

## Original Articles.

## INTOLERANCE OF FATS.\*

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I HAVE had some hesitation about discussing the subject of which I am to speak, because I have few substantial facts to add to what is already known, and because, under this heading, I am obliged to refer to a considerable extent to matters that may appear somewhat trivial and will certainly seem, to some of you, at least, old and time-worn. But while I think it was expected that I should choose a more specific subject in dietetics, various reasons have led me to discuss this one. In the first place, I continually grow more thoroughly convinced — and this, I am sure, is the case with every one who devotes much thought to such matters — that in considering dietetic problems we must have quite as clear knowledge of the tools that we are obliged to use as we have of the conditions in which they are to be employed; and that we must also know how to use these tools with the individual, quite as much as with the disease.

It is for this reason that I give so general a title, rather than one relating to some specific disease or class of diseases; and I want to discuss intolerance of fats because, while there is a very general realization that there are limitations in the powers of different persons to utilize protein and carbohydrate safely and successfully, there is, I think, less general and less accurate attention given to the not uncommon cases in which there is digestive or metabolic disability in the utilization of fats, and little discussion is given the subject by most writers.

It has been traditional with the laity for many years that fat is an exceedingly nutritious form of food. We have indeed all been impressed with this fact since, in our childhood, we heard of the diet of the Esquimaux; and ever since the nutritive values of various forms of foods were first accurately measured this fact has been only more firmly established and made more emphatic. Fats, as is well known, have, for a given weight, more than twice the combustion value of protein or carbohydrate, and, furthermore, fatty foods, as they appear on the table, are very often more concentrated than are most protein or carbohydrate foods; the latter very frequently containing an extremely large proportion of water and often of waste material also. It is only natural, therefore, that foods containing a high percentage of fats should be used with freedom in cases in which it is desirable to improve nutrition; and in recent times there has been so much and such wise emphasis laid upon the important rôle played by depraved nutrition in a large proportion of diseases of various kinds that generous feeding has come to be an essential element of treatment in cases that are met with almost daily. Such generous feeding almost always means the free use of foods that contain

a relatively large proportion of fats — milk, cream, butter, eggs, olive oil and the like.

I would not protest for a moment against the wisdom of such a measure, when used with discrimination. On the contrary, I am confident that the attitude of the profession in this regard is one of the most fortunate things, for many patients with chronic disease especially, that has developed in many years; but I think I may with justice say that among those that deal chiefly with patients that are well past their infancy too little attention is often given to the fact that certain of the great classes of foods, rather than certain culinary preparations, may be difficult for the patient to handle. Since I am at present dealing solely with the fats in the diet, I would especially say that sufficient emphasis is not ordinarily laid upon the fact that individual patients are not able to utilize fats in large amount, and some, indeed, cannot utilize them in normal amounts. Sufficient attention, too, is not given to the clinical methods by which one may determine — or, better, attempt to determine — whether a patient does make use of the fats that are given him.

Open rebellion of the digestive tract against fatty foods is, of course, recognized; and any student can recite a few instances, such as fatty stools in icterus, pancreatic disease and extensive structural change of the intestinal wall, as examples of poor digestive utilization of fats. At present, also, every one is well acquainted with the fact that fat-metabolism may go dangerously astray in some conditions, more especially in diabetes; but I do not believe that enough thought is given to the not uncommon, comparatively minor disturbances that seem to be dependent upon a greater or lesser inability to take fats, and are often first brought out by an attempt to push fats somewhat, in the desire to improve general nutrition.

I cannot make an attempt to give a systematic and complete review of these conditions, and shall merely touch in a fragmentary and hasty way upon a number that are more or less well known but, apparently, not always thought of in a therapeutic way. I shall refer in somewhat greater detail to a group of cases that I have not seen described, but that constitute, I believe, rather definite and somewhat specialized examples of fat intolerance. I wish, also, to give a little consideration to the question of determining the degree of digestion and absorption of fats, as this is of interest in connection with any of the cases of which I shall speak, although, unfortunately, it is, as yet, of limited practical utility. I shall not try to discuss disorders in the utilization of fat that result from pancreatic or very grave intestinal disease, because this would require too much additional time, and because I am intentionally dealing chiefly with rather minor disturbances.

Digestive difficulty in utilizing fats appears to increase in commonness as one goes back toward infancy; in other words, the young seem to be, on the average, more limited in their

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powers of digesting fats than are adults. I think it probable that they are also more limited in their ability to metabolize fats properly. It is only recently that pediatricists have given serious attention to the question of fat indigestion; and yet I think that most experienced pediatricists would say at present that this is exceedingly common, and I am sure that a considerable proportion would say that it is the most common form of disturbance produced by milk, although the latter appears to me to be an extreme view. There is no doubt, however, that those common cases of persistent regurgitation of small amounts of curdled milk, and likewise many more definite instances of vomiting, — whether this be the vomiting that occurs occasionally without other severe symptoms, that which appears with the symptoms of more or less violent gastritis or gastro-enteritis, or the gastric irritability that frequently follows or accompanies acute disease in infants — are due in large proportion to the fat in the food; and the symptoms may often be overcome by largely reducing the fat, and subsequently increasing it very gradually. The same thing is true of intestinal disturbances, but perhaps in less degree. Looseness of the bowels, even when associated with curdy masses in the stools, is not infrequently dependent upon the fats in the milk; and also the passing of hard, often extremely dry, stools, usually very pale in color, has been insisted upon by Czerny and Keller, probably with propriety, as due, in the great majority of instances, to inability to manage the amount of fat the infant is taking. The stools in instances of the latter kind usually consist largely of fat, in the form of soaps, and the infants are often in unsatisfactory general condition, though by no means always under weight. They are not infrequently more or less fat, but are pasty looking, flabby and peevish, and evidently do not feel well.

