ON
ALKALESCENCE OF THE URINE
FROM
FIXED ALKALI
IN SOME CASES OF
DISEASE OF THE STOMACH.

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IN the 'Philosophical Transactions' for 1845, I stated that the urine was occasionally alkaline from fixed alkali, and I contrasted this state with the alkalescence of the urine from volatile alkali.

Afterwards, when I was examining more closely the variations of the acidity of the urine in health, I found that this state of alkalescence from fixed alkali was not unfrequently observable during the time when digestion was taking place. (Phil. Trans., 1849.) Hence I concluded that alkalescence of the urine from fixed alkali was not caused by any disease of the urinary organs, but depended only on some slight disorder of the stomach. I have since frequently examined the urine of patients suffering from slight indigestion, and who were passing oxalate of lime; and not unfrequently in such cases the urine has made red test-paper permanently blue when dry; but with one or two exceptions this reaction was very transitory, though frequently recurring. One patient in whom this kind of alkalescence was daily known to be present, was a medical man, whose occupation prevented me from tracing the variations of the urine, and

from watching the state of the digestion as I wished. Very lately in two most marked cases of disease in which *sarcinæ ventriculi* were found in the vomited matter, this alkalescence of the urine from fixed alkali has occurred to me in St. George's Hospital; and as they confirm the view which I have taken regarding the influence of the stomach in causing this state of urine, they may be worthy of the attention of the Medical and Chirurgical Society.

David M—, æt. 46, a stout, well made, ruddy faced Welsh farmer, was admitted, October 1st, 1851, into St. George's Hospital.

He says that fifteen years ago after a cold, he first had slight pain in the stomach, which usually came on about 11 o'clock in the forenoon; medical treatment relieved him in about a fortnight. Three months afterwards, in the autumn, the pain returned. Still without any vomiting. For many years he was subject to the same kind of attacks every two or three months. About five years since he first suffered from vomiting as well as pain; still with intervals in which he was tolerably well. For the last eighteen months, however, he has had constant pain in the abdomen, with a sensation of heat and pain along the œsophagus, with almost daily vomiting.

His bowels are always costive, and when they are open he is always better.

He says that the longest interval of freedom from the sickness was seven weeks, and that was whilst drinking some waters in Wales, during which time his bowels acted regularly. Tongue white, furred. Pulse quiet, 56. Complains of frequently feeling cold. In other respects he is quite well, able to take good exercise, and is not at all emaciated.

October 1st. Broth diet.

3d. The bowels were open. The total quantity of urine passed was acid to test-paper. He had much sickness in the night, accompanied with much flatulence. The vomited matter was not frothy, but of a dirty colour, of a yeasty odour, and highly acid. *Torulæ* and *sarcinæ* were easily found on examination by the microscope. He complained

of thirst. Bismuthi Trisnit., gr. x, t. d. The broth diet was changed for roast slice and beef-tea.

4th. Vomited at 11 p.m. last night, and suffered much from flatus in the night. The fluid thrown off the stomach was about three pints, more yeasty in appearance, contained more sarcinæ, and was intensely acid.

The urine was passed into separate vessels each time of making water. The vessels were marked 1, 2, 3, 4, 5.

1. Passed early in the evening before vomiting. Acid contained a plentiful deposit of the urates.

2. Passed later in the evening before he vomited, was lighter in colour, and without any sediment. It was also acid.

3. Passed at 11 p.m. directly after vomiting, was cloudy from deposit of phosphate of lime, and triple phosphate in small quantity. The surface was iridescent. Blue test-paper remained blue on drying. Red paper was turned blue, and remained blue when dry.

4. Passed at 1 a.m., rather less alkaline, iridescent, cloudy from phosphates.

5. Passed before breakfast; much less alkaline, clear, and without sediment.

The usual hours of taking food were — breakfast at 7 a.m.; dinner at noon; tea at 4 p.m.; gruel at 7 p.m. Bread was often eaten at other hours during the night and day.

