A Lecture

ON

THE INTENSIVE ALKALINE TREATMENT OF GASTRIC AND DUODENAL ULCER.

DELIVERED TO THE KENT BRANCH OF THE BRITISH MEDICAL ASSOCIATION

BY

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To the general practitioner the treatment of gastric and duodenal ulceration has always bristled with difficulties. Patients suffering from these lesions are frequently encountered in general medical practice, and very often the results of medical treatment are unsatisfactory. If relief does not come within a short time the patient is generally handed over to the surgeon, since it is considered that, on the whole, medical treatment in these cases is not very efficacious. Surgical intervention is not infrequently productive of excellent results; on the other hand, the last state of the patient may be worse than the first, and though surgery has many successes to its credit in this field it has also many failures. Different views are held as to the exact indications for surgical treatment, but the appearance of a well-marked niche or so-called "penetrating" ulcer in the radiogram is often accepted as evidence that the condition is not likely to be benefited by medical treatment, and so operation follows. In many cases operation is quite unnecessary, for excellent results may usually be obtained by simple medical means which can be quite easily carried out by any medical practitioner with little or no inconvenience to the patient. This can be done by the use of intensive alkaline treatment. Before describing this treatment in detail it is necessary to make a few preliminary observations.

THE USE OF ALKALIS IN STOMACH LESIONS.

For a very long time indeed alkalis have been used by almost every medical practitioner in the treatment of gastric conditions. That these substances have a very marked action in relieving distressing gastric symptoms is known to all. How they produce this effect is a matter for discussion, and opinion on this point is not unanimous. According to some observers this action is an indirect one, while others take the view that it is due to the antacid properties of these bodies. Personally, I have little doubt that the latter view is the correct one. If the action were an indirect one after absorption it is impossible to imagine that relief from symptoms would follow so quickly after ingestion as is usually the case.

Although almost every medical man has recognized the value of alkalis for many years it is somewhat strange that this fact has not resulted in a more intensive use of alkali treatment. Though undoubted benefit was derived from small doses of these bodies it was recognized that this benefit was usually but a temporary one, and that very often symptoms recurred after a short time. Assuming that alkali produces these good effects by neutralizing the hydrochloric acid of the gastric juice, it is a matter for wonder that more physicians did not push the treatment to its ultimate conclusion and give sufficient alkali, not only to neutralize the acid temporarily, but to do so for long periods. Logically, this would be the most likely means to cure an ulcer, and I will try to convince you that this statement is correct. It is quite true that several medical men did give large doses of alkali, but to Sippy¹ belongs the credit of first pointing out that an ulcer could usually be cured by giving sufficient alkali to keep the stomach alkaline for several days or weeks. Though Hurst,² in a very interesting paper, published an account of Sippy's method, it does not appear to have been taken up with any enthusiasm in this country. Perhaps this was due to the fact that Sippy's directions were somewhat elaborate. In spite of certain alarming statements as to the danger of the treatment it is, in ordinary circumstances, perfectly safe. For five years my colleagues and I have used a

simple modification of the method with most excellent results. Altogether over 350 patients have been treated without any untoward symptoms. Indeed, I have not been able to find a single case of any toxic effects when our modification was carried out. The method is now in use by many of the staff of St. Thomas's Hospital and by many of our recent graduates, yet I have found no one who has had the slightest difficulty with the treatment. In our experience there is no method that gives such excellent results in a short time. It is simple, requires no special knowledge or supervision, and can be carried out at the patient's home, however humble his circumstances.

EXPERIENCES WITH INTENSIVE ALKALINE TREATMENT.