I have mentioned these types of digestive disturbance in infants, not because I want to discuss the regulation of fats in the diet of infants, but because I am convinced that a little knowledge of dietetic and other matters relating to infancy and early childhood has often been helpful to me in interpreting and managing the disorders of older patients; and all those disturbances due to fat that I have referred to as occurring in infants have, I am sure, their close analogues in older persons. The cue to the management of such conditions in older persons, though partly known before, has, in considerable part, been furnished by the experience of pediatricists with infants, whose diet is so simple that it is comparatively easy to modify with fair accuracy the various elements that it contains and to determine which is at fault.

It is an old story that fats may cause gastric disturbance in older patients as well as in infants, but I have repeatedly found little ways of extending this fact and of making use of it that I had not recognized before, or had not fully appreciated. In half-grown or older children,

occasional unexplained, but recurring, attacks of vomiting, which may be mild and transitory or more severe, are at times done away with entirely or almost entirely, if one very largely excludes fats from the diet. This is, of course, recognized by many observers. In occasional instances, these attacks may resemble so-called recurrent vomiting, and I have seen one case, at least, in which there were all the characteristics of typical recurrent vomiting and in which the first severe attack seemed to have been precipitated by pushing the fats in the diet. Prolonged freedom from attacks followed upon decided reduction of the fats, while the attacks returned when, in accordance with other advice, the mother again increased the fats. They again subsided when the fats were once more greatly reduced. This case I shall describe briefly later.

In cases with such gastric symptoms, the amount of fat that has been taken is, at times, not above the normal; in other words, the patient appears to have a natural inability to use normal amounts of fats. In other instances, and I think that these are much more common, it is easy to determine by carefully investigating the diet that the patient has been on generous amounts of fat, though often on amounts that most persons can take without disturbance. Not uncommonly, it may be found that he has been on over-generous amounts, usually because he has been under weight or not very robust or has recently had some debilitating disease, and it has seemed desirable to build him up. It is exceedingly remarkable to note the extremes that are at times unconsciously reached in such cases by the parents of children that are out of health, or by older patients themselves; sometimes, unfortunately, as a result of rather loose orders by doctors. I have recently seen, for example, a boy of eleven years, whose doctor had advised that he be "fed up freely," and whose devoted mother was giving him a diet that a little conservative calculation showed to contain at least 250 gm. of fat a day. I think, indeed, that it almost certainly contained more than 300 gm., while the total caloric value of his daily food was unquestionably 5,000 to 6,000. One can hardly wonder that this boy was not capable of taking care, without disturbance, of the amounts that were given him; but lesser degrees of overfeeding are common, and careful detailed inquiry into the diet will often give the key to the treatment. In the cases that I am especially referring to, it will often show that the fats are particularly superabundant. Such conditions are seen more frequently in children than in adults, but this is, I think, largely because their diet is not regulated by their own choice but by those that watch over them. A child's appetite, when let alone, is very commonly a better guide than is an over-anxious parent, though the real method is, of course, to regulate accurately the amount that should be taken.

The same disturbances do, however, occur in adults, and particularly in those that are receiving more or less marked forced feeding. I have

repeatedly seen phthisical patients that showed such conditions. It may be said that such cases do not deserve the term fat-intolerance but are simply instances of overfeeding, particularly with fats. I include them under the term, however, because I think that in a considerable portion of such cases the disturbance has been set up chiefly by the fats and that this has produced a subsequent actual intolerance of normal amounts of fat. One of the most important points in the treatment is, then, to reduce the fats to an abnormally low point. Some of these phthisical patients that I have mentioned, for example, had been very freely fed, and were referred to me on account of gastric symptoms. They could not take milk, cream or eggs without a good deal of distress and sometimes even vomited them; but they could with freedom take skimmed milk and eggs from which the yolks had been largely or wholly removed. I think, therefore, that they rebelled at the fats.

I have, perhaps, given the impression that I think these symptoms occur almost solely when an over-abundance of fats is given. Over-generous amounts are, of course, much more likely to cause such disturbances than are normal quantities, but it is perfectly well known that some persons cannot stand even normal amounts. A certain number of persons have, for example, real distress after taking milk or eggs, even in moderation. With milk this can sometimes be overcome by mere dilution or by modifying the curd in much the same manner as it is done for infants, using a cereal gruel or cracker dust, or some similar method of preparation. Quite as frequently, however, especially when burning, acid regurgitation or, as sometimes happens, vomiting, occurs after taking milk, the symptoms may be controlled by simply giving skimmed milk and subsequently adding very gradually small amounts of cream; and when eggs cause distress, it can often be overcome by removing, at first, some or all of the yolk, increasing quantities of this being afterwards added, thus slowly educating the stomach to take moderate quantities of fat.

Such symptoms occur even in normal persons, and in a variety of diseased states, but I think that they are particularly common in acute disease, such as pneumonia or typhoid fever. I still persist in using, in the course of typhoid fever, until the patient begins to brighten and grow hungry, a practically exclusive milk-diet. I do this deliberately, not so much because I am afraid of direct harm from other simple foods, as because I think it has been sufficiently shown that the digestive tract can take care of one form of food better than of a variety, since this simplifies its labors, and because there is no question that, of simple forms of food, milk is the most nutritious. I do believe, however, that digestive disturbance is occasionally due to milk in such cases, and I treat such disturbance by modifying the milk, much as if I were treating an infant, attempting to determine which element in the milk is chiefly at fault and to elimi-

nate this element to a considerable degree, temporarily, at least. In those cases in which there is gastric distress or a tendency to vomiting, or in which there is mere looseness of the bowels without offensive diarrhea, skimming the milk often does good. I would say parenthetically, however, that I have no question that by far most commonly any digestive disturbance in acute disease — perhaps especially in typhoid fever — that is due to the milk, particularly when this digestive disturbance is troublesome diarrhea, is due to infection of the milk, and this is controlled in no other way than by securing good milk, by pasteurizing the milk, or by excluding milk from the diet. This question I have discussed at some length elsewhere.