5th. Bowels not open. Vomited at 7 a.m. with the usual pain, which is relieved by the sickness.

Urine passed at 8 p.m. last night, acid to test-paper.

„ 12 midnight, acid.

„ 3½ a.m. acid.

„ 7 a.m. alkaline.

„ 10½ a.m. alkaline.

6th. Tongue white and coated. Bowels well open. No vomiting, and very little pain.

Urine passed at 9 p.m. neutral to test-paper.

„ 2 a.m. alkaline.

„ 6 a.m. very alkaline.

Urine passed at 8 a.m. very alkaline.

„ 10 a.m. acid.

„ 12 more acid.

7th. Vomited at midnight about four pints of intensely acid, yeasty matter; was very much troubled with flatus during the afternoon of yesterday.

Urine passed at 8 p.m. acid.

„ 12 p.m. alkaline.

„ 7 a.m. alkaline.

„ 9 a.m. alkaline.

„ 10-15 a.m. alkaline.

„ 2-15 p.m. slightly acid.

8th. Vomited twice; once at midnight and again at 5½ a.m. Had more pain and flatulence last night. Bowels not open since the 5th.

Urine passed at 9 p.m. acid.

„ 12 p.m. acid.

„ 5 a.m. alkaline.

„ 7 a.m. alkaline.

„ 9 a.m. alkaline.

„ 1 p.m. alkaline.

Sodæ Sulphitis, gr. xx; Aquæ, ℥iiss, bis die sumend.

Repetatur enema commune. Milk, one pint.

9th. Vomited about half an hour after midnight. Had much pain and flatulence. Bowels open.

Urine passed at 8 p.m. acid.

„ 12½ acid.

„ 7 a.m. alkaline.

„ 9 a.m. alkaline.

„ 11½ a.m. alkaline.

10th. Has had no sickness or pain. Says that after taking the mixture he has great eructation. Feels much better.

Urine passed at 9½ p.m. acid.

„ 5 a.m. acid.

„ 6 a.m. alkaline.

„ 8½ a.m. alkaline.

„ 11½ a.m. acid.

11th. Had no return of the sickness, but a good deal of pain at the pit of the stomach. Bowels not open since the 8th. Tongue cleaner than on admission.

Urine passed at 4½ p.m. slightly alkaline.

„ 8½ p.m. acid.
 „ 1½ a.m. acid.
 „ 3½ a.m. acid.
 „ 6 a.m. acid.
 „ 8½ a.m. acid.
 „ 10½ a.m. acid.
 „ 11½ a.m. acid.
 „ 1½ p.m. acid.

Ext. Col. c., gr. x, primo mane quotidie.

12th. Vomited about one pint of yeasty, sour matter, containing *sarcinæ*, at 4 a.m. The pain in the stomach was not so much as usual.

Water passed at 5 p.m. alkaline.

„ 7½ p.m. alkaline.
 „ 9 p.m. acid.
 „ 1½ a.m. acid.
 „ 4 a.m. alkaline.
 „ 6 a.m. alkaline.
 „ 8½ a.m. slightly acid.
 „ 11½ a.m. quite acid.

13th. No sickness, no pain. Tongue scarcely furred. Feels much easier in the stomach.

Water passed at 7½ p.m. slightly alkaline.

„ 1 a.m. slightly acid.
 „ 4 a.m. more acid.
 „ 5 a.m. acid.
 „ 7 a.m. acid.
 „ 9 a.m. acid.
 „ 11½ a.m. more acid.

14th. Had more pain and sickness last night. Vomited three times, at 2, 4, 7, a.m.; the first time very little; the two following about a pint each time. Bowels open.

Water passed at 5 p.m. alkaline.

„ 7 p.m. acid.
 „ 10 p.m. acid.

Water passed at 2 a.m. acid.

„ 7 a.m. acid.

„ 9 a.m. alkaline.

„ 12 alkaline.

P. in med., meridie, vespere, nocteque.

15th. No sickness. Bowels open. Slept better.