Personally, I have always been interested in the physiology and pathology of gastric secretion, and very many years ago had frequently given large doses of sodium bicarbonate and other "alkalis" in cases of severe dyspepsia. In 1920, when I was put in charge of beds at St. Thomas's Hospital, we began to test various methods of treatment for gastro-duodenal ulceration, and among these methods was the use of large doses of alkali. This continued until 1923, when it appeared to us that the results with alkali were very much better than those afforded by other means. In 1923 the majority of our gastric cases were treated by the intensive alkali method, with such excellent results that since 1924 the method has been used as a routine one. The results have been gratifying in the extreme, and far better than we had hoped for. Uncomplicated ulcers clear up in a short time, as indicated by x rays, and in the great majority of cases all the symptoms disappear quickly. Often large "penetrating" ulcers clear up in a few weeks. So far we have not had a single instance of an ulcer recurring at the site at which it was formerly present as indicated by radiograms. Our operation list has gradually diminished, and for the last year not a single case out of over 70 treated has required operation. Even in patients suffering from pyloric stenosis an operation can often be avoided by the use of alkali treatment. For the last year we have had only one patient readmitted to the wards after he had undergone treatment. These results are altogether better than any we have had by other means, and seem to us to indicate that in the judicious use of alkali we have a method that will cure the average case of uncomplicated duodenal or gastric ulcer.

In my monograph³ on gastric diseases published in 1925 I pointed out the great value of this method of treatment, and further experience has more and more impressed me with its value. At the beginning of this year my colleagues and I published a paper⁴ showing a number of radiograms illustrating the excellent effects obtained by this treatment. This article elicited a certain amount of criticism which had to a large extent but little bearing on the facts, but nothing helpful transpired. Apparently, however, if we may judge from the mass of correspondence received from medical practitioners, this article has served to stimulate interest in the method. For some years I have described the alkaline treatment at various meetings of medical men, and invariably, so far as I know, those who have tried it have had good results. We hope to publish a detailed account of our medical unit results at an early date, but, so far, the conclusion we have arrived at is to the effect that the method will cure the ordinary case of gastro-duodenal ulceration. Patients with adhesions and other complications are probably not suitable cases, but we have some evidence which may suggest that even cases with adhesions to sundry organs may do quite well. On this point, however, we are not certain at present. We have so few failures that on general averages some of our successes probably had complications.

THE RATIONALE OF INTENSIVE ALKALINE TREATMENT.

In nearly every case of severe dyspepsia and ulceration hydrochloric acid is present in the stomach secretion. Now it is well known that hydrochloric acid is very injurious in the case of an ulcer; it causes irritation and prevents healing. This has been amply proved by Bolton⁵ and many others. To what extent the gastric pepsin is also responsible for this deleterious action is unknown, but

this is of no great importance, since pepsin is inactive in the absence of acid. The hydrochloric acid is therefore the important factor in preventing the healing of an ulcer. While this is generally admitted, there seems to be a good deal of confusion regarding the matter. It is sometimes said that there is not necessarily any excess of acid concentration in gastro-duodenal ulceration. This is often true, but why worry about excess of acid? The ordinary normal acid secretion is sufficient to cause the damage. Very often there is a "hyperacidity" in the sense that the stomach continues to secrete acid after digestion is completed and the food has passed on to the intestine. This acid must do a very great deal of harm.

A theoretical objection to the use of large amounts of alkali is to the effect that it prevents gastric digestion. This is, however, exactly what we wish to prevent. If the food is passed into the stomach in a finely divided pultaceous mass there is no need for gastric digestion. The food is passed into the duodenum and digested by the pancreatic juices lower down. Stomach digestion is not essential to health, and its temporary suspension will do no harm. Now it is a strange fact that ulceration practically never occurs in the alkaline small intestine. In the first part of the duodenum ulceration is common, and here acid frequently comes into contact with the mucous membrane; in the remaining parts of the duodenum, where an alkaline medium is the rule, ulceration is almost unknown. All this seems to indicate, on theoretical grounds, that ulceration is in some way associated with the presence of hydrochloric acid. This conclusion is enormously strengthened by the observation that ulcers will heal when they are no longer subjected to the action of acid, but are bathed in an alkaline medium.

DETAILS OF INTENSIVE ALKALINE TREATMENT.