One condition that is not commonly thought of as exhibiting intolerance for fat, one, indeed, that is so generally considered to be improved by a generous use of fats that I speak of it with some trepidation, is gastric hyperacidity. I fully concur in the general view that a large proportion of cases of gastric hyperacidity are benefited by the use of fats. It has been commonly believed that this is due, in considerable part, at least, to the fat directly reducing the secretion of gastric juice, but it appears now to be quite as probable that it is due to the improvement in general nutrition that fat produces; for, on the one hand, depraved nutrition is undoubtedly the chief factor in producing or, at any rate, in causing the persistence of hyperacidity in many cases; and, on the other hand, the recent observations of Pawlow's pupils have apparently demonstrated that the earlier studies that appeared to show that fats decrease the secretion of gastric juice were incomplete, and that this is only the first effect, while it is followed later by an increased secretion. However this may be, I am convinced that while most persons with hyperacidity do well on the free use of whole milk, cream and other fatty foods, a limited number are harmed by them and have an increase in their burning, acid eructation and other symptoms; and these added symptoms are in such cases controlled more or less completely by merely greatly reducing the cream, butter, and other fat-rich foods, and giving generous quantities of skimmed milk instead of whole milk. The ability to use skimmed milk may be of great aid in securing the improvement in general nutrition that is so important in many of these cases, while attempts to use whole milk are fruitless.

Regarding intestinal conditions, it is, I think, almost automatic with everyone to consider that fats may cause looseness of the bowels, and we all see instances, from infancy on to adult life, but particularly in early life, in which it is easy to control a mild constipation by using fats somewhat freely. A step farther on, we see cases in which a generous, or even a moderate, use of fats produces an undesirable looseness of the bowels, and in which the bowels become normal again, if the fats are restricted somewhat. This is particularly true of children. As with

infants, it may not infrequently be observed with children, especially after an acute digestive upset, that a fair amount of fat, sometimes even the quantity present in whole milk, is not well borne and causes diarrhea, while skimmed milk is freely taken by such patients without any disturbance. Like vomiting, one not infrequently sees mild, persistent looseness of the bowels and sometimes more severe and more acute intestinal disturbance produced by unwisely plying children with cream, rich milk and butter. Similar conditions occur at times in adults. I have at times seen cases, as I suppose every one has, of persons that would quickly get loose movements after the free use of fats; and others that had chronic looseness of the bowels from ordinary amounts of fats, without suspecting the cause, and whose disturbance ceased upon reducing the fats. The stools in such cases are usually soft, copious, of a sticky consistency, often somewhat glistening, and microscopically they show a good deal of fat. Very striking and severe grades of this condition have been carefully studied and described by Salomon. While cases of such marked form as his are, as he says, very uncommon, I am sure that milder degrees are not so, and they have some importance, particularly because of the fact that the nature of the condition is frequently overlooked, while recognition of it may lead to ready control of the disturbance. Those cases, not very uncommon in adults or children, in which even moderate use of milk produces diarrhea, are, I think, most commonly of this order; that is, it is the fat in the milk that causes most of the trouble.

These instances in which even moderate quantities of fat produce looseness of the bowels are likely to have some evidence in their history of recent or old enteritis or enterocolitis, and they usually have in their stools abnormal amounts of mucus, ordinarily of the character that indicates that it has come from the small intestine. They generally require treatment of this condition, as well as regulation of the diet; but careful attention to the diet, and this frequently means decided reduction of the fatty elements, will often, if the food is kept of bland form, largely control their trouble.

While diarrhea is likely to suggest the thought of fat-indigestion, the contrary condition certainly does so much less frequently; yet it is perfectly well recognized that constipation is occasionally due to disturbed absorption of fats, the stools in such instances being usually pale, hard, dry, often brittle and frequently large, and the unabsorbed fat being present chiefly in the form of soap. This condition is entirely analogous to that insisted upon by Czerny and Keller as being very often seen in infants. It is a common condition in young children whose diet consists largely of milk; and it is not infrequently seen in older children or adults, especially when the diet contains much milk. It may often be overcome by reducing the amount of milk-fat in the diet, together with

the addition of more laxative foods, much better than by simply adding the other food and continuing rich milk; or than by adding more cream, as is often erroneously done with the thought that the fat in the cream will act as a corrective.

This state of the stools when persistent, or one of similar character but with softer consistency and without the constipation, sometimes becomes associated with sallowness or pallor, flabbiness, and indefinite general ill health, and forms a part of that group of cases frequently described under the term *acholia*. I mention this fact merely in order to say what is, I am sure, largely superfluous, — that *acholia* is ordinarily not what its name implies: that it has usually nothing to do with lack of bile, and that while the color of the stool is often due to a change of the urobilin, the normal coloring-matter of the stools, into so-called leuco-urobilin (colorless urobilin), it is sometimes due to a mere excess of fat in the stools, usually in the form of soaps. If examination of the stools indicates this, or if a careful investigation of the diet shows that an excess of fat is being taken, restriction of the fats will frequently go far toward correcting the condition, or will entirely do so.

