

## THE DIET IN GASTRIC ULCER AND HYPERCHLORHYDRIA \*

JOHN BENJAMIN NICHOLS, M.D.  
WASHINGTON, D. C.

There are three main methods of treatment of gastric ulcer: (1) the surgical method, (2) the duodenal feeding method, and (3) the hygienic-dietetic-medicinal method, each having its own appropriate field of employment. The relative merits of these methods, and the considerations which guide in the selection of one of them in given cases, it is not proposed to discuss in this paper. Even if the surgical and duodenal methods possess advantages in the way of certainty and celerity of results, it is likely that there will always be patients who will decline or defer resort to these methods, or are so circumstanced as to necessitate a trial of ambulant treatment, or with whom for various reasons hygienic, dietetic, and medicinal treatment will be adopted.

In the medical treatment of gastric ulcer the necessary hygienic and medicinal measures may in importance equal or even exceed the dietetic regimen. Rest in bed, prolonged for a sufficient period, is especially of the greatest service and in many cases is absolutely essential to the attainment of a medical cure. Medicinal treatment, such as the use of astringents like bismuth or silver nitrate, of alkalies, of analgesics like orthoform or codein, and other remedies, is also an essential concomitant of the dietetic treatment. It is not purposed to consider those concomitant measures or the treatment of complications in this paper, which is to be devoted to a discussion of the physiologic and therapeutic principles that may guide to the selection of a rational diet in those cases of ulcer of the stomach and hyperchlorhydria in which this line of treatment is adopted.

A dietary regimen which has been extensively employed in this condition is that of Leub, more or less modified. This system begins with a period of fasting or great restriction of food, followed by gradual increase in the amounts given. Milk is the staple of this diet, along with soups and broths; eggs, carbohydrate food, and meat are gradually added later. The intervals between feedings recommended by different authorities range from as short as one hour up to several hours. The object of the restricted diet is to afford rest and freedom from irritation to the ulcer by minimizing gastric activity and dyspeptic conditions.

The dietary introduced by Lenhartz<sup>1</sup> in 1903 has also attracted much attention. This diet consists of milk and eggs, to which sugar, meat and carbohydrate food are early added. The daily amount of food is rapidly increased from a small allowance to an adequate maintenance ration. The object of this more ample regimen is to promote the general nutrition, while its abundant protein by entering into combination with the excessive hydrochloric acid of the gastric juice is supposed to neutralize or inactivate the latter.

Another diet, the fatty diet, has been introduced, but as yet has attained only a limited use.

It is my opinion (possibly presumptuous) that much of the current dietetic practice in gastric ulcer is based on fallacious grounds, and that a consideration of certain well-established physiologic facts will afford a definite guide to the adoption of a rational diet for this condition.

There are some factors in the causation and treatment of ulcers of the stomach corresponding to those of ulcers elsewhere; and some etiologic factors that are still obscure; but there is one factor peculiar to this condition that is of the utmost importance in its etiologic and therapeutic bearings, namely, the digestive properties of the gastric juice. Whatever the other determining conditions, it is clear that the corrosive action of the gastric secretion is a potent factor in producing and maintaining peptic ulcers. The high acidity characteristic of the gastric juice in cases of ulcer, whether it be cause or effect, is significant of this causative action. In addition to the indications that apply in the treatment of ulcers in general, such as rest, avoidance of irritation, promotion of nutrition, etc., we therefore have as a fundamental and peculiar object in the treatment of gastric ulcer the reduction to a minimum of the acidity and digestive power of the gastric juice.

The secretion, composition and potency of the gastric juice vary definitely and markedly under the influence of various dietetic conditions, thus enabling us to arrange a diet calculated to effect a maximum reduction of its elements.

Ordinarily gastric secretion takes place only in response to the ingestion of food. When there is no food in the stomach there is no gastric juice, and hence during the fasting period an ulcer would be free from its corrosive action. Duodenal feeding enables the gastric secretion to be thus suppressed for an indefinite period. Excepting by this method (rectal feeding being ineffective) intragastric alimentation can be dispensed with harmlessly only for a few days. In gastric ulcer a preliminary period of complete fasting can be carried out for a few days; when feeding is instituted, it seems rational that the intervals between feedings should be made as long as possible, in order to gain the longest practicable periods of freedom from the action of the gastric secretion.

After the ingestion of food, as shown by Pawlow,<sup>2</sup> the flow of gastric juice takes place in two stages and under two sets of influences; first, a flow starting immediately, due to psychic influences; and, second, another flow starting fifteen to forty-five minutes later, due to chemical stimulation (hormone action) by certain of the foodstuffs.