Sufficient "alkali" must be given to prevent the presence of free hydrochloric acid in the stomach for some time. The substances generally used to neutralize the acid are sodium bicarbonate, magnesium carbonate or oxide, and calcium carbonate. In America magnesium-ammonia phosphate has been frequently used, and a mixture of calcium phosphate and magnesium phosphate has been recommended by Shattuck, Rohdenburg, and Booker.⁶ Sodium bicarbonate being very soluble is an excellent antacid, but has the disadvantage that it tends to produce a secondary increased flow of acid. It is not satisfactory to use this substance alone, but when associated with less soluble bodies such as magnesium and calcium carbonate a very satisfactory mixture is obtained. It does not matter very much what combination of "alkalis" is used, but the following powder will be found to give excellent results.

Sodium bicarbonate	...	...	...	...	3ss
Heavy magnesium carbonate	...	...	...	...	3j
Calcium carbonate	...	...	...	...	3j
Bismuth oxy carbonate	...	...	...	...	3ij

It is important to have the bowels fairly free, and usually the above mixture, when given as directed, will produce a fairly free bowel movement. Should this be too free, some extra bismuth carbonate may be given, while, on the other hand, if constipation should prove troublesome extra "magnesia cream" may be given in doses sufficient to overcome the difficulty. Bismuth carbonate does not neutralize acid to any appreciable extent under ordinary conditions unless the acid is in greater concentration than is usually found in the stomach. It does, however, seem to possess some beneficial effect in gastric lesions, and is very useful in regulating any diarrhoea that may be present. Calcium carbonate is an excellent antacid with little effect on the bowels; magnesium carbonate, on the other hand, tends to act as a mild purgative, but is a good neutralizer of acid.

In order that the powder should have its maximum effect the patient should be put on liquid diet for a week or longer according to the severity of the condition and the intensity of the symptoms. Pain usually disappears within forty-eight hours, and the patient feels comfortable. If definite symptoms persist after two or three days' treatment it is probable that the condition is not an ulcer, or that adhesions to adjacent organs are present. The im-

portant point in treatment is to make certain that sufficient alkali is given to control gastric acidity. This is generally quite easily done during the daytime, but may be more difficult to accomplish during the night. It usually happens that the patient sleeps well if the acid is satisfactorily controlled, but if this is not the case he often wakes up complaining of pain and discomfort. It is therefore necessary to warn the patient that he must take a dose of the powder when he wakes up with feelings of discomfort. By this means the difficulty of preventing accumulation of acid during the night may be overcome.

Though it is best to have the patient in bed during the early stages of treatment, this is not always necessary, and we have treated many patients with success in the out-patient department. After some weeks of treatment the amount of powder given is gradually reduced. Patients with duodenal ulcer should, however, take the powder three times a day for two to three months. One most important point is to warn the patient that he must resume taking the powder and go on to liquid diet for a few days if any symptoms return. By this means an attack which might otherwise prove troublesome can be cut short. Patients who have had ulcers are sometimes liable to attacks of dyspepsia when they get run down, or after some infection such as influenza, but these attacks do not mean that there is a recurrence of the ulcer. This we have shown by x-ray investigation in such cases.

Though the exact details of treatment may be varied to suit different patients, the following general scheme will be found useful in the majority of cases.

First Week.

The patient is kept on a fluid diet consisting of milk, or milk with Benger's food. About three pints of milk per day are given in feeds of approximately 8 oz. every two hours. It is important, especially during the earlier part of the treatment, to prevent the clotting of milk in the stomach, and in order to ensure this 10 grains of sodium citrate are added to each feed of milk. This, of course, acts as a neutralizer of acid as well as an anti-coagulant. A small teaspoonful of the "alkali" mixture described is given every two hours shortly after the milk. The powder is best swallowed in a little water; care must be taken to stir the mixture thoroughly immediately before drinking. The powder is practically tasteless. About six to seven doses of powder are given per day. In addition, a double dose is given immediately before going to rest at night. The patient is warned that if he wakes up at night with any pain or discomfort he must take an extra dose of powder, or more than one dose if necessary.

