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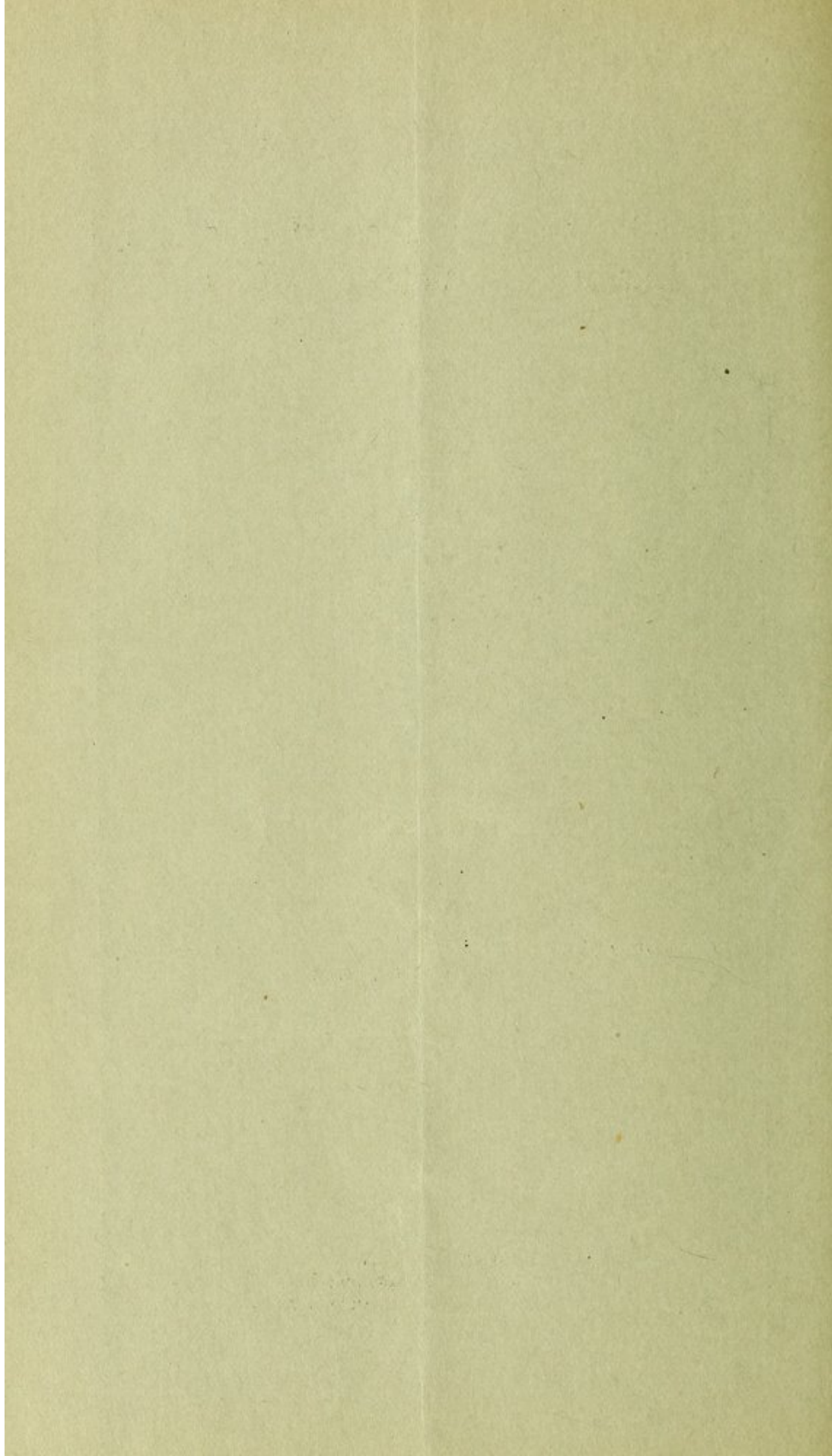
# The Operation of Gastro-Jejunostomy and Its Physiologic Effects.