Water passed at 8 p.m. alkaline.

„ 5 a.m. alkaline.

„ 7 a.m. very slightly acid.

„ 9 a.m. slightly acid.

„ 11 a.m. acid.

16th. No sickness; no pain. Bowels well open.

Water passed at 9 p.m. acid.

„ 2 a.m. acid.

„ 7 a.m. acid.

„ 9 a.m. acid.

„ noon acid.

17th. Vomited about a pint of very yeasty substance at 2½ a.m.

Water passed at 4 p.m. acid.

„ 2 a.m. acid.

„ 7 a.m. alkaline.

„ 9 a.m. alkaline.

„ 1 p.m. acid.

Augeatur dosis Sodæ sulphitis ad 3ss.

18th. No sickness.

Water passed at 9 p.m. acid.

„ 1½ a.m. acid.

„ 6½ a.m. acid.

„ 8½ a.m. acid.

Extra bread.

19th. No sickness. Feels much more easy. Bowels not open. The urine was acid each time it was examined.

20th. No sickness. Urine was acid each time examined.

21st. No sickness, but he suffered from a great deal of pain and fulness of the stomach in the evening.

Water passed at 9 p.m. alkaline.

„ 4 a.m. slightly acid.

„ 6 a.m. acid.

„ 10½ a.m. acid.

22d. No sickness. The urine, each time it was examined, was acid. Complains of slight cedema of the legs.

23d. Has had no sickness and no pain.

Water passed at 9 p.m. alkaline.

„ 2 a.m. acid.

„ 7 a.m. acid.

„ 9 a.m. acid.

„ 12 a.m. alkaline.

„ 2 p.m. alkaline.

24th. Last evening he had a great deal of pain, and vomited about midnight a pint of the same acid yeasty matter as heretofore. Bowels not open.

Water passed at 9 p.m. alkaline.

„ 12 p.m. acid.

„ 7 a.m. acid.

„ 9 a.m. alkaline.

Pil. Cambog., Ext. Colocy. Co. āā, gr. v, primo mane quotidie. Extra roast slice. Ordinary bread.

25th. No sickness. Passed much water. No pain.

Water passed at 9 p.m. alkaline.

„ 4 a.m. acid.

„ 7 a.m. acid.

„ 10 a.m. neutral.

26th. No sickness and no pain.

Water passed at 9 p.m. alkaline.

„ 12 p.m. acid.

„ 5 a.m. acid.

„ 7 a.m. more acid.

„ 9 a.m. most acid.

27th. No sickness. No pain. Bowels not open.

Five specimens examined, passed from 9 p.m. to 1 p.m. : the first was slightly acid ; the others increasingly acid until 1 p.m. this day, when the urine was very acid.

28th. No sickness. Bowels not open.

The urine was acid each time it was examined ; light coloured, and very clear.

He went home, at his own request, relieved.

Richard H—, æt. 38, carter. A stout and ruddy Welchman. Admitted June 6th, 1850; York Ward. For many years was in the habit of drinking beer to excess, sometimes being drunk for a whole month. About six years ago he became a steady man. He first felt uneasiness in his stomach about fifteen years ago, at times amounting to severe pain. Vomiting did not occur oftener than once a month. Says that he always felt worse in the spring of the year, and better in the winter. The intervals at which the vomiting recurred became gradually shorter, and the amount of fluid ejected increased in quantity. For the last fourteen months the amount of fluid vomited has been excessive, often two or three quarts, and of almost daily occurrence; but until last winter he has been free from sickness for two months at a time, during which he had no pain or uneasiness of the stomach.

Usually he feels comparatively well in the morning; about two or three in the afternoon his abdomen begins to be distended, and a rumbling sound may be heard in the bowels; this increases until eight or ten in the evening, when he ejects an intensely acid fluid, which has a frothy head like yeast. After this he feels well, eats with appetite, and feels comfortable until the following afternoon.

On admission he complained of severe pain in the left side and epigastrium, and of great constipation of the bowels. No tumour could be felt in the abdomen.