Generally, it is quite easy to control the acidity by the above procedure, but in a few severe cases it is difficult. This failure to control the acidity usually becomes obvious to the patient by a return of the pain or discomfort. When this happens the patient must always take an extra powder; if the pain is due to insufficient neutralization it is immediately relieved by this extra dose.

In severe cases it is a good plan to give rather a smaller dose of the mixture every hour, for a two-hourly interval may allow of the passage of the whole of the powder from the stomach, with the result that free acid may be present. I have frequently used this plan with excellent results. In ordinary cases one or other of the above methods will generally give the desired effect. With patients suffering from renal disease or pyloric stenosis slight modifications may be advisable, but this will be discussed later.

Second Week.

If the patient has had no pain or discomfort for several days a little solid food is now added. If any discomfort or pain still persists the procedure of the first week is continued for a few days longer. If there are no symptoms the powder may now be reduced to five or six times a day, the quantity of milk being somewhat reduced also. Two or three eggs are now added to the milk and beaten up, or lightly boiled eggs are given. This is followed by small amounts of toast and butter, and cream. The diet is then gradually increased until by the end of the week the patient is taking, in addition to his milk,

a certain amount of toast, plain biscuits, butter, eggs, custards, a little porridge, and weak tea. A dose of powder immediately before retiring is taken as before, and the same care to take a powder during the night if pain occurs is still necessary; also an extra powder must be taken if pain or discomfort occurs during the day. Indeed, it is very important during all stages of the treatment that any discomfort arising by day or night should be immediately checked by a dose of powder.

Third Week.

Powder reduced to four or five times a day, and at bedtime. Food is gradually increased and should now consist largely of eggs, cream, toast, butter, plain biscuits, rice and other cereal puddings, porridge, custards, a little steamed white fish, and a small amount of potatoes. Sodium citrate need no longer be added to any milk taken.

Fourth, Fifth, and Sixth Weeks.

Milk is taken only in the usual average quantities. Powder is reduced to three or four times a day and at bedtime if no pain or discomfort is present. Food is still further increased with the addition of chicken, preferably creamed to begin with. In the fifth week a little meat (mutton or veal) may be taken, but only a small amount. By the end of this time the patient is taking a simple, nourishing diet, and the ulcer should be healed or well on its way towards healing. All the symptoms should have entirely disappeared in the average case.

After-Treatment.

The powder should be taken two or three times a day for another six to ten weeks. If there is an entire absence of symptoms the powder may then be given up during the day, but a dose should be taken at bedtime for several months. If any symptoms persist the powder should be taken two or three times a day for several months. A powder containing a suitable amount of magnesia may be taken at bedtime as a laxative for years without doing the slightest harm. It is impossible to give exact directions with regard to the length of time the powder should be taken, for this differs in different patients. It is, however, better to err on the safe side and to continue the powder for a long time if there is any evidence of dyspepsia.

It goes without saying that any source of infection, such as septic teeth or tonsils, should be attended to. Whether or not the wholesale extraction of teeth, so largely practised to-day, is an advantage or otherwise is a point for discussion.

Diet.

Much of what is written regarding diet is purely empirical and has no scientific basis in fact. Indeed, for many of the statements made in the literature there can be no foundation whatever. Rules regarding diet can be made quite simple, and may be summarized as follows.

1. The patient should avoid any article of food which would tend to cause physical irritation in the stomach. Now since raw vegetables are not digested to any appreciable extent in the stomach they should not be taken. Salads are therefore prohibited. The same applies to such articles as currants, raisins, nuts, or anything that would tend to leave an undigested residue in the stomach. If this principle is remembered the patient cannot go far wrong.
2. Meat, which tends to cause a marked secretion of gastric juice, should not be taken except in small amounts. Beef-tea and meat extracts of all kinds should be avoided.
3. Great care should be taken never to take too large a meal at one time, for this often tends to bring on symptoms.
4. The food should be thoroughly well masticated, so that it enters the stomach in a homogeneous pulpaceous mass.

