

BENIGN OBSTRUCTION OF THE PYLORUS.¹

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CONGENITAL OBSTRUCTION.

BENIGN obstruction of the pylorus may either be congenital or acquired. Of the congenital variety, we may distinguish two forms,—one which presents itself as a complete closure of the first part of the duodenum and pylorus, the intestinal tract at this point being either converted into a fibrous band, or showing a stenosis of very high degree, and another, generally at the outset, moderate narrowing, which is always situated at the pylorus, and becomes clinically apparent only after several months of life. The first variety is supposed to be the result of a foetal peritonitis, of probably syphilitic origin, and generally causes death in a few days. The second, known as congenital hypertrophy, is generally ascribed to a hyperplasia of the inner circular muscular layer of the pylorus. Pfaunder, in a critical analysis of all cases reported, has lately questioned the correctness of this view, based on direct measurements of the thickness of the pyloric wall. He calls attention to the fact that a normal stomach, with contraction of the pylorus persisting after death, presents identically the same appearance as is found in so-called cases of congenital hypertrophy. The symptoms during life are due, according to Pfaunder, to gastro-intestinal disorders, so frequent in young infants. The appearance of the pylorus after death is

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explained as a post-mortem condition. That this does not apply to every case, he himself admits, and quotes Finkelstein, in whose cases a distinct tumor was at times felt in the region of the pylorus during life. I have also found a recent case of Batten, who says "a firm transverse mass, in shape like the pylorus, could be felt. It was not always palpable, when no peristalsis was taking place." For certain cases, if not for all, we may therefore assume that hypertrophy, mainly of the circular, muscular layer, does exist, leaving the question undecided whether this is a congenital malformation (Meltzer), or the result of over-action due to deranged nervous mechanism (Thomson). I have found four gastro-enterostomies for congenital hypertrophy in the late literature of the subject, two of which have been successful, and one pyloroplasty, which also resulted in a cure.

ACQUIRED OBSTRUCTION.

Fibrous Stenosis.—Of the acquired forms of obstruction, the most common is fibrous stenosis. The simple round ulcer, of the chronic variety, situated either at the pylorus or near the same, is the most frequent cause of such obstruction, either from cicatricial contraction or the formation of a false tumor, due to chronic infiltration. The latter is often diagnosed as cancer, even after laparotomy, and only appreciated at its real value when gastro-enterostomy leads to a permanent cure or resection insures a microscopical examination. Thayer reports such a case, in which, on the basis of a chronic ulcer, a tumor formed which was due to fibrous thickening about an ulcer, and a great muscular hypertrophy of the pylorus. Another case is described by Hirsch in 1896. A tumor, the size of a plum, could be distinctly felt to the left of the median line. The symptoms of pyloric stenosis were present. At the operation, the tumor was found very near the cardia, drawn there by adhesions to the lesser curvature. The patient was well, and had gained considerably in a year. Lindstrom describes a similar case. About a year ago, I performed posterior gastro-enterostomy on a woman of twenty-six years,

with a well-defined and movable tumor of the pylorus as large as an egg. At a second laparotomy, five weeks later, no trace of the tumor could be found. These are not isolated cases.

Traumatic ulcers are much less frequently the cause of fibrous stenosis. They are either the result of contusion in the epigastric region or of ingestion of corrosive fluids. External violence leads to laceration, necrosis, and separation of the mucous membrane from the muscular coat of the stomach. But contusion does not always determine so severe a lesion. On the contrary, simple laceration of the mucosa may give rise to hæmatemesis, during the first few days after injury, and to nothing more. It has been demonstrated experimentally that wounds of the inner coat of the stomach have a great tendency to heal. Where stenosis of the pylorus follows external injury, we must assume that a considerable area of mucous membrane has become necrotic. Kroenlein has recently published two interesting cases,—in one, a man, of twenty-four, who was caught between the end of a wagon-pole and a wall, developed eight months later a very marked obstruction of the pylorus. In a second case, a man who was struck in the epigastric region with a pitchfork, while not materially disabled, presented himself three months later with the clinical picture of a severe stenosis. Swallowing of corrosive liquids is frequently followed by stenosis of the pylorus, with no serious lesions to the œsophagus or any parts of the stomach. Doyen was one of the first to point to the position of the normal stomach as the explanation of this phenomenon. He believes that the latter is always more or less vertical, the direction of the small curvature corresponding with that of the median line of the body. When the stomach is empty, the pylorus is its most dependent portion, lying a little to the right of the median line. As the stomach fills, the antrum pylori becomes distended, and the lowest part of the organ is now found at the large curvature. In support of this view, a case of Mikulicz may be mentioned, in which drinking acid after a meal was followed by an hour-glass contraction of the stomach, and not by stenosis of the pylorus. Hartmann,

