid calculi, there can be no doubt of its use in the phosphatic. Dr. Druitt says of the action of carbonic acid on phosphatic calculi, it acts "by disintegrating the animal matter which connects them together". (*Surgeon's Vade Mecum*, 6th edit., p. 547.) Dr. Willis, in his excellent article "Calculi", in the *Cyclopædia of Surgery*, p. 571, says: "The earthy phosphates, and especially the phosphate of lime, are only held in solution by virtue of the excess of acid with which they are combined, or in consequence of the presence of some other free acid in the urine, which can in many cases be demonstrated to be the carbonic. The neutral phosphate of lime is a salt to all intents and pur-

poses insoluble. Phosphate of magnesia, another urinous salt, is not very soluble, requiring at least fifty times its weight of water to take it up. Phosphate of ammonia, indeed, is soluble enough by itself; but in combination with the phosphate of magnesia, as it always exists in urine, it becomes exceedingly insoluble. A slight excess of phosphoric acid, and, as it would appear, the presence of carbonic acid in some cases, put an end to the insoluble character of these salts; as superphosphates or carbophosphates, they become readily soluble, and are safely carried out of the system." Those who have more to do with calculi than I have would do well to investigate this point, the more so now that a method of injecting the bladder is known, and of retaining it pure for almost any length of time, and with perfect safety.

VII. *Summary.* 1. In most painful affections of the pelvic organs, arising from nervous, sympathetic, or organic causes, carbonic acid exerts an anæsthetic and sedative effect, particularly when injected into and retained in the bladder.

2. In most forms of incontinence of urine, in the male or female, it is temporarily or permanently a specific.

3. According to the method I have described, there is no danger of over-distension of the bladder, or of narcotic poisoning by absorption or otherwise.

4. In *acute* inflammatory conditions, it is likely to aggravate the symptoms; in *chronic* states, it is the desideratum; hæmorrhage and pus being no obstacles to its employment; in which condition, previously washing out the viscus is advantageous.

5. The frequency of its repetition must be guided by circumstances; it has been injected three times a day in some few cases with safety; twice a day more frequently with equal safety; often once a day, or once in two or three days, according to circumstances and the nature of the case.

6. In some very irritable states of the bladder, it is well to dilute it with more or less of atmospheric air, and regulate the time of retention and repetition.

7. Where it agrees, the patient ought to be made to retain it as long as possible, *passing the urine* when necessary, but *retaining the gas*. If debility or lassitude are caused by its presence in the bladder, it ought to be expelled.

8. The state of the kidneys and urine, and the digestive and assimilative organs, should be attended to, as also the condition of the pelvic viscera.

9. It promises well as a chemical litholite in the solution of phosphatic calculi, and may also prove useful in uric acid and other calculi.

10. In irritable bladder and spasmodic stricture in the male, it may be found useful; it only requires a trial.

ON SIMPLE BOILS.

By JOHN WATSON, M.D., Southampton.

THE subject I am about to offer some remarks upon is generally consigned by the active practitioner to milk of sulphur and old women; and when he is called on to treat it seriously, from want of fixed principles to guide him, he seldom has cause for any great satisfaction at the result. At all events, I would say thus much of myself, without presuming to speak of others. To keep in due form, I will introduce the matter as presented in the following case.

A. B., aged 41, of spare bilious habit, having undergone much business anxiety, and living in the country, became attacked with boils in October last; but as they were solitary, occurring at intervals of a week or two, he sought no medical treatment.

In January of the present year, from their numbers increasing, and his appearance and feelings indicating a state of general debility, he placed himself under my care. He took steel with quinine, an occasional aperient, and was recommended generous diet, with bitter beer (having previously been a teetotaler), and free exercise in the open air. After a little perseverance in this plan, he recovered, and remained well for about two months. At the end of this period, however, he found other boils making their appearance on his hip and thigh, having had upwards of thirty since the time first mentioned. Each boil generally commenced as an itching *papule* in some portion of the skin, which gradually passed through the *pustular* and *tubercular* stages, till it ripened into the usual form of an exquisitely painful *abscess*, with a central slough of skin and areolar tissue. As soon as this slough was cast off, the abscess quickly healed, and the *papule* re-appeared elsewhere, often in the precisely corresponding part on the oppo-

* This was written about July 27th. On August 16th, the printed proof was revised; and I have to note that the enuresis in this lady's case remains successfully cured.