Smoking and Alcohol.

Excessive smoking is a very frequent cause of gastric symptoms, and the less tobacco is indulged in the better. It should be given up entirely for a time. Alcohol should also be avoided, for it tends to excite the flow of gastric acid, which is so injurious to patients suffering from ulceration.

Other Considerations.

When the above treatment is carefully carried out as indicated, no other therapy is necessary in the average case. The tendency to excessive secretion of acid can sometimes be controlled to some extent by giving fats or oils. For this purpose they are of little value unless given on an empty stomach between meals, but if the patient can take olive oil, a dessertspoonful, two or three times a day, shortly before meals, may prove useful. Cream acts in a somewhat similar manner.

Various other measures may be used, but it is unnecessary to discuss them here. Probably belladonna is the most useful drug, but it is seldom necessary. The value of tonics and good general conditions as part of after-treatment is obvious.

RESULTS OF TREATMENT.

The rapidity and ease with which the majority of gastric ulcers heal when this treatment is used is very striking. It was hoped that actual photographs illustrating

FIG. 1.—Case I. X-ray findings: (a) January 3rd; (b) January 19th; (c) January 27th.

this point might be given in the present article, but this was impossible owing to printing difficulties. Drawings from four cases are therefore given. These have been carefully copied from the originals by an expert, and have been drawn to scale; they present exactly the same appearances as the original photographs, and show well how quickly these

ulcers disappear without leaving any trace whatever of their presence.

CASE I.

A police sergeant, aged 38, who had had symptoms for over nine years, was admitted to hospital on January 2nd, 1928, on account of recurring attacks of haematemesis associated with severe epigastric pain. Melaena had been marked of late. Three years ago he commenced to have "hunger pains," which caused him great inconvenience, so that often he was unable to remain on duty. He was always conscious of some more or less intense upper abdominal discomfort. At times food gave relief, but sometimes it only intensified the discomfort. He had had many forms of treatment, but symptoms gradually became worse. He stated that he had vomited blood on four occasions during the three months before admission, but never in very large quantity. Vomiting had been troublesome, and recently the vomit had contained much mucus. There had been considerable loss of weight during the last year. Palpation showed marked epigastric rigidity, especially on the right side; there was also a very tender area above and to the left of the umbilicus.

The patient was put on intensive alkaline treatment on January 3rd. He quickly lost all his symptoms, was quite comfortable, and in about three weeks from the beginning of the treatment all signs of the ulcer had disappeared.

The x-ray findings are shown in Fig. 1 (a) (b) (c). In the first photograph (January 3rd) the x-ray report was "large penetrating lesser curvature ulcer low down." The next radiogram (January 19th) showed "a smaller crater low on lesser curvature." The third radiogram, taken on January 27th, showed a normal stomach with no appearances of ulcer.

The patient is quite well and has had no further symptoms.

CASE II.

A boilermaker, aged 55, had suffered from stomach trouble for thirty years. He was admitted to hospital on January 16th, 1928, with a provisional diagnosis of carcinoma of the rectum. He was very anaemic and wasted, and showed marked cachexia. He stated that for over thirty years he had been "a martyr to indigestion," and "had tried all remedies, but without effect." Upper abdominal discomfort had been troublesome for several years. He had vomited frequently, especially during the last few years. Food nearly always made him worse. During the last six months his condition became so bad that he could scarcely get to his work. He thought his stools had been tarry. Marked tenderness and rigidity were present in the epigastrium, and his

general condition was very bad. Nothing was found in the rectum. A diagnosis of gastric ulcer was made, and a radiogram taken. The patient was put on intensive alkaline treatment, and soon obtained marked relief. He is now quite fit, and says that he has not felt like this for over twenty years.