four years ago, tabulated twenty-one cases of the traumatic variety of benign obstruction, seventeen of which were caused by the drinking of acids, two by the drinking of caustic alkalis, and one by the swallowing of chloride of zinc; in one case the agent is not named.

Acquired hypertrophic stenosis, although known to Cruveilhier, Andral, and others, was first accurately described by Lebert, some thirty years ago, who published a report of six of his own cases. The affection is due to a catarrhal condition of the stomach and consecutive proliferation of the muscular and connective tissues, especially at the pylorus. The disease seems to be one of early adult life, attacking individuals of from twenty to fifty years. Boas has lately published three cases, which were operated on by Hahn (gastro-enterostomy), all recovering and continuing perfectly well. In one of these cases the obstruction felt to the touch like the rubber ring of a beer-bottle. The clinical picture was that of stenosis of the pylorus of varying degree.

Obstruction of the Pylorus by Gall-stones is rather a rare form of stenosis. There are cases on record in which pressure of the adherent gall-bladder filled with stones caused obstruction; for simple evacuation of the stones was followed by the disappearance of all the symptoms (Mikulicz). In the majority of cases, adhesions having formed between the gall-bladder and the intestinal tract, more frequently the duodenum than the pylorus or stomach, perforation takes place, and the gall-stone passes into the intestine. It may here cause obstruction simply by its size. Stones as large as an egg have been found at the pylorus, but even smaller ones, not entirely filling the lumen of the bowel, have given rise to symptoms of complete obstruction by inducing a spasm of the pylorus or a thickening of its muscular coat, as the result of prolonged irritation (Bouveret). Gall-stones may leave the bile-ducts, become encysted in adhesions, and thus compress the pylorus or duodenum. Peritoneal bands and adhesions, the formation of which so frequently accompanies perforation of the biliary passages into the intestinal tract,

will cause obstruction by compressing or kinking the region of the pylorus. Alex calls attention to the changes in the gall-bladder itself, when the latter has long been filled with stones, also to the contraction of the bowel at the seat of perforation; when the latter shows a tendency to cicatrize long after the gall-stones have passed by the rectum, or have escaped by way of the stomach during vomiting spells, the resulting contraction may lead to compression in the pyloric region.

The literature of this subject leaves no doubt, I think, of the fact that the mechanical conditions, which are the outcome of irritation and inflammation, are much more frequently the cause of pyloric obstruction than the gall-stones themselves. Tuffier and Marchais, in a recent article, expressed doubt as to the possibility of a gall-stone in the intestine ever being able to cause obstruction of itself; and Sokolowski related a case in which a huge gall-stone was caught in a fistulous opening between the gall-bladder and the stomach; yet the autopsy showed that complete occlusion was not due to its presence, but to the formation of bands and adhesions about the pylorus. The general consensus of opinion as to the causation of obstruction in these cases seems to be that in most of them all the factors enumerated are responsible, and that it is exceedingly difficult to name one of them as the only exciting cause.

Syphilitic Lesions of the Stomach are not uncommon. The tertiary forms alone interest us here, in the discussion of obstruction of the pylorus. Gummata situated at the pylorus, or along the lesser curvature, can obstruct the outlet of the stomach as such, or by ulceration lead to the formation of a cicatricial stenosis. Einhorn has very lately described two interesting cases of stenosis of the pylorus depending on syphilis. In one, an oval tumor first gave the impression of a cancer, but under specific treatment it disappeared entirely after several weeks. In the other, no tumor could be felt at the site of the pylorus; but the ineffectual general treatment which was continued for some time, with the improvement

which followed specific treatment, sufficiently support the diagnosis of syphilis. I have found another case of syphilitic stenosis of the pylorus, reported by Durante, which recovered after operation.