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## THE OPERATION OF GASTRO-JEJUNOSTOMY AND ITS PHYSIOLOGIC EFFECTS.\*

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When your distinguished President of last year conveyed to me a cordial invitation to be present at this meeting of the American Medical Association, I accepted at once, thinking of the opportunity which I should have of seeing for myself and profiting from the work of the many in your country whose fame has spread across the sea. When I came to seek for a subject on which to address you, however, I realized the rashness of my ready compliance. So much work has been done here on that branch of surgery in which I am especially interested that I felt that, were I to dwell on any purely surgical aspect of gastric disease, I should be going over ground already familiar to you, and so should be trespassing too far on that indulgence and leniency which I have heard you so invariably extend to those who are your guests.

In my Hunterian lectures,<sup>1</sup> delivered before the Royal College of Surgeons last year, I gave the results of some investigations into the effect of the operation of gastro-jejunosomy on the metabolism of the human body. After some consideration I determined to pursue those investigations further and to lay the results before this meeting.

When, as was the case but a few years back, the operation of gastro-jejunosomy was performed only as a last resort in cases of pyloric stenosis, physiologic questions

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\* Read in the Section on Surgery and Anatomy of the American Medical Association, at the Fifty-eighth Annual Session, held at Atlantic City, June, 1907.

1. Gastric Surgery, London, 1906.



were a secondary consideration, but at the present time, when the operation is frequently advised for conditions such as intractable gastric ulcer, in which it is an operation of expediency rather than of necessity, a knowledge of its precise effects on the gastric and metabolic functions of the body must be one of the determining factors in the decision for or against operation. It is on this aspect of gastro-jejunostomy that I purpose to offer some observations for your consideration.

#### THE EFFECT OF GASTRO-JEJUNOSTOMY ON THE FUNCTIONS OF THE STOMACH.

*The Presence of Bile in the Stomach.*—All observers are agreed that a certain amount of bile finds its way into the stomach after the operation of gastro-jejunostomy. It is said that the quantity is at first fairly abundant, but after a few weeks considerably less.

In my own experience it is rare to find bile in the fasting stomach, and I regard its presence under such conditions as evidence of inefficiency of the efferent opening. The fluid drawn off one hour after a test breakfast often appears to contain bile, but Gmelin's test usually gives a negative result. If the gastric contents be tested two hours after a test meal, Gmelin's test is frequently obtainable. I use the expression obtainable advisedly, for considerable care is often requisite to demonstrate the presence of bile, although from the appearance of the gastric contents one would judge that it is present in some quantity.

Indeed, I believe that the amount of bile which regurgitates into the stomach is considerably overestimated. Gmelin's test does not give a positive reaction unless bile be present to the extent of about 5 per cent., and the green color of the test is, as a rule, only just visible and sometimes can not be seen at all. It is probable, therefore, that the regurgitated bile forms not more than 5 or 6 per cent. of the stomach contents. I need hardly point out that if bile gains entrance into the stomach pancreatic secretion must do so as well.

Granted, then, that there is a permanent reflux of bile into the stomach after gastro-jejunostomy, the question arises, Is its presence harmful? All the evidence indicates that it is not, provided the efferent opening of the



anastomosis is efficient. Dastre<sup>2</sup> and Masse<sup>3</sup> have shown that in dogs the presence of bile in the stomach does not interfere with the digestion and general health. The well-known case reported by Moynihan<sup>4</sup> as well as the results of the operation of cholecysto-gastrostomy in man, confirm these observations, while the metabolism experiments, to which I will refer later, afford further evidence to the same effect. Indeed, I think we may safely affirm that, in part at least, the beneficial effects of gastro-jejunostomy on gastric ulcer are due to the entrance of the alkaline pancreatic juice and bile into the stomach.