At first only Ext. Colocy. Comp., gr. x, omni nocte, were ordered. He was given ordinary diet, without beer or potatoes.

The vomiting usually occurred between nine and twelve at night, and not unfrequently he vomited in the forenoon as well as at night. Sarcinæ and torulæ were always present in the matter vomited, and in the fæces.

On the 17th of June attention was directed to the state of the urine. He had vomited at 8 a.m. and at 1½ p.m. The urine, examined at 2 p.m., was found to be highly alkaline. Blue paper remained blue when it was dried; red test paper became blue, and remained so when dry.

June 18th. Vomited at 11 p.m. last night and 8 a.m. this morning.

Urine passed at 7 p.m. last night was alkaline from fixed alkali.

„ 3 a.m. this morning alkaline, and contains a phosphatic deposit; crystals of triple phosphate can be found.
No trace of mucus or pus.

June 19th. Has not vomited.

Urine passed yesterday at 5 p.m. alkaline, pale, clear.

„ „ 8 p.m. alkaline.

„ to-day 6 a.m. alkaline.

„ „ 2 p.m. alkaline.

20th. Vomited at 5 a.m. and 1 p.m.

Urine passed at 5 a.m. alkaline.

21st. Vomited at 4 a.m., 11 a.m., and 1½ p.m.

Urine passed at 4 a.m. }
„ 1 p.m. } alkaline.
„ 6 p.m. }

22d. Vomited at 1 p.m. and at 7 p.m.

Urine passed at 6 a.m. alkaline.

„ midday, slightly acid.

24th. Vomited at 7 a.m. and 11 p.m.

Urine passed at 8 a.m. slightly acid. Specific gravity 1030.

The last vomiting was much more than usual, and perfectly black from sulphuret of bismuth, formed from nitrate of bismuth, of which he was taking a scruple thrice daily.

25th. Says that he felt much worse the whole of yesterday, but that he has been much relieved by the vomiting. Complains of hunger.

Urine passed at 7 a.m. and 11 p.m. highly alkaline. Specific gravity, 1030. Vomited at 11 p.m.

29th. Urine passed at—

2 a.m. alkaline.

1 p.m. acid.

Vomited at 11 p.m.

30th. Vomited at 10 a.m.; fluid, very black.

July 2d. Has not been sick since the 30th.

Urine passed at 8 p.m. yesterday is more acid than any hitherto observed; crystals of uric acid and urate of ammonia granules were seen in it.

Urine passed at 5 a.m. very slightly acid.

Vomited at 2 p.m.

3d. Has passed a very bad night, from pain in the epigastrium.

Vomited last night at 6 p.m.

„ this morning at 3 a.m.

„ 12

„ 1½ p.m.

Urine passed at 2 p.m. alkaline.

He remained in the house until the 19th of August, when he returned to Wales without relief.

These two cases are very far from showing those hourly variations of the acidity of the urine which, in a more healthy state of the stomach, may be proved to depend on the state of digestion: the disease of the stomach leads to a most convincing proof of the influence of the acidity of the stomach on the reaction of the urine. When an excessive quantity of acid fluid was thrown out of the stomach, an alkaline state of the urine was produced. When most acid was ejected from the stomach, the urine was then most alkaline; and the alkalescence of the urine was lessened or was made to disappear when the vomiting was stopped.

The disease of the stomach which existed in these cases most certainly retarded the absorption of the digested food, probably by preventing it from passing out of the pylorus; and, judging from the variations of the state of the urine, it appears to me to be very probable that, in these cases, the secretion of gastric juice did not so immediately follow the taking of food as it does in the state of health.

The slow absorption of the acid and the sluggish secretion of it may be the causes that hindered the immediate effect of food on the variations of the acidity of the urine from being apparent. Moreover, these lesser variations may be partly lost in the greater effect produced by the removal of pints of acid fluid from the stomach.