The psychic influences which initiate the flow of the gastric juice are the appetite and an eager desire for food. These influences act independently of the chemical character of the food taken, and may operate even in the absence of actual swallowing of food. Theoretically, therefore, it would be rather an advantage in treatment of gastric ulcer to employ articles of food that are not especially tempting or appetizing, as thereby a lessened primary flow of gastric juice is excited.

The secondary stimulation of gastric secretion, which begins about fifteen to forty-five minutes after the ingestion of the food, is dependent definitely and markedly on the chemical character of the food materials. Some foodstuffs greatly increase the amount and potency of the gastric juice secreted at this period, some lessen it, some are indifferent.

The substances which have been found active in stimulating the secondary flow of gastric juice are water, impure peptones, meat extractives and caffeine. Water does not act in small amounts, but in quantities of 400 or 500 c.c. it evokes a considerable gastric secretion. Meat extractives, as in soups, broths, bouillon, beef tea,

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1. Lenhartz, H.: *Deutsch. med. Wchnschr.*, 1904, xxx, 412.

2. Pawlow, J. P.: *Work of the Digestive Glands*, second English ed., 1910.

meat juices, meat, etc., are active excitants of the flow of a potent gastric juice. The products of protein digestion also chemically excite secretion by the stomach; native proteins, such as white of egg, lack this power, but when their digestion is once started by the primary psychic or appetite juice, the digestive products so formed further stimulate secretion. Beverages and solutions containing caffeine have been found by Moore and Allanson<sup>3</sup> to cause (in general) a marked increase in the hydrochloric acid content, total acidity, and digestive power of the gastric juice one hour after ingestion, as compared with the controls; coffee acted most strongly, tea next, cocoa least. According to Pawlow, soaps formed from fat in the food also stimulate gastric secretion.

The amount and duration of gastric secretion are of importance as well as the acid content and peptic power. In experiments on dogs Portis<sup>4</sup> found that on a meat diet the total amount of gastric juice secreted and the duration of the secreting period were three or four times as great as on a vegetable diet. Milk gave a time slightly longer than the vegetable diet, but much less than the meat feeding.

The bearings of these facts on the treatment of peptic ulcer are obvious. Water should be allowed in limited quantities only, not more than 250 c.c. (8 ounces, or one glass) at any one time. Coffee, tea and cocoa should be excluded. Soups and similar preparations rich in meat extractives from their lack of nutritive value are not only useless, but from their powerful stimulating effect on gastric secretion would seem to be absolutely contraindicated. Meat, it would seem, should be avoided, and protein food in general reduced to a minimum. The practice of giving protein food with the view of its neutralizing the gastric juice would appear to be fallacious and disadvantageous, since this kind of food causes a maximum flow and potency of gastric juice and increases the free hydrochloric acid, which will act on the ulcer as well as on the material that called it forth.

Some ingredients of the diet are without any specific chemical effect on gastric secretion, such as carbohydrate material. Ingestion of sodium chlorid or of hydrochloric acid causes no flow of gastric juice or increase of its hydrochloric-acid content (Floersheim<sup>5</sup>). Organic acids (acetic, citric, lactic, butyric) have been found (Foster and Lambert<sup>6</sup>) to cause no increase of gastric secretion; the acidity of fruits would therefore not be objectionable in gastric ulcer.

Among substances that inhibit gastric secretion may be mentioned sodium bicarbonate; weak solutions (0.05 to 1.0 per cent.) of this substance evoke no secretion of gastric juice in amounts that would be effective if water alone were taken.

The greatest practical importance in this respect attaches to the influence of fat, which has been clearly shown by Pawlow and others to cause a marked lessening of gastric secretion, as compared with meals otherwise identical containing no fat.

Pawlow<sup>2</sup> found that when meat is given one-half to one hour after introducing large amounts of olive oil into a dog's stomach, the primary psychic flow of gastric juice is abolished, and the subsequent gastric secretion is very much retarded and greatly diminished in amount

and potency. A similar result is obtained when the fat is given immediately after the meat, except that the psychic flow begins in the usual five minutes, the inhibitory influence of the fat appearing later. The effect of the oil continues for two or three hours, after which an increase in gastric secretion may take place. The formation of soaps may produce a late stimulation of gastric secretion.

Moore and Ferguson<sup>7</sup> in comparative tests in sixty-one cases (including twenty-nine of peptic ulcer) found that the total acidity, hydrochloric acid, and digestive power of the gastric juice, determined one hour after eating, were in the general average reduced about one-third when the test-meals were preceded half an hour by an ounce of almond oil.