The changes in the ulcer are shown in Fig. 2 (a) (b) (c). In spite of the length of his illness the ulcer healed completely in less than two months. The first radiogram showed "a large penetrating lesser curvature ulcer with much delay in emptying of stomach from atony." The next one, taken about a month later, showed "crater still present but very much reduced in size; local tenderness not present." The third radiogram, taken a fortnight later, showed the entire disappearance of the ulcer. These results, in a case of thirty years' standing, are certainly very striking. The patient has put on weight steadily and is now quite fit and well.

CASE III.

A police constable, aged 44, says he has had stomach trouble "ever since he was a young man," but that it generally improved when he went on to a milk diet. He has had several teeth removed at intervals during the last seven years as they were "bad." He states that he has suffered "indescribable agony" during the last five years whilst on duty, with a feeling of "hunger and emptiness." For this period he has never been able to get relief for more than a day or two, no matter what he took. Recently he has lost weight and his ordinary clothes are now much too big for him. The epigastric area was very tender and rigid. His general condition was bad, and he looked as if he had suffered a good deal.

He was admitted to hospital on January 9th, 1928. A radiogram taken the following day showed a large penetrating lesser curvature ulcer (Fig. 3, a). He was put on intensive alkaline treatment and almost immediately got relief from his symptoms. A radiogram taken on February 14th still showed a crater, but this was considerably smaller than before (Fig. 3, b). Another radiogram taken on February 23rd showed that the ulcer had entirely disappeared, the report being "no ulcer now seen" (Fig. 3, c).

This patient is now quite free from symptoms and is rapidly gaining weight.

CASE IV.

A married woman, aged 35, was admitted to hospital on January 2nd, 1928, on account of a long-standing dyspeptic condition

FIG. 2.—Case II. Showing changes in ulcer: (a) January 19th; (b) February 23rd; (c) March 6th.

through the abdominal wall, history of vomiting food eaten the day before for many months, the aspiration of food eaten twelve or more hours before, and the presence of abundant sarcinae, often rapidly disappears, so that at the end of ten days' or two weeks' management, seven hours after the largest and coarsest kind of a motor meal is given the stomach is found empty."

The reason for this wonderful effect of alkali depends on the fact that the obstruction is often due not to fibrotic changes alone, but to inflammatory oedema and spasm. Under the influence of alkali the spasm relaxes and the oedema subsides, so that a way is formed sufficiently large for the passage of food. I use this method in all but the most severe cases of pyloric stenosis, and generally with good results. Sometimes, indeed, the effect is really striking. About two years ago an elderly lady, aged 72, was admitted to St. Thomas's Hospital with all the usual signs of stenosis. She vomited two or three times a week, and

FIG. 3.—Case III. Showing changes in ulcer: (a) January 10th; (b) February 14th; (c) February 23rd.

becoming so severe that she could not carry on her household duties. She gave a history of more or less troublesome indigestion for some ten to twelve years. She had had much nausea, together with pain, for which she could never get definite relief until recently, when she bought large quantities of patent alkaline preparations. When she went on to a very low diet she obtained some relief, but she always had a definite sense of discomfort. Her weight had got progressively less, and on admission she was thin and careworn, with much epigastric pain and tenderness. A radiogram was taken before the patient entered hospital, and the report was as follows: "Stomach a little low and showing no duodenal cap. Emptying is definitely delayed. Appearance of partial pyloric obstruction probably due to an old ulcer" (Fig. 4, a).

Treatment was commenced on January 3rd, and another radiogram taken on February 3rd. The patient's symptoms cleared up immediately and she is now quite well.

The report on the second radiogram (Fig. 4, b) was "general appearance much improved—emptying in normal time—a small cap now seen."

Many other similar results could be given, but the above will serve to show the extraordinary marked and rapid effects produced by this treatment, even in very long-standing cases with severe symptoms and marked x-ray changes.

ALKALINE TREATMENT IN PYLORIC STENOSIS.