*The Effect of Gastro-jejunostomy on the Gastric Secretion.*—The most marked effect of gastro-jejunostomy is the diminution of the total acidity of the gastric contents which follows operation. At first sight it would appear that this diminution is but the result of partial neutralization of the gastric contents by the bile and pancreatic juice which gain entrance into the stomach. But the problem is not such a simple one.

Time will not permit me to describe in detail the observations which I have made on this interesting subject, so I will briefly indicate what appear to me to be the chief factors at work.

From an examination of a considerable number of cases I find that the average diminution of the total acidity after gastro-jejunostomy is about 35 per cent. There are several reasons which appear to me to indicate that this diminution is not due solely to partial neutralization.

First, judging by the amount of bile usually found in the stomach, the diminution is too great to be the result of a purely chemical reaction.

Second, if the diminution were the result of a chemical reaction we should expect all the free hydrochloric acid to be neutralized, but this is not invariably the case. In several cases I have found free hydrochloric acid present, and in those cases in which it has been present before operation it can usually be demonstrated after operation, by giving a suitable test meal, such as Leube's.

2. Archives de Physiol., 1890, II, 316.

3. Congres Francais de Chirurgie, 1898, 300.

4. Brit. Med. Jour., 1901, 1136.



Third, there is a diminution of the total chlorids in the gastric contents which must be the result, not of neutralization, but of diminished secretion. Two factors at least, therefore, appear to be at work in bringing about the diminution of total acidity which is found after gastro-jejunostomy: 1, A diminution of the total chlorids secreted; 2, partial neutralization of the gastric contents by bile and pancreatic juice.

The brilliant researches of Pawlow<sup>5</sup> and his co-workers have demonstrated the striking interdependence of the secretions of the digestive glands, and it is this interdependence which seems to me to afford us a reasonable explanation of the diminution of chlorids. We may, I think, safely assume that during the churning movements of the stomach some of the gastric juice will be, as it were, squeezed through the anastomotic opening. This escape of some of the acid will prevent the total acidity rising as high as would otherwise be the case. But it will have a further effect. The presence of an acid fluid in the jejunum causes a secretion of pancreatic juice (Wertheimer).

Thus after gastro-jejunostomy, if my hypothesis be correct, the early presence of acid in the jejunum will lead to a flow of pancreatic juice at an earlier period of digestion than in a normal individual. With this earlier stimulation of the pancreas there will be a correspondingly earlier diminution of the gastric secretion, and, as a consequence of this, a diminution in the total chlorids secreted by the gastric mucous membrane. Possibly other factors are at work, such as an inhibitory effect of secretin or other constituent of the pancreatic juice. In those cases in which there has been hyperacidity before operation the removal of the abnormal excitation of the gastric mucosa, which results from spasmodic stenosis of the pylorus, will lead to a considerable diminution of the total chlorids, and it is certainly significant that it is just in these cases of gastric ulcer with hyperacidity that the diminution of the total acidity of the gastric contents is most marked.

*The Effect of Gastro-jejunostomy on Gastric Digestion.*—Some authorities maintain that gastric digestion is lost after gastro-jejunostomy. Even if this were true, it is not of such importance as would at first sight appear, for we know from the experiments of Pachon and



Carvalho<sup>6</sup> on dogs, from the observations made on Schlatter's<sup>7</sup> celebrated case of total gastrectomy, as well as from the clinical evidence afforded by those patients who have survived complete removal of the stomach, that Nature is able to dispense with this organ. There is, perhaps, nothing more wonderful in the whole range of surgery than that human beings should not only survive the operation of total gastrectomy, but should remain for years in the enjoyment of perfect health and activity. I need hardly remind you that the first surgeon to conceive and carry out this daring project was one of your own countrymen.