Benign Tumors of the Stomach are always mentioned in text-books as a cause of obstruction of the pylorus. Still, a survey of the literature upon this subject rather convinces me that such cases must be very rare. Large non-obstructing myomata, adenomata, polypi, and papillary growths have been reported, and even removed by operation. One of the earliest cases of obstruction was published by John Webster in 1827, who reported a tumor in a man of sixty-two: "A cartilaginous body intermixed with numerous spicula of bone, firmly attached by one extremity to the coat of the stomach, close to the pylorus, into which the other projected like a stopper, preventing passage into the small intestine." Betz, in 1884, observed a case of stenosis in a man of fifty-two, caused, as the autopsy showed, by a fold of mucous membrane, perhaps a polypus, two and one-half centimetres long, which was attached to the upper circumference of the pylorus. Mikulicz has seen a similar case. Andersen, Finnell, and Hutchinson have published cases of cysts in the wall of the stomach, all situated near the pylorus; but Hutchinson only speaks of the same in his case as large enough to completely occlude, as a valve, the pyloric opening. J. B. Stevens, 1896, has described a case which presented symptoms of obstruction. At the autopsy the stomach was found dilated and the pylorus thickened. A mass of soft pedunculated polypi sprang from the mucous membrane near the pylorus. It is probable that during the contractions of the stomach the polypi were forced into the opening of the pylorus, and thus acted as a valve. Pernice, in 1890, reports the case of a man of seventy-five who died of stenosis of the pylorus. At the autopsy a myoma was found, egg-shaped, six centimetres long and four centimetres broad, on the upper anterior wall of the stomach, near the pylorus, completely occluding the latter. Finally, Herhold, in 1898, relates the case of a woman of thirty-seven, with symptoms of

partial obstruction, in whom, at the operation, a tumor as large as a hazel-nut was excised from the pylorus. Pyloroplasty was added to the excision, and the patient made an excellent recovery. These are most of the cases of obstruction by benign tumor that I have been able to find.

Spasm of the pylorus may be intermittent or permanent. It is, as Doyen remarks, an exaggeration of physiological function. It is generally combined with hyperchlorhydria, and the relation of one to the other, the determination of cause and effect, has given rise to considerable discussion. Spasm of the pylorus is probably a reflex phenomenon, dependent upon some slight lesion of the mucous membrane at or near the pylorus; so small, indeed, as to escape detection after incision of the stomach wall. Or the reflex may be due to some general gastric disturbance. The trouble is regarded by others as a functional neurosis. The result of spasm is stasis and decomposition of the contents of the stomach. The presence of food in the normal stomach stimulates the secretion of hydrochloric acid, and, as this stimulation is increased by the presence of undigested and decomposed particles of food in stasis, a hypersecretion is the natural consequence. This hyperacidity, in turn, causes firmer contraction of the pylorus, thus establishing a vicious circle, which is only broken by the final relaxation of the pylorus and the increased action of the hypertrophic muscular coat of the stomach. That spasm of the pylorus is, in the first place, responsible for the clinical picture of hyperchlorhydria is well supported by the argument of Carle and Fantino, who have shown that hyperacidity disappears as soon as an operation has relieved the stasis. I have recently found an interesting case, published by Schnitzler, in which intermittent spasm of the pylorus was visible during operation. Even before the same, a tumor could at times be felt through the abdominal walls which, at other times, entirely disappeared. When the abdomen was opened, nothing was at first seen. But soon the pyloric portion of the stomach began to contract, forming a hard tumor, which disappeared and reappeared three times in a few minutes under

the eyes of the operator. It is well to remember that permanent spasm may lead to a chronic pyloritis and a genuine fibrous stenosis.

THE SURGICAL TREATMENT OF BENIGN OBSTRUCTION.

In the treatment of obstruction of the pylorus, we may either employ methods which aim to relieve the undue retention of food and secretions in the stomach, or such as deal directly with the seat of disease, in a mechanical way. Among the former, which should be employed in milder cases, are repeated daily washings of the stomach, the horizontal position after meals, a very restricted diet, and the use of Vichy or Carlsbad waters. Among the latter, we class all the operative procedures upon the pylorus itself, and gastro-enterostomy.

Dilatation of Stricture.—Ogston, in 1895, advised the ingestion of small gutta-percha spheres, beginning with a size smaller than the probable stricture of the pylorus, and gradually increasing its calibre to 40 French. Every five days one is to be taken after breakfast, the size of the spheres being very slowly increased. His results, in four cases, are not very encouraging. Hemmeter has constructed a tube