It might be thought that stenosis of the pylorus from old ulceration would not be much influenced by medical treatment, and that the aid of surgery should always be sought in such cases. Strange as it may seem, intensive alkaline treatment is often of the greatest value in pyloric obstruction, and, if the symptoms are not too severe, a trial should

be given to this treatment before deciding on operation. In mild cases alkaline treatment often gives excellent results, and even in patients suffering from intermittent vomiting relief from symptoms may be obtained. In this connexion Sippy¹ remarks that

"Pyloric obstruction, even of the highest grade, and of long duration as evidenced by the presence of vigorous peristaltic waves showing

through the abdominal wall, history of vomiting food eaten the day before for many months, the aspiration of food eaten twelve or more hours before, and the presence of abundant sarcinae, often rapidly disappears, so that at the end of ten days' or two weeks' management, seven hours after the largest and coarsest kind of a motor meal is given the stomach is found empty."

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FIG. 4.—Case IV. Showing condition of duodenum (a) on January 1st, (b) on February 3rd.

food eaten twenty-four or thirty-six hours before was often found in the vomit. Peristalsis was observed through the abdominal wall, and it was obvious that the condition was passing on to a serious stage. An operation was suggested as the only means likely to help, but this the patient obstinately refused, and no amount of persuasion could induce her to yield on this point. Though it was thought that the case was much too severe for medical treatment, a trial was given to alkalis. In a short time all the symptoms passed away, and the patient could take a certain amount of food without discomfort. It is over two years since she had the treatment, and she has not vomited once during that time. Special inquiries made a fortnight ago elicited the fact that she is doing quite well and has no gastric symptoms.

In cases of mild stenosis the ordinary alkaline treatment as indicated above may be used, but in very severe cases with vomiting a slight modification, as indicated below, may be advisable.

ALLEGED DANGERS OF INTENSIVE ALKALINE TREATMENT.

No medical man need be afraid to use this treatment. In some patients it may give rise to slight symptoms, especially during the earlier stages, but generally these symptoms rapidly subside, and the system accommodates itself to the comparatively large amounts of alkali ingested. According to American writers, the chief symptoms encountered are, first of all, dryness of the mouth and throat, followed by headache, anorexia, nausea, and vomiting. There may also be mental depression and loss of energy. Analysis of the blood in some of these patients shows that the nitrogenous waste products may be somewhat increased, while there may be some interference with the "acid-base equilibrium" of the body. This so-called "alkalosis" following the use of very large doses of sodium bicarbonate has been described, among others, by Hardt and Rivers⁷ in 1923, by Brown, Eusterman, Hartmann, and Rowntree⁸ in 1923, by Ellis⁹ in 1924, by McVicar¹⁰ in 1924, by Houghton, Venables, and Lloyd¹¹ in 1925, and by Jordan¹² in 1926.

From a careful perusal of the literature on alkalosis it seems fairly clear that the medical practitioner need not fear in the slightest degree to use the intensive alkaline treatment as indicated here. That certain symptoms may occasionally appear is admitted, but they are exceedingly rare. Indeed, it is obvious that, in many cases where the symptoms were described, quite excessive doses of sodium bicarbonate were used. The exact dose is not always given, but where it is recorded it often amounted to about 30 grams a day over long periods. When the treatment is used as indicated here there is practically no risk of alkalosis in otherwise healthy people, and even if symptoms should intervene there is no harm done. If the patient complains of headache, nausea, vomiting, anorexia, and excessive dryness of the mouth it is quite easy to stop the treatment for a few days. So far, as already indicated, I have never seen anyone who had any symptoms. If followed on the lines indicated here the amount of sodium bicarbonate taken daily is too small to cause any damage in ordinary cases. That there may be some danger when the patient is suffering from chronic nephritis is admitted (see Stieglitz¹³ and others), and the same may be true when very marked pyloric stenosis with excessive vomiting is present.

SPECIAL TREATMENT IN PYLORIC STENOSIS.