Cowie and Munson<sup>8</sup> in their investigations found that olive or cotton-seed oil given in quantities of one or more ounces half an hour before the meal as a rule caused a reduction (averaging about a third) of the hydrochloric acid and total acidity of the gastric juice (as determined after the usual test period of one hour). When the oil was given after or just before the feeding the effect was much less. The reduction corresponded to the quantity of oil given, larger amounts usually causing a greater inhibition. The oil delayed the beginning of the secretion of gastric juice, and retarded the height of secretion, so that although the acidity was less with oil after sixty minutes, it frequently increased later, often reaching a maximum as great as that of the control. The oil tended to retard the motility and evacuation of the stomach and prolong the period of digestion.

The fat content of milk also has an inhibitory effect on gastric secretion. Test-meals containing milk bring about the secretion of a gastric juice with a less hydrochloric acid content and lower peptic activity (after one hour) than meals containing the same amount of water instead. This effect is proportionate to the amount of fat in the milk; cream causes a greater reduction than whole milk, while skimmed milk is least effective (Pawlow<sup>2</sup>). The total acidity of the gastric contents after milk is, however, considerably greater than after other foods. This is apparently due to the lipolytic action of the gastric juice splitting the milk fat and setting free fatty acids, which increase the total acidity. The fat-splitting action of the gastric juice is most effective on fat in a state of fine subdivision (as in milk); it has little effect on fats or oils in bulk, which are very little changed in the stomach.

As to the way by which oil lessens peptic activity, Pawlow holds that it acts by reflex nervous inhibition of the secretory mechanism (as evidently occurs in the abolition of the psychic juice). Others believe that in addition there is some mechanical interference with the secretory stimulation caused by the oil forming a coating over the gastric mucosa and the food masses. Reflux of duodenal contents into the stomach has also been suggested as having some effect.

Other properties possessed by fat that are of importance in connection with its use in the dietary of gastric ulcer are: its high caloric value; its local sedative properties; its relaxing effect on pyloric spasm, and its laxative action.

Investigations of the inhibitory influence of drugs on gastric secretion have been very scanty. Portis<sup>4</sup> obtained little effect from scopolamin or opium; the only drugs

3. Moore and Allanson: *Proc. Roy. Soc. Med.*, London, V, Medical Section, Nov. 28, 1911, 19.

4. Portis, M. Milton: *Louisville Month. Jour. Med. and Surg.*, 1908-9, xv, 230. *Illinois Med. Jour.*, 1909, xv, 267. *Lancet-Clinic*, Cincinnati, 1909, cl, 9; *THE JOURNAL A. M. A.*, Sept. 28, 1912, p. 1154.

5. Floersheim, S.: *Med. Rec.*, 1912, lxxxi, 1089.

6. Foster and Lambert: *Jour. Exper. Med.*, 1908, x, 820.

7. Moore and Ferguson: *Proc. Roy. Soc. Med.*, London, III, Medical Section, Nov. 23, 1909, 25; *Lancet*, London, Dec. 11, 1909, p. 1737.

8. Cowie and Munson: *An Experimental Study of the Action of Oil on Gastric Acidity and Motility*, *Arch. Int. Med.*, January, 1908, p. 61.

which he found effective were belladonna (especially before meals), and bromids (preferably in large doses and before eating, the strontium salt most effective). Hydrogen peroxid has been asserted by a number of observers to cause a reduction in hydrochloric acid secretion; it may be given in teaspoonful doses in a glass of water after meals, and is stated to be beneficial in hyperchlorhydria, though less so in ulcer (Hall<sup>9</sup>).

All the foregoing physiologic considerations have obvious, or at least theoretical, bearings on the dietetic treatment of both gastric ulcer and hyperchlorhydria, which may be thus summarized: The intervals between feedings should be made as long as possible, food being given preferably not more than two to four times a day. The diet should be as little appetizing, tempting and palatable as is practicable. Soups, broths and other preparations of meat extractives should be absolutely forbidden. Meat is to be excluded and protein food reduced. Coffee and tea should be avoided. Water should not be drunk in large amounts, not over 250 c.c. or 8 ounces at one time. Alkaline drinks, however, may be more freely taken. Carbohydrate food is permissible. Oil should be taken half an hour before meals, or the diet should contain a large amount of fatty material.

The fatty diet for gastric ulcer is grounded on these principles. While it has not yet come into extended use, the actual results obtained by those who have employed it have demonstrated its efficiency. No form of dietetic treatment will cure or ameliorate more than a certain proportion of ulcer cases; and good results are obtainable by diverse systems of feeding. There are no statistics by which the relative effectiveness of the fatty diet as compared with the Leube or Lenz methods can be estimated, but it is rational in theory and in practice it is capable of yielding satisfactory results in many cases.