Notwithstanding, however, Nature's adaptability, the retention of gastric digestion undoubtedly adds to the resisting power of the individual in the struggle for existence. Personally, I do not believe that loss of gastric digestion is a necessary consequence of a short circuit between the stomach and jejunum. Those who have expressed an opposite view base their conclusions on the subsequent diminution of chlorids found in the gastric contents. This argument is not conclusive, as the chlorids may be greatly diminished without the loss of gastric digestion. Further, unless atrophy of the mucous membrane is advanced owing to disease existing before operation, there is, in my experience, usually a progressive increase in the chlorids secreted during the digestion of a test meal. A more conclusive indication of the extent of gastric digestion can be gained from an examination of the feces. Schmidt has shown that only the gastric juice can digest raw connective tissue. I have on many occasions fed patients, after gastro-jejunostomy, on raw beef, but have never found any undigested connective tissue on microscopic examination of the feces.

*The Effect of Gastro-jejunostomy on the Motility of the Stomach.*—Impairment of the motility of the stomach is a much more serious matter than impairment of its secretion, for it appears that the stomach, if its peptic power be reduced, endeavors to make up for the failure of digestive power by greater energy in moving on its contents. Under these circumstances the food leaves the stomach incompletely digested, but this does not seem of serious import, for Von Noorden maintains that

6. Comptes rendus de la Société de Biologie, 1893, 794.

7. Hofman: Münch. med. Wochschr., May 3, 1898.



the intestine can vicariously assume the peptic functions of the stomach. I have already pointed out that after gastro-jejunostomy some diminution of the gastric secretion occurs; if then it were the case that gastro-jejunostomy in addition impairs the motility of the stomach, the usefulness of the operation would be considerably curtailed.

Diverse views have been expressed on this subject. Hartmann and Soupault, Rydygier, and Rosenheim found the motility of the stomach permanently impaired; Carle and Fantino, on the other hand, maintain that the emptying of the stomach is hastened rather than retarded. It is, I think, possible that in such investigations the existence of impaired motility before operation has not always been excluded. Although motor insufficiency be present after operation, we can not assume that the insufficiency is due to operation unless we have shown the stomach to have been normal in this respect before operation.

I have investigated the motility of the stomach before and after gastro-jejunostomy in a considerable number of cases, but I will now refer only to three typical examples:

CASE 1.—The first of these was a woman on whom I performed gastro-jejunostomy for repeated attacks of hemorrhage from a gastric ulcer. Examination before operation showed that on an average the stomach was empty three and a half hours after a test breakfast. Two months after operation a number of observations showed that the stomach was empty four hours after a similar test meal. You will observe that although the motility was slightly impaired by operation, the delay in evacuation did not exceed the physiologic limits. This case raises the question: How does gastro-jejunostomy influence those cases of gastric ulcer in which the motility of the stomach is not impaired? I will return to this point later.

CASE 2.—The second observation was carried out on a patient on whom I performed gastro-jejunostomy for gastric tetany, with almost complete pyloric stenosis and greatly impaired motility. Two years after operation examination showed the stomach to be empty on two occasions four hours after a test breakfast, and on another occasion, four hours after a full dinner, only 25 c.c. of fluid containing a trace of bile was drawn off.

CASE 3.—Observations on a third patient showed that before operation 20 c.c. of fluid remained in the stomach four hours after a test breakfast. One month after operation, at which a chronic gastric ulcer with dense adhesions to the abdominal



wall was found at the cardiac end of the stomach, examination showed that on one occasion 15 c.c., and on another occasion 5 c.c. of slightly green, tenacious fluid, showing a faint Gmelin's reaction, remained in the stomach three and a half hours after a test breakfast.

From these and numerous other observations I think we may conclude that, in those cases in which the motility is markedly impaired by pyloric stenosis or by adhesions, the operation of gastro-jejunostomy usually results in a marked improvement in the evacuation of the stomach contents. In those cases, on the other hand, in which before operation the motility is unimpaired, gastro-jejunostomy may either slightly retard or slightly hasten evacuation, but inasmuch as this retardation or acceleration falls within the physiologic limits we are justified in saying that in cases in which the motility is normal before operation the evacuation of the stomach is for practical purposes unchanged by gastro-jejunostomy.