In ordinary cases of mild pyloric stenosis with little or no vomiting, but showing marked x-ray changes, the ordinary alkaline treatment may be used. In severe cases, however, with excessive vomiting, there is practically no communication between the stomach and the intestine, and in such cases hydrochloric acid is constantly being lost to the body by vomiting. This results in a decrease of acid and a consequent relative increase of alkali, so that the body fluids may tend to pass to a more alkaline condition than normal. This "alkalosis" may be accompanied by severe symptoms, the most pronounced being tetany. If the symptoms are dependent on relative or absolute excess of alkali in the body, it is obvious that it might be dangerous to give more alkali, especially a soluble alkali such as sodium bicarbonate, for this would tend to make the condition worse. Theoretically we should really give an acid to make up for the acid loss.

Now in cases of practically absolute obstruction the giving of sodium bicarbonate could do no harm, for it could not get through into the intestine and so reach the blood. It would simply neutralize the acid in the stomach and then be thrown out, either as bicarbonate or chloride. From the stomach, absorption of sodium bicarbonate does not take place. It is true, however, that the effect of the sodium bicarbonate in neutralizing the acid might result in a subsidence of the oedema and spasm of the pylorus, so that some gastric contents might pass on into the intestine. At this stage an excess of sodium bicarbonate would tend to increase the alkalosis, and what we really want is something to favour acidosis.

Haldane¹⁴ has shown that calcium chloride when taken by the mouth acts as an acid, and is equivalent in effect to giving hydrochloric acid, because most of the calcium remains in the intestine while the chloride is absorbed.

Gamble, Ross, and Tisdall¹⁵ showed that about 40 per cent. of the chlorine of CaCl_2 acted inside the body as HCl . Indeed, instead of causing an alkalosis the bivalent cations (calcium and magnesium) produce an acidosis in the body (McDonald and Godfrey¹⁶).

Therefore, in a case of very severe pyloric stenosis it would obviously be best to use as an antacid, not sodium bicarbonate, but calcium carbonate, or this along with magnesium carbonate. The carbonate would be changed into chloride by the gastric acid, and some of this would act as hydrochloric acid in the body, and so tend to prevent the drain of acid. That calcium carbonate acts quite efficiently as an antacid has been demonstrated by Loevenhart and Crandall.¹⁷ The safest treatment for severe pyloric stenosis would therefore appear to be by means of a powder consisting largely of calcium carbonate with some magnesium carbonate to help the bowels. Teaspoonful doses of such a powder should be given on the lines indicated above for the ordinary powder. In addition to this, small doses of calcium chloride would help the alkalosis.

Generally speaking, the intensive alkaline treatment is not associated with any real danger under ordinary conditions, but the treatment must be carried out on the general lines indicated here, and the vastly excessive doses of sodium bicarbonate sometimes used should be avoided.

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DEBATABLE ASPECTS OF THE SURGERY OF GASTRO-DUODENAL ULCERATION.*

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So long as the innate nature of gastro-duodenal ulceration is still ranked among the unknown phenomena of pathology there is bound to be disputation about the manner of its control. Controversy arises over many problems of the disease and its complications, but the greatest of these is the problem of the uncomplicated ulcer.

THE NEED OR IMPROPRIETY OF SURGERY FOR THE UNCOMPLICATED ULCER.

It is most perplexing to read the writings of physicians and surgeons, for they are often directly contradictory in their views and recommendations; but their very discordancy engenders the suspicion that the conclusions of the extreme enthusiasts of medical or surgical measures must largely cancel each other out, and that the truth lies somewhere between them. The relevant facts upon which alone a sound judgement can be based are simply stated.

(a) Ulcers of the stomach and duodenum can and do heal without the aid of surgery when conditions are favourable. This has been proved by actual visual inspection through a gastroscope,¹ by the x-ray disappearance of the ulcer niche under medical treatment,^{2,3} and by the finding of the scars of ulcers after death at necropsy.

(b) Certain ulcers fail to heal with the most careful medical treatment, or they heal and break down again so that the symptoms recur. The number of ulcers which will heal without surgical help is large. It has been stated that *post mortem* as many scars as open ulcers are to be found.⁴ But one pathologist discovered nine times as many scars as ulcers in the stomach.⁵ This is the highest

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