In this connection, I wish merely to mention conditions in which there is icterus, and in which bile is more or less completely absent from the intestine. Through the work of Friedrich Müller and others that have followed him it has become well established that fats are usually very badly absorbed in such cases. I have myself determined that as much as 85% of the amount ingested may pass unabsorbed; the figures mentioned having been obtained in a case that was definitely determined at operation to be simple obstructive icterus. I mention the conditions in icterus only because I think they constitute a clear instance of lack of utilization of fats; and, since this is true, a large part of the fat given undoubtedly merely burdens the digestive tract. These patients are usually put on a diet that consists largely of whole milk. I think they do better on milk that is partly or entirely skimmed, and this is certainly a more rational diet for them than whole milk.

There is another group of cases to which I said I would refer, of which I have seen a number of examples and which I have never seen described. I believe, however, that they exist, and that they have some clinical importance, although how common they are I am not yet prepared to say. Their chief interest lies in the fact that from my point of view, at least, the disturbed health exhibited by them is due largely to unrecognized difficulty in utilizing fats; and the lack of recognition of their nature depends chiefly upon the fact that they may exhibit no signs of fat-indigestion that can be determined by ordinary methods of clinical observation. They appear to me to be due to metabolic difficulty in making use of fats, although whether this is actually true or not, I cannot state,

because ordinary methods of observation and of examination of the stools do not suffice to demonstrate or to exclude mild grades of trouble in the digestion or absorption of fats. The question can be decided only by accurate studies of absorption and metabolism; and these I have, as yet, been unable to make in any case, because the instances of this type that I have seen were in private patients, who could not be subjected to such studies. Hence, I cannot offer definite evidence that they were not due to disturbed fat-digestion.

So far as I know, there is in literature no clinical consideration of the possible existence of a deranged fat-metabolism, beyond the derangement that probably occurs in some cases of obesity and that which certainly sometimes occurs as a secondary matter, though a very important one, in conditions in which carbohydrate metabolism is greatly disordered; or, what amounts to the same thing, in cases in which the carbohydrate intake is much reduced — chiefly, that is, in diabetes. Some authors, indeed, indicate quite clearly that they consider that disturbance of health due to disordered fat-metabolism does not occur primarily, and is not seen unless the carbohydrate intake or the power of utilizing carbohydrate in the system is largely below normal. I cannot offer any convincing testimony that such disturbance does occur, but, as I have said, the cases that I am about to refer to appear to me to be probably instances of mild disturbance of this sort. It is, I think, wholly rational to consider that there may be such primary disorder or incapacity of fat-metabolism, just as protein and carbohydrate metabolism show limitations of varying degree in different individuals. I believe, indeed that the literature relating to acid-intoxication in diabetes and in other conditions indicates very strongly that the excessive formation of toxic products from fats, or the imperfect oxidation of such products, whichever may be the cause of acid-intoxication from fats — and not improbably it is both — may be due in some cases quite as much to actual disorder of the mechanism of fat-metabolism as to a hitch in carbohydrate-metabolism that merely involves the fat-metabolism secondarily. Certainly the degree of acid-intoxication in diabetes is by no means always in direct proportion to the degree of carbohydrate disturbance, and I do not believe that the Von Noorden school are correct in considering that acid intoxication is inevitably associated with marked reduction in carbohydrate intake. Indeed, I have seen marked cases that convinced me that this is not always true. However, even if I am correct in considering that the cases to which I am more particularly referring at present are instances of disorder of fat-metabolism rather than fat indigestion, they are not necessarily examples of ordinary acid intoxication and, therefore, do not necessarily depend upon the same factors as does ordinary acid-intoxication; and I would furthermore repeat the statement that I have not clearly shown that my cases were due to

deranged metabolism, as distinguished from deranged digestion.

I shall describe an example of these cases. The number that I have seen is limited: five or, perhaps, a sixth, in children; and two or three probable cases in adults. They may, nevertheless, be more frequent than this would indicate, for I have seen them all within a comparatively short time, since my interest in the matter was first aroused.

A very trivial matter led to my first observation of this kind: One of my medical friends, who is not a practitioner, but is a very thoughtful observer, and investigator told me casually that, as a child, his breath was very offensive, and that, no other cause having been discovered, his mother had ultimately overcome the trouble empirically by taking cream and butter out of his diet, and giving him skimmed milk instead of whole milk. He tells me that, even yet, his breath becomes offensive if he takes much rich milk or cream.

Soon after this I had referred to me by Dr. John G. Clark, a boy of ten years who had been the rounds of various doctors in Philadelphia and abroad, chiefly pediatricists and throat specialists, because his breath was so offensive that his family, and especially his mother, who was devoted to him, but had very delicate susceptibilities, found it difficult to have him in intimate contact. In addition to this most apparent symptom he was thin and sallow looking, had dark rings under his eyes, was nervous and rather irritable, and tired easily. I made a very careful general examination and studied his urine, stools and blood, but found nothing abnormal except the general look of ill health and certain conditions of the urine that I shall mention. He had no digestive symptoms, and a very competent specialist had just found the nose and throat normal. The mother said that the chief advice that had been given her as to treatment had been to get him better nourished, and hence she had been having him take milk, cream and the like freely, though not immoderately, for three years. During this time she thought that the general condition had grown rather worse than better, he had gained no weight, and his breath had undoubtedly grown worse.