*Is Gastro-jejunostomy a Drainage Operation?*—The observations on the motility of the stomach which have already been mentioned are against the view that gastro-jejunostomy is a drainage operation, and W. B. Cannon and J. B. Blake<sup>8</sup> in their invaluable article also put forward strong arguments against such a supposition. These writers, too, from observations on dogs by means of Roentgen rays, have come to the conclusion that in cases in which the pylorus is unobstructed the food continues to pass through the pylorus rather than through the new opening. Are we justified in assuming that this holds good for a human being if the anastomotic opening is made of large size? It is at least suggestive that in the only case in Cannon and Blake's series in which the food passed out through the anastomotic opening rather than through the pylorus the opening which had been made was a large one. This observation appears to me to be a most important one. It emphasizes the necessity for a large anastomotic opening, which is, in my judgment, the most important point in the technic of gastro-jejunostomy.

*To What Are the Beneficial Effects of Gastro-jejunostomy on Gastric Ulcer Due?*—Most writers have assumed that gastro-jejunostomy is a drainage operation, and have attributed the beneficial effects of the opera-

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8. *Annals of Surgery*, May, 1905.



tion on gastric ulcer to hastened evacuation of the stomach. If this be true it follows that, in those cases of gastric ulcer in which the motility of the stomach is normal, the operation of gastro-jejunostomy would be of no avail. This has not been my experience. I have already told you of a case in which the motility was slightly impaired after operation. Notwithstanding this impairment the patient rapidly improved, lost all her gastric symptoms and has remained ever since in excellent health. Indeed, some of the most striking successes I have witnessed have been cases in which before operation there was no evidence of delayed evacuation of the stomach. We must, therefore, I think, look for some other factor than drainage to explain the influence of gastro-jejunostomy on gastric ulcer.

There is a general agreement that hyperacidity is the factor which prevents healing of gastric ulcer. After gastro-jejunostomy there is a marked diminution of the total acidity of the gastric contents, which diminution does not depend on improved evacuation. Are we not justified in assuming that it is to this diminution of the gastric acidity that the beneficial effects of gastro-jejunostomy on gastric ulcer are due?

#### THE EFFECT OF GASTRO-JEJUNOSTOMY ON THE METABOLISM OF THE HUMAN BODY.

In the year 1897 Jöslin<sup>9</sup> published some observations on the metabolism of two patients on whom gastro-jejunostomy had been performed. He maintained that as a result of this operation there is a marked diminution of the proportion of nitrogen absorbed from the food, and an ever more marked diminution in the fat absorption. These conclusions have been accepted without question. In my book on Gastric Surgery, published last year, I gave details of observations on four patients in whom the absorption of fat and nitrogen was practically unaffected.

There still are writers who dilate on the evil consequences of this operation and of the interference with the physiology of digestion which it entails. Two years ago a distinguished surgeon wrote: "It is improbable that so much interference with the anatomy and physiology of digestion as this operation involves can be tolerated without some ill effects." As recently as six

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9. Berl. klin. Wochschr., 1897, 1047.



months ago another writer remarked: "The interference with the physiology of digestion which such an operation entails is not well tolerated." He then pointed out the necessity for the existence of the acid medium of the stomach with its pepsin for the digestion of the fat cells and starch granules.

I have already pointed out to you the evidence that connective tissue digestion continues after gastro-jejunostomy, and I will now endeavor to prove, from the further observations which I have made, that these hypotheses about interference with the nutrition of the body are unsupported by chemical pathology or clinical experience. Indeed, it was the remarkable evidence I obtained in investigating the remote history of a large number of patients on whom gastro-jejunostomy had been performed which led me to doubt the accuracy of Joslin's conclusions, and to test their correctness by the touchstone of experimental demonstration.