However, the broad outline of the two cases is too marked

to be overlooked. In the first, when there was vomiting of acid fluid twice a day, the urine was frequently alkaline from fixed alkali; when the vomiting became of rare occurrence, the urine was generally acid, rarely alkaline. In the second case, in which the vomiting occurred three or even four times daily, the urine was almost constantly alkaline from fixed alkali.

That the occurrence of *sarcinæ* in the fluid vomited has no direct relation to the alkalescence of the urine, may be shown—1st, by the occurrence of constant acidity of the urine in other cases in which *sarcinæ* were vomited; and, 2dly, by the occurrence of alkalescent urine when the vomited matter was perfectly free from *sarcinæ*.

1st. In much slighter cases of the disease of the stomach in which *sarcinæ ventriculi* occur, no alkalescence of the urine may be detectable; of this the following case may be taken as an example:

M. de M—, æt. 42, admitted January 22d, 1851; York Ward. Has been out of health about three years, but during the last three or four months he has been suffering every evening, about seven or eight o'clock, from sickness, and a quantity of sour water, mixed sometimes with matter like yeast, was brought up. He does not think his food is vomited. During the last four months he has wasted much. His face is thin and wasted; his tongue is excessively coated; his pulse is feeble and quiet; there is great resistance over the abdomen, and the superficial veins are large. He was ordered—

Bismuth. Trisnitr., gr. x, ter die.
Acid. Hydrocyan. dil., Ph. L., ℥ vj;
Sodæ Carb., ʒss;
Aquæ, ʒij. Urgente vomitu.

25th. He was sick twice during the night; the matter brought up was very acid, and somewhat resembled yeast in smell and appearance; *sarcinæ* were discovered without any difficulty. Magnesiæ, ʒss, omni mane.

26th. Tongue quite clean; pulse small, very soft; appetite good; urine plentiful, acid.

27th. Bowels have acted three times. Urine healthy.

Feb. 3d. He has been rather sick the last two nights. The first night the draught stopped the sickness, but last night it had no effect, and he vomited a small quantity of thin watery fluid, in which I could not find any sarcinæ. Bowels relaxed; pulse quiet; no pain.

7th. Bowels rather confined; no sickness; sleeps well; appetite good; tongue clean; pulse quiet; urine very free, pale, acid.

8th. Went out relieved.

11dly. Urine may be alkaline from fixed alkali, in cases in which the matter vomited is perfectly free from sarcinæ.

Ann P—, æt. 39; married, and has had nine children. Admitted, under Dr. Wilson, October 8th, 1851; Queen's Ward.

Cachectic look, sallow complexion, face thin and emaciated; pulse very rapid and exceedingly feeble; breathing very hurried; tongue rather pale, clean; abdomen soft; muscles not over resistant; no tumour to be felt in the abdomen.

For three years she has been subject to sickness, which has been more or less constant the last five months. Within the last two months the vomiting has become much more distressing and more frequent; and at times she has likewise had severe pain in the epigastric region, and also in the left hypochondrium and back; occasionally there is a large swelling in the left hypogastric region; distension of the stomach, from flatus, probably.

Latterly she has become very much thinner, and likewise weaker. She has a very good appetite; but vomiting occurs in about four or five minutes after taking any food whatever, whether liquid or solid. She does not feel thirsty. The bowels are open, the motions solid and large. The urine free, and of natural colour. Sleeps badly. Catamenia regular, pale, and offensive. She states that the vomited matter is dark, and like coffee-grounds.

9th. No sarcinæ to be found in the matter which she

vomits. It is not, and she says never has been, yeasty. Two scruples of sulphite of soda were ordered thrice daily.

12th. Not the least improvement.

15th. No sarcinæ to be found in the vomited matter.

Nov. 2d. Has had a good deal of pain in the abdomen all night. Feels relieved by an injection which was given this morning. The sickness much the same: the matter vomited is not yeasty, contains no sarcinæ, is more fluid, and does not smell sour.

3d. Severe pain in the abdomen last night, but is much better now. She has been very sick; the vomiting began at 5 p.m. yesterday, after some coffee, and since then she has been sick very often. The matter ejected is highly acid.