I attempted to demonstrate some evidence of intestinal putrefaction or fermentation not exhibited by the symptoms or the condition of the stools, and made estimations of the ethereal sulphates and volatile fatty acids of the urine and tested the urine for indican, and the distillate from the urine for phenol and acetone. I also estimated the total nitrogen and the ammonia nitrogen. The only abnormalities were a rather marked reaction for acetone, decidedly high volatile fatty acids (120 for twenty-four hours, expressed in terms of deci-normal NaOH, using Blumenthal's method), and possibly a somewhat high amount of ammonia for a child (0.650 gm. of ammonia nitrogen and 9.5 gm. of total nitrogen). These conditions were merely sufficient

to emphasize slightly a suspicion that his difficulty was due to the fats of the diet, but they did not, of course, demonstrate it. However, I removed fat almost completely from his diet, gave him skimmed milk in generous amounts, replaced the fat by easily digested carbohydrates, and later, since he bore them well, gave him green vegetables freely. The only medication that I used was milk of magnesia, which I gave him temporarily because he had at first a little constipation and because I thought the alkali to be indicated.

The effect in this case was in most particulars exceedingly gratifying. I saw him, all told, for about two months. His breath rapidly grew sweeter, and after two weeks the mother said she rarely noticed anything wrong with it. All offensiveness later disappeared and has not, I think, returned up to the present time—a period of two years. He got a good color, became brisk and jolly, and seemed to be perfectly well, except that he did not gain in weight and remained of spare build. His condition, however, became, I was informed, better than since his early childhood.

The other cases of this class I need not detail, except for one that has since especially interested me. I would say, however, that the offensive breath that I have mentioned prominently in describing this first case has not been so noteworthy a feature of the others, although they have all exhibited it in some degree. It merely happened to be a prominent feature in the first case. The other symptoms were of the same order as in the case described; indefinite and not very characteristic evidences of lack of health, poor color, languor, frequent irritability and nervousness, and usually a rather thin build; and, — a fact of considerable importance in pointing out the source of the trouble — all were evidently, when their daily diet was investigated in detail, taking generous or immoderate quantities of fats. All, however, showed a lack of evidence of digestive disturbance or of abnormalities of the stools, upon ordinary clinical examination.

Besides the five or six such cases that I have seen in children I have observed in adults several that I think belong to this group, but they all had rather copious bowel movements and I had no opportunity to secure any definite evidence that their trouble was not attributable simply to disturbance of fat digestion.

The one further case that I wish to describe briefly is the one that I mentioned earlier in which there was definite recurrent vomiting. This patient was a girl of five who, since she was three years old, had had several times a year at irregular intervals, attacks of mild vomiting without known cause. She was the child of very intense parents, who belonged to neurotic families. The child was herself over-intense, and her attacks, from her history, seemed to bear a somewhat definite relation to overstrain. They were probably recurrent vomiting of the ordinary type but of a very mild grade.

About a month before I saw her, she had been

put by her doctor on a very generous fat diet because she was under weight, of poor color and languid, and because her mother had told the doctor that she seemed to have difficulty in taking starches. Previously she had for several years been taking rich milk freely, and also considerable amounts of butter and cream and the increase in fat made actually a very heavy fat diet. Between two and three weeks after this increase in fats, and about a fortnight before I saw her, she developed a severe attack of vomiting, more severe than she had ever had before, lasting three days.

When I examined her, I found, except for the features of her general condition that I have already described, nothing of importance. The morning after my examination, about eight o'clock, the mother sent for me to see the child at once, as she appeared to be about to develop another attack, and it was desired that I should observe it; it had been noted that the child was heavy and very languid, had a peculiar odor to her breath, and refused most of her breakfast. She was already vomiting when I got there and had a decided acetone odor about her; and her urine, which the mother had happened to secure for me early that morning before the vomiting had begun, contained a good deal of acetone, diacetic acid and betaoxybutyric acid. This attack was fairly severe, and lasted three days. She had never before had attacks in such quick succession or of such severity.

The subsequent treatment that I used was almost entire exclusion of fats from the diet, substituting for them generous quantities of readily digestible carbohydrates, which she took without any difficulty, and very moderate doses of sodium citrate. She remained absolutely free from vomiting for a year. After three months, indeed, the mother, who lived at a distance, wrote me that the child was in better general health than she had ever been. After a year, largely upon the advice of her family physician, the mother began giving the child fats again, rather generously and rather abruptly. Whether as a consequence of this or not, a very violent attack appeared within two weeks and another severe attack, which lasted nearly a week, occurred soon after this. The diet was then changed again, fats being almost entirely excluded, and since then, in a period of eighteen months, she has had no distinct attack.

Several years ago I directed attention to the apparent relation between recurrent vomiting and acid intoxication. I attempted at that time to make it clear that I realized that acid intoxication is a secondary matter, in any circumstance, and that, consequently, control of the acid intoxication could not cure the primary disorder. I hoped, however, that if it could be shown that many cases of recurrent vomiting were associated with acid intoxication, as they appeared to me to be, direct treatment of the acid intoxication might greatly relieve the symptoms of this disorder, as it does in suitable cases of diabetes. I think I was undoubtedly too optimistic at that time,



as many cases do not appear to have been greatly helped by large doses of alkali, but it has become clearly evident since then that most, if not all, of these cases do show decided evidences of an acid-intoxication that clearly stands in some direct relation with their disorder, and is not due merely to the inanition that is consequent upon prolonged vomiting and lack of food. I still believe that in some of these cases the acid intoxication is an important factor in producing the symptoms, and that treatment of it is rational, as it at least controls an evident abnormality, while the nature of the other abnormalities present is unknown. Indeed, at times, such treatment entirely overcomes the tendency to violent outbreaks. How frequently this is the case I do not know, but I have seen four cases, one of them excessively violent and rebellious, and all of them very severe, that have, I know, had no attacks since alkali treatment was first started — that is, a period, at present, of three to five years in the different cases.