#### CLINICAL OBSERVATIONS.

OBSERVATION 1.—This was carried out on a man aged 26, five months after I had performed anterior gastro-jejunostomy for gastric ulcer. During the four days which the observation lasted, the patient absorbed 91 per cent. of the nitrogen taken in his food and 92.3 per cent. of the fat. Now in a series of metabolism experiments on 75 apparently healthy individuals on a mixed diet, Harley and Goodbody found that the highest nitrogen absorption amounted to 97.07 per cent. and the lowest to 90.1 per cent. of the nitrogen taken in the food, the average absorption being 93.46 per cent. of the nitrogen taken in the food. As regards fats, Harley and Goodbody found that the highest absorption amounted to 98.5 per cent., and the lowest to 90.19 per cent. of the fat taken in the food, the average absorption of 79 observations being 95.05 per cent. If you will compare the results of my observation after gastro-jejunostomy, you will see that the nitrogen absorption is only 2.4 per cent. below the average, and the fat absorption 2.7 per cent. below the average, and both nitrogen and fat absorption are higher than the lowest absorption found in a healthy individual.

OBSERVATION 2.—This observation on a patient (also on a mixed diet) seven months after gastro-jejunostomy and suture of a perforated gastric ulcer, showed a nitrogen absorption of 90.5 per cent., and a fat absorption of 92.5 per cent. Comparing these figures with those which I have quoted from Harley and Goodbody, you will observe that the nitrogen absorption is 2.9 per cent., and the fat absorption 2.5 per cent. below the av-



erage, but both nitrogen and fat absorption are above the lowest percentages found in healthy individuals.

OBSERVATION 3.—This was made on a patient on a mixed diet two years after gastro-jejunostomy for gastric tetany, and I may mention for the interest of those who regard the functions of the duodenum with reverence, that there existed complete obstruction of the pylorus, so that the food could pass only through the anastomotic opening. During four days on a liberal mixed diet (40 kilograms for each kilogram body weight) the patient absorbed 92.1 per cent. of the nitrogen taken in the food, and 92.7 per cent. of the fat. In other words, the nitrogen absorption was 1.3 per cent. and the fat absorption 2.3 per cent. below the average, both nitrogen and fat absorption being above the lowest absorption found in healthy individuals.

OBSERVATION 4.—This was carried out on a patient on a milk diet one month after gastro-jejunostomy for gastric ulcer. The nitrogen absorption amounted to 92.7 per cent. of the nitrogen in the milk taken, and the fat absorption 94.7 per cent. Compared with the average absorption of a healthy person on a milk diet, these figures show a diminished nitrogen absorption of 1.5 per cent. and a diminished fat absorption of 1.4 per cent., both nitrogen and fat absorption being higher than the lowest percentage absorption found in a normal individual.

OBSERVATION 5.—This was made on a patient on a mixed diet, one month after gastro-jejunostomy for pyloric stenosis. In this instance 92.4 per cent. of the nitrogen and 93.5 per cent. of the fat taken in the food was absorbed, the figures being 1.0 per cent. and 1.5 per cent., respectively, below the average, but both well above the lowest normal absorption.

The preceding observations were made on patients on whom anterior gastro-jejunostomy had been performed; the remaining four observations were carried out on patients on whom I had performed the posterior "no-loop" method.

OBSERVATION 6.—This was carried out on a patient on a milk diet one month after gastro-jejunostomy for gastric ulcer. The nitrogen absorption was 91.2 per cent. and the fat absorption 92.3 per cent. of the fat taken in the food, that is, the nitrogen absorption was 3.0 per cent. and the fat absorption 3.8 per cent. below the average.

OBSERVATION 7.—This was made on a patient on whom I had performed gastro-jejunostomy for duodenal ulcer with partial stenosis and who was on a milk diet. The nitrogen absorption was 92.2 per cent., and the fat absorption 95.4 per cent.; that is, the nitrogen absorption 2.0 per cent. and the fat absorption 0.7 per cent. below the average absorption on a milk diet in a healthy individual.



OBSERVATION 8.—This was made on a patient on whom I had performed gastro-jejunostomy for gastric ulcer. The patient was placed on a milk diet and the observation lasted seven days. During this period the man absorbed 93.5 per cent. of the nitrogen and 94.1 per cent. of the fat taken in the food. In this case the nitrogen absorption was 0.9 per cent. and the fat absorption 0.9 per cent. below the average.