In practice two forms of fat are mainly used, namely, (1) vegetable oils, such as olive oil, almond oil, cottonseed oil; and (2) milk fat, as in the form of cream.

In using vegetable oil, the best results would seem to be obtainable by giving it in quantities of an ounce or more a half hour before meals; with it is given a simple carbohydrate-fat diet. A number of writers have reported satisfactory results from this method. Oil thus given is, however, apt to become very tiresome and distasteful. As a variant method of administration it may be given made up in mayonnaise dressing, in which form it may be more acceptable and may be generously used as an ingredient of the diet.

The use of cream as the sole or chief ingredient of the diet is another plan that has found favor. The high caloric value of cream makes it one of the most valuable of dietetic articles for building up body weight and strength. One quart (four glasses) of cream a day yields about 1,800 calories, which alone is sufficient for many small-sized persons leading the quiet lives of invalids. (For a person weighing 100 pounds 1,800 calories is equivalent to 2,700 calories for a person of the standard weight of 150 pounds.) A quart of cream, it is true, contains only about 25 gm. of protein; but 20 gm. more of protein would be furnished by the addition of, for instance, 600 c.c. of milk, or 220 gm. (six slices) of bread, or 230 gm. (five tablespoonfuls) of oatmeal gruel (cooked with milk), or three eggs. With cream as a basis an ample dietary can be arranged on which the body-weight will be maintained and even increased. The richness of cream in fat effects a marked inhibition of gastric secretion, and adapts it preeminently for use in

peptic ulcer. Cream is less constipating than milk. It may cause acid gastric indigestion from the splitting of its fat by the lipolytic action of the gastric juice; but in my experience this troublesome effect usually disappears after a few days' persistence in the diet. Some patients cannot comfortably take cream as an exclusive and continued diet; yet in general it is better tolerated than might be expected, and if it causes no great disturbance there is no disadvantage in its not being especially relished. If not tolerated in full strength, the cream may be given diluted with an equal or greater amount of milk. The use of corresponding amounts of ice-cream in place of plain cream is a useful variant method of administration, which may be adopted *ad libitum*; and it is significant that unexpected benefit from the use of ice-cream in gastric ulcer was empirically noted before its physiologic rationale was elucidated.

My personal experience with the fatty diet in gastric ulcer covers about twenty-six cases. Not then aware of the published work along these lines, I was led by theoretical considerations to the conclusion that an abundance of fat with restriction of protein was the proper diet for this condition, and fixed on cream as a suitable foodstuff. In these cases cream was employed as the basic ration, ordinarily  $1\frac{1}{2}$  to 2 pints daily, divided into three or four feedings. Some patients were started with the full amount of cream, some with smaller amounts gradually increased, some with an initial fasting period. At first the cream was used alone; later were added cereal, bread, puddings, other vegetable food, eggs, etc.; oil (before or with meals), butter, mayonnaise dressing, and the like, were generously introduced into the dietary. Whenever desirable the cream was given diluted with milk, or in the form of ice-cream. Meat and soups were allowed last of all. The usual concomitant measures, such as rest in bed when feasible, astringents, alkalies, analgesics, etc., were employed as indicated.

During the first few days of the cream treatment troublesome dyspeptic symptoms (nausea, gas, acidity, etc.) often developed, frequently as severe as any the patients had ever experienced, and causing much discomfort and discouragement. This was probably due to the setting free of large amounts of fatty acids by gastric lipolysis. If the cream was persevered in these symptoms usually subsided, tolerance was established, and the diet was borne comfortably and contentedly.

The diversity of results characteristic of the treatment of gastric ulcer was observed in this series; some patients recovered, others were partially or temporarily relieved, some were unimproved. Some marked cases, including one with profuse repeated hemorrhages, progressed to good recovery, though two or three months or more of treatment, with many weeks in bed, were sometimes required to effect this result. The method is adapted to ambulant treatment, and seems a rational treatment for simple hyperchlorhydria as well as ulcer. It was also found to be of prophylactic service, as dyspeptic symptoms suggestive of recurrence of ulceration in treated cases usually promptly subsided after a few days' resort to cream diet. Although this series was too small for any very weighty deductions, the impression which I have formed of the results of the fatty diet has been favorable, and I believe that it is a rational and efficient method of dieting for gastric ulcer.

**Beginnings of Modern Medicine.**—There is not a single development, even the most advanced of contemporary medicine, which is not to be found in embryo in the medicine of the olden time.—Littre, *Introduction to the Works of Hippocrates*.

9. Hall, G. W.: Boston Med. and Surg. Jour., 1911, clix, 846.