Considering, then, the fact that acid intoxication does occur in these cases, and that control of this intoxication does at times seem to do decided good, and considering, also, the close relation known to exist between fatty foods and acid intoxication, it appears to me to be wise to determine carefully what the patient's diet is in regard to fats, to see to it that the amount of fats is kept low and, at the same time, to determine that generous quantities of carbohydrate of proper form are given. There is often, in these cases, a real or fancied difficulty in taking carbohydrate, and the amount of it is consequently quite frequently reduced to an abnormal and unwise extent. The case that I have cited is probably an instance of the importance of this, decidedly — the most striking instance that I have ever seen. It is by no means certain that the generous fat diet was productive of that child's attacks, but the course of her case does make it appear probable. At all events, it appears to me to be wholly possible that a diet much distorted from the normal such as is often given these patients, especially if the carbohydrate is much reduced and the fats coincidentally much increased, may occasionally be largely responsible for the attacks, and I consider it highly probable that if there is a tendency to such attacks it may readily be exaggerated by pushing the fats in the diet of a person who is not capable of managing them easily, whether the result in such cases be acid intoxication or something else.

Recurrent vomiting, while much more common in children than in adults, occurs occasionally in adolescents and adults; at least, a condition seemingly identical or closely analogous with it is occasionally seen. The remarks that I have made concerning children apply to these similar cases in older persons.

In consideration of the limits that I have purposely placed upon the character of cases to be discussed in this communication I shall let what I have said suffice for the more direct clinical

side of my remarks. I wish still, however, to lay some emphasis upon certain points regarding the methods of determining the degree to which a patient digests and absorbs fats — points that are not in any way essentially new and have been determined repeatedly by others, but that I have many times had occasion to see overlooked.

There is, I am sure, a tendency among clinicians to consider that a gross inspection of the feces, which frequently means inspection of only portions of one or more stools, combined with a microscopic examination and some easy qualitative chemical tests, furnishes fairly accurate and reliable knowledge regarding fat digestion and absorption. It is quite true that information may be gained in this way, and that at times, especially in cases with very severe disturbance, the information may be of great clinical value; but it is equally, indeed still more, true that in order that any conclusion reached may even approximate to correctness, certain other matters, chiefly the amount of fat that is being ingested and the copiousness of the bowel movements, must be taken into consideration in most instances.

At one time it was a common custom to make a rough estimation of the percentage of urea in a small specimen of urine, and to reach a conclusion therefrom as to the patient's powers of eliminating nitrogenous end products. Certainly most skilful clinicians have wholly abandoned this practice. It has become apparent that, aside from more complex and more technical reasons, any such method is utterly worthless unless one can, with considerable accuracy, determine the whole amount excreted in twenty-four hours and also the amount of nitrogenous food ingested; and can contrast these two with each other, and thereby determine whether some of the intake fails to appear in the excretion.

The same principle applies to examination of the stools for fat. Unfortunately, there is no direct and ready clinical method of determining, in most cases, with even approximate accuracy, the actual extent to which fats are digested and absorbed; and one is obliged, in the vast majority of instances, to deduce conclusions from a combination of observations of different sorts. If one desires to avoid gross error, one must go at least so far as to make a rough comparison of the intake with the excretion. In order to do this, one must determine in somewhat careful detail the character of the diet and the amount of the fat-containing foods that have been taken, and, on the other hand, one must learn how large a bulk of feces is passed within a given period. If, when this is done, examination of the stools by the ordinary methods shows that they contain only a small amount of fat, while the patient's diet contains a normal quantity, it is proper, of course, to decide that there is no serious abnormality of fat absorption. On the other hand, if large amounts of fats are passed in the stools, and the diet is not over rich in fats, it is reasonable to assume that there is poor absorption. In most cases, one cannot, when using ordinary methods, make more emphatic

or more specific assertions than these, as to the extent of fat digestion and absorption.

This is not always absolutely true. In rare instances, for example, one may see large quantities of liquid fat in copious bowel movements, and in such cases one is justified from mere inspection in deciding that there is very severe reduction of fat digestion and absorption, and even in suspecting strongly that grave pancreatic disease is present. Unless, however, such manifestly serious conditions indicate that there is unquestionably severe disease present, or unless, on the other hand, there is evidently very little fat left when considerable quantities are known to have been taken, one must be guarded in one's conclusions and must at least make a careful attempt to determine whether an apparently good absorption is not due to taking very little fat, or whether a seemingly bad absorption is not the result merely of overburdening the digestive tract with immoderate amounts. And although the amount ingested be known, even, indeed, if a test diet, such as that of Schmidt and Strassburger, is used, one must go further, and take into account the bulk of the bowel movements in one, or, better, in several definite periods, or one may still fall into error. It is easy when the total bulk of the feces is very small to be deceived into thinking that a large *relative* amount of fat means a large *absolute* amount, and grossly wrong conclusions may be reached by overlooking this point.

A case that I have recently studied will illustrate this: The details essential to my present purpose are that the patient, a woman of forty-seven years, was admitted to the private ward of the University Hospital under the care of Dr. Frazier, with a diagnosis of chronic appendicitis. She presented no signs of appendicitis but had had digestive symptoms and loss of weight for several months, and an examination of her feces by a man exceptionally skilled in this work had shown that they seemed to be composed almost entirely of fats and soaps. In the absence of jaundice, this led to a strong suspicion that the patient had either severe pancreatic disease or extensive and grave disease of the intestine, probably the former. Her digestion of albumin was, however, apparently good. In order to determine the severity of the disturbance of fat absorption, I estimated the total intake of fats throughout three days, and marked off the feces of this period with carmine. I then estimated the amount of fat and soaps in the feces, after drying and pulverizing, by means of extraction in the Soxhlet apparatus, the soaps having been converted into fatty acids by heating with acid alcohol.

She took during this time 142.24 gm. of fat and passed in the feces 17.12 gm. of fat, including soaps. She had, then, rather poor absorption, but it was very much better than was indicated by the qualitative examination. Her feces were, as had been reported, composed in very large part (66.6%) of fat and soaps, but the total amount of feces — only 25.67 gm. of dry residue

in three days — was so extremely small that the high relative amount of fat that they contained became of very much less importance than it had seemed to be, and really indicated only an extremely moderate grade of disturbance of absorption (only 12% of the intake having been passed in the feces), instead of the very severe grade that had been thought at first to be present. The condition of the stools became, thereby, entirely compatible with a moderate grade of chronic enteritis — a diagnosis that the other circumstances in the case and the effect of treatment made by all means the most probable.

In addition to the precautions that I have already recommended, one should, before drawing important conclusions from an examination of the feces, know something of the rapidity of peristalsis; and one must sometimes interpret findings, both as to the amount and as to the character of the fat in the feces, directly in accordance with this. Brugsch, for example, has carefully studied a case that was clearly a neurotic disturbance with precipitate peristalsis, and he found very pronounced disturbance of fat absorption, over 40%, even, of the ingested fat having been passed unabsorbed. In his case, the fats were well split; but in some cases of hurried peristalsis, whether due to neurosis or to other causes, there seems to be insufficient time for the splitting — possibly, also, disturbed ferment action. Some persons, for example, are mildly purged by olive oil or other oily fats, the oil in some of these instances, and possibly in all, seeming to act merely as a mild irritant or as a lubricant, and the contents of the intestine are at times very quickly passed along in such cases, and noteworthy amounts of the oil may appear in the feces unchanged, and even in liquid form. This is of importance in relation to the fact that it is commonly considered that the presence in the feces of any considerable amount of neutral fat, especially in liquid form, is strongly suggestive of severe disease, more particularly of the pancreas. When very considerable amounts are present, this is almost always a correct tentative conclusion, provided that unduly large quantities have not been taken in the food; but unless the abnormality is exceedingly striking, one should not draw hasty conclusions until one has determined that it is not the result merely of hurried peristalsis.

If the question be looked at in the manner that I have indicated, I think that one can determine extremes with a reasonable degree of accuracy; that is, one can in some cases learn that fat splitting and absorption are apparently very good, and in some others that they seem to be very bad. Even when the disturbance is only moderately severe, one can reach a fairly accurate conclusion. In the numerous cases, however, in which the percentage of splitting or absorption of fat is neither very bad nor very good, examination of the feces is an uncertain and unreliable guide, when done by ordinary methods; and it is particularly so, unless combined with careful consideration of the clinical features of



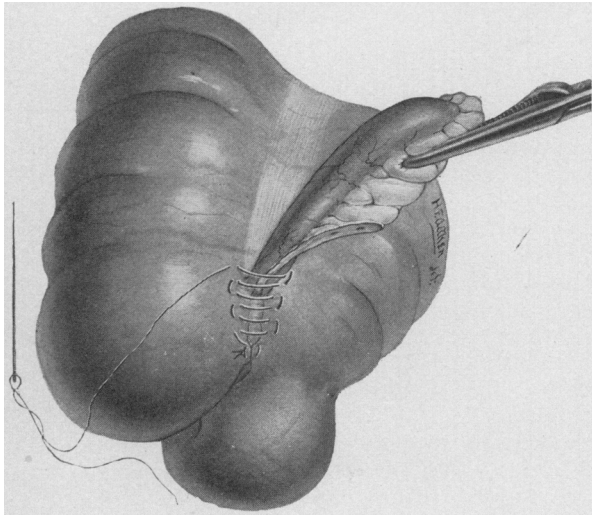


FIG. 1.

Shows the first three or four right and left sutures for inversion and infolding of the appendicular stump.

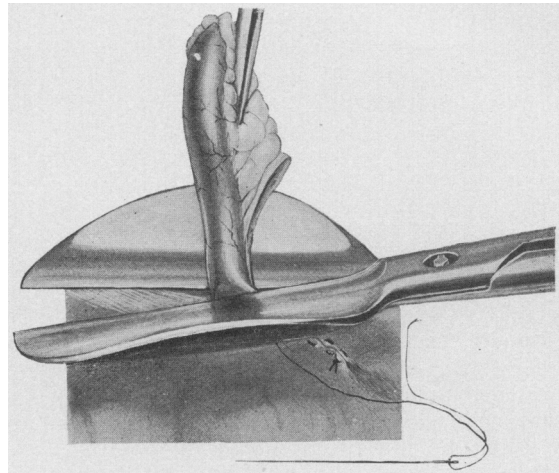


FIG. 3.

Represents gentle traction upon the appendix and amputation with appendix scissors.

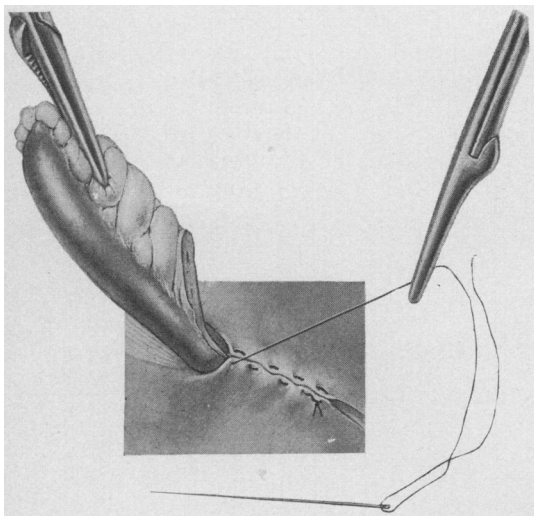


FIG. 2.

Shows the base of the appendix partly buried, yet on gentle traction of the appendix and relaxation of the suture it emerges sufficiently to facilitate amputation at its junction with the cecum.

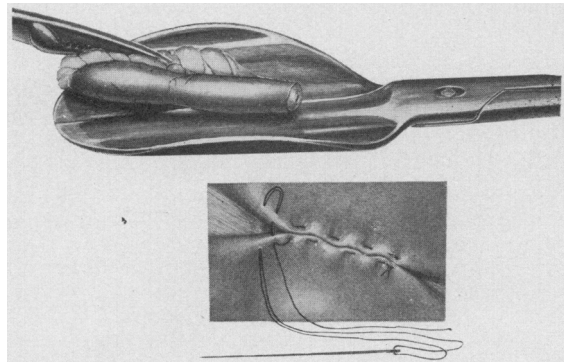


FIG. 4.

This cut represents the appendix lying in the concavity of the appendix scissors. The stump has spontaneously inverted. Two or three more right and left passes of the suture completes the operation.

the case, together with detailed inquiry concerning the habitual diet, the bulk of the feces, and, in suitable cases, a trial of the effect of altering the amount of fat taken. Accurate determination of the fat ingested, and of the amount split and absorbed, is the only method of furnishing definite knowledge in most cases, and this is, of course, so tedious and burdensome a measure that it is impossible to use it in ordinary clinical work.

This is naturally very unfortunate in many instances, particularly in cases in which graver clinical questions than most of those that I have considered arise. It is especially unfortunate in cases suspected of pancreatic disease, for while in such cases it is occasionally possible to reach very important conclusions by means of simple methods of studying the feces, in a large proportion of instances these methods do not give any definite aid; but on the other hand, the work of Friedrich Müller, Deucher, Ury and Alexander and Brugsch has shown that careful studies of digestion and absorption, although they not infrequently leave the question wholly unsettled, often do throw the weight of evidence largely upon one side or the other.

Nevertheless, in the group of cases that I have especially referred to in this paper, in which, to be sure, the disorder of fat indigestion and absorption is not usually severe and in which, therefore, ordinary examination of the feces is likely to give at best extremely approximate results, it is, as a rule, less important than in pancreatic and other severe cases to determine the actual degree of fat splitting and absorption. It would frequently be very useful for purposes of prognosis and of accurate diagnosis, but the main purpose in these milder cases is accomplished if one reaches a clinical conclusion that is sufficiently accurate to point out clearly—or, at least, to suggest—that the fats should be restricted; whether the symptoms in the case be due merely to a rebellious stomach, to poor digestion of fats in the intestines or to the patient's simply overburdening himself with undue quantities of fat in his diet.

### A SIMPLE METHOD OF TREATING THE APPENDICULAR STUMP.

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At the outset the writer wishes to distinctly state that the method herein set forth applies to appendicular stumps, the tissues of which are in a normal or an approximately normal condition. It is therefore applicable to nearly all cases of interval appendectomies and all cases of acute appendicitis when the inflammatory changes have not involved the tissues of the cecum about the base of the appendix.

The method was devised and has been used for the purpose of reducing to the minimum the danger of infection of the abdominal wound from the appendicular stump and to simplify the technique of appendectomy.

In the present era of appendicular surgery, a very large percentage of appendectomies are in cases where the appendix is still unruptured; therefore, if, in the process of healing, suppuration appear in the wound and culture examination show it to be from colon bacillus infection, such must be accepted as proof that the method of dealing with the appendicular stump was defective. In other words the method was such as permitted material to escape from the appendicular stump and become smeared upon the freshly cut tissues of the abdominal wound. That this is a real danger needs no argument. In the prevailing method, of ligating the base of the appendix, amputating it and touching the exposed mucous membrane with the thermocautery, the pathway is open for conveying infection to the surrounding tissues.

Furthermore, such a method of dealing with the part is surgically a shiftless one, because ligation *en masse* approximates mucous surfaces for amalgamation, which we know does not readily take place, and, moreover, an appreciable amount of tissue is strangulated which would in the natural course of events undergo retrograde changes. Surrounding the base of the appendix with a pursestring suture and inversion before tying, is a much better mechanical arrangement of the parts but considerable manipulation in the way of preliminary dilatation of the opening, before inversion can be easily accomplished, is usually necessary, and the process affords opportunity for escape of liquid feces and gas. Therefore this method is open to more serious objection than the former. The method recently exploited, of crushing the tissues of the base of the appendix *à la* Doyen and then cauterizing, is open to the objection that it lacks simplicity, calling for two special instruments,—a crusher and a thermocautery.

Any and all of these methods in the hands of a skillful and careful surgeon, surrounded by the safeguards of a well-organized hospital clinique, yield good results, but for simplicity of technique and reliability, the writer has found nothing equalling the method herein described.

#### DETAILS OF METHOD.

After the appendix has been exposed and brought into the field of operation as far as circumstances will permit, the meso-appendix is ligated and divided in the usual way. An intestinal needle with fine silk, or Pagenstecher thread, is passed through the cecal coats on the meso side of the appendix, including the edges of the peritoneum which have been severed in the cutting away of the meso appendix. The needle then takes up a dip of peritoneum just outside the mesenteric wound, skips over to the other side, takes up a corresponding dip and is tied. This constitutes the first step in the suturing, the remainder being a continuation of the same in the form of a right and left continuous suture, applied in such a way as to gradually embrace the circumference of the base of the appendix and at the same time bury it. (See Fig. 1.) After