OBSERVATION 9.—This, too, was made on a patient on a milk diet twenty-four days after gastro-jejunostomy for gastric ulcer. In this patient 92.4 per cent. of the nitrogen and 96.8 per cent. of the fat taken in the food were absorbed, a diminution of 1.8 per cent. in the case of the nitrogen, and in the case of the fat an increase of 0.7 per cent. above the average.

Taking the whole series of nine observations, the average diminution of nitrogen absorption is 1.7 per cent. and the average diminution of fat absorption 1.9 per cent., while in every instance the variation is within the limits found in individuals who are in good health.

It may be urged that in those cases of this series in which there was no pyloric stenosis the food passed out through the pylorus rather than through the anastomotic opening. If this be true, although I am not prepared to admit it, it does not affect the conclusions to be drawn from the observations. We know clinically that gastro-jejunostomy has a very beneficial effect on gastric ulcer. This effect is probably due to the diminution of the acidity of the gastric contents which the operation brings about. Which route is taken by the food is a matter of academic interest, as it does not affect the therapeutic value of the operation. The important point is that the short circuit does not appreciably affect the metabolism whether the pylorus be patent or not, for you will observe that in those patients who have marked pyloric stenosis the absorption after operation is as good as in those in whom the pylorus is patent.

It is interesting to look back and observe how incomplete knowledge leads to the formation of erroneous hypotheses, and how as knowledge progresses facts apparently irreconcilable become reconcilable. Pawlow showed that the injection of acid into the duodenum causes a flow of pancreatic juice and that the acid chyme passing through the pylorus acts in the duodenum as the normal stimulus of the pancreatic gland. Herein apparently lay the cause of the loss of fat absorption which was supposed to follow gastro-jejunostomy.



Since after this operation the food passes directly into the jejunum, it was urged that the normal stimulus of the pancreas is absent, and that consequently there is a diminished flow of pancreatic juice, and as a result of this serious impairment of fat absorption. Now, Wertheimer has shown that the flow of pancreatic juice can be excited by the introduction of acid into the jejunum, and more recently Bayliss and Starling<sup>10</sup> have demonstrated that the stimulus is not a reflex one, but due to a substance which they call secretin, which is conveyed to the pancreatic gland through the blood stream. Therefore, both the hypotheses as to the diminished fat absorption and as to the cause of this supposed diminution are now shown to be erroneous. The physiologic and chemico-physiologic facts as we know them agree, for I hope that I have been able to prove that the digestion and metabolism of the human body are practically unaffected by the operation of gastro-jejunostomy, while the researches of Wertheimer and Bayliss and Starling tell us why the alteration of the route taken by the chyme does not prevent adequate stimulation of the pancreatic gland. Is it not a striking example of the wonderful power which Nature possesses of adapting herself to the altered conditions brought about by surgical intervention?

These experimental observations are supported by the evidence of clinical experience. May I remind you of one striking fact. As I have pointed out before, there are at the present time children alive and in perfect health on whom this operation was performed in early infancy. It is inconceivable that they would have lived for six or seven years and developed into strong healthy children had the operation the harmful effects which have been attributed to it.

Lastly, let me say this: Just because gastro-jejunostomy is not in itself harmful, there is a danger that we may be tempted to resort to it in doubtful cases in the hope that good may come. Great as is my respect for gastro-jejunostomy, I am no advocate of such a course. To operate for subjective symptoms in the absence of definite clinical and chemical signs is, to say the least, unscientific. Above all, we must guard against the failure and discredit which results from operation

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10. Proceedings Royal Soc., 1902, 352.



on neurasthenics and on those patients who, as Dr. W. J. Mayo so pithily puts it, "have had their movable organs fixed and their removable ones removed." Such persons, as we all know, are often only too ready to tempt fortune further at the shrine of surgery. Neither gastro-jejunostomy nor any other surgical procedure short of the removal of the higher centers of their brains will cure such of their ills.