The urine passed at 4 p.m. yesterday is alkaline, and red test paper remains blue when dry.

„ 7 p.m. „ is alkaline; on the surface there is a pellicle of phosphate of lime in plates and no prismatic crystals of phosphate of ammonia and magnesia.

„ 7 a.m. to-day is alkaline with the same iridescent pellicle.

4th. She is much more cheerful and lively this morning, and says she is better. No pain in the abdomen; much less sickness; no headache; pulse very feeble; tongue clean; very pale; breathing short when she speaks. Vomited at 4 p.m. yesterday, and often since; matter ejected thin, and highly acid.

Urine passed at 8 p.m. yesterday, alkaline, dark colour, with phosphate of lime on surface.

„ 12 p.m. „ alkaline, pale colour, slight pellicle.

„ 7 a.m. to-day, alkaline, no pellicle.

5th. Much pain in the abdomen, with sickness, which began at 4 p.m. yesterday, and it has been very frequent since. The matter vomited is highly acid.

Urine passed at 3 p.m. yesterday, alkaline.

„ 8 p.m. „ alkaline.

„ 12 „ alkaline.

„ 8 a.m. „ alkaline.

Scarcely any iridescent pellicle on any of these specimens.

6th. Sickness not at all less. Pulse small and feeble. She has been so sick "she cannot say when it began and when it ended." Some bottled stout ordered.

Urine passed at 1 p.m. yesterday, alkaline.

" 4 p.m. " alkaline.

" 12 " acid.

" 9 a.m. " alkaline.

7th. Has not been sick since she had the stout at 12 midday yesterday; is more cheerful; bowels open; sleeps well; pulse very feeble; occasional pain in the abdomen.

Urine passed at 1 p.m. yesterday, acid.

" 5 p.m. " alkaline.

" 8 p.m. " acid.

" 7 a.m. " feebly acid.

9th. Has had a return of sickness, at 5 p.m. yesterday, after tea.

Urine passed at 4 p.m. yesterday, alkaline.

" 7 p.m. " alkaline.

" 5 a.m. to-day, acid.

" 7 a.m. " acid.

" 12½ " very feebly acid.

10th. Feels great weakness. Has occasional paroxysms of pain in the abdomen. Pulse exceedingly feeble. Was sick all yesterday, and also very frequently during the night. Feels very thirsty, and anything she takes instantly makes her sick; as soon as she took breakfast this morning was sick; the matter vomited was highly acid.

Urine passed at 4 p.m. yesterday, alkaline.

" 8 p.m. " alkaline.

" 2 a.m. to-day, alkaline.

" 9 a.m. " alkaline.

" 2½ p.m. " alkaline.

" 4 p.m. " alkaline.

" 7 p.m. " alkaline.

On examination after death, which occurred in a few days, excessive thickening and ulceration of the pylorus was found to exist.

In conclusion, the practical point of my Paper is this:

If the stomach does so directly influence the reaction of the urine as to cause it to be alkaline at one hour and over acid at another hour of the same day, then the prescription of acid or alkaline medicines must never be made to depend on the reaction of the urine passed at any one period of the day; for at one hour acids may appear to be indicated, and at another alkalies. Moreover, if acids be given to correct the alkalescence of the urine at one hour, they will increase the acidity of the urine which will be passed when digestion is completed; whilst, if alkalies are given to correct the increased acidity after digestion, the urine will become more alkaline during the period of digestion. Hence, the reaction of the total quantity of urine passed in 24 hours ought to determine the prescription of acids or alkalies, when their chemical action on the urine is required; whilst the hourly variations, if excessive, must be controlled by directing our remedies to the stomach, and not to the kidneys.

I cannot finish this paper without expressing my thanks to Dr. Jenner for his suggestion and example in the use of the sulphite of soda, which enabled the patient, whose case I first related, to leave St. George's Hospital, saying that he was better than he had been for eighteen months.