The technic and statistics of gastro-jejunostomy I do not purpose to discuss. They have been recently fully dealt with in addresses delivered before this association. If you will allow I should, however, like to bring to your notice two time-saving devices which I have found of great value. The first is this set of suture reels. Each reel is of a different length so that the different sizes of silk or thread are wound on different sized reels, and the surgeon is able to see at a glance without examination of the suture material, which size of ligature he requires during the course of the operation.

The other device is this pattern of needle, which may be called a "grip-eyed" needle. It is designed to obviate the inconvenience and delay caused by the accidental unthreading of needles during suturing, and is especially adapted for continuous suturing. By pulling the suture firmly into the extremity of the eye furthest from the point the thread is firmly gripped so that it can not slip out.

#### SUMMARY.

To sum up, we are, I think, justified in drawing the following conclusions as to the physiologic effects of gastro-jejunostomy:

1. A certain amount of bile and pancreatic juice enter the stomach after gastro-jejunostomy, but the amount is small and has no injurious effect.

2. The acidity of the gastric contents is markedly diminished, usually about 30 or 35 per cent. This is due partly to a diminution of the total chlorids secreted, and partly to the partial or complete neutralization of the free hydrochloric acid by the alkaline bile and pancreatic juice, and probably also to earlier stimulation of the pancreatic secretion, and compensatory earlier fall of the gastric secretion. In gastric ulcer cases the removal of spasmodic stenosis of the pylorus likewise tends to diminish the total acidity.



3. Gastric digestion is impaired but not lost after gastro-jejunostomy.

4. The motility of the stomach, if normal before operation, is for practical purposes unaffected. Gastro-jejunostomy is, therefore, not a drainage operation. Its beneficial effects on gastric ulcer are due to the diminution of the acidity of the gastric contents.

5. Gastro-jejunostomy has no material effect on the metabolism of the human body, the percentage of nitrogen and fat absorbed being within the limits observed in individuals who are apparently healthy. This chemico-pathologic evidence is supported by evidence of clinical experience.

In conclusion it is my pleasant duty to thank you one and all most cordially for the honor you have done me in inviting me to address this meeting of your association. Conscious as I am of the fragmentary nature of my remarks, I would remind you that just as "Nature exists in leasts," so the science of medicine has been built up by the accumulation of little facts. I venture to think that the dry bones of the observations which I have put before you are in reality clothed with the interest of practical importance in the surgery of the stomach.

Be that as it may, this at least I hope, that such visits as mine serve as an evidence of that good fellowship which should, and I believe does, exist between members of our profession in the old world and in the new. Although separated by the sea, we are united in the brotherhood of our common art. May we each glory in the share the other takes in its advancement. Let us say, as Marcus Aurelius said of old, "What matter by whom the good is done"?

And here may I pay a tribute to those in your country, some of whom now no longer speak to us, who have played so great a part in the progress of gastric and intestinal surgery. To mention only a few of these, the work of Halsted and Cushing on intestinal suturing, the work of Murphy on intestinal anastomosis, and the brilliant results of the Mayos, Ochsner, Finney, Deaver and others, are landmarks in the history of the surgery of the stomach. And let us not forget the early work of Senn, the father of intestinal surgery, and of O'Connor, whose conception and intrepid execution of the first



total gastrectomy gave a powerful stimulus to gastric surgery. All honor to those early pioneers. Let us strive to follow in their footsteps.

"Science moves but slowly, slowly, creeping on from point to point;

Men, my brothers, men the workers, forward, forward let us range."

The science and art of surgery is incomplete and incompletable. We are aiming for a goal which we may never reach, but as your great writer, Emerson, says:

"The persuasion that we must search that which we do not know, will render us beyond comparison, better, braver, and more industrious, than if we thought it impossible to discover that we do not know, and useless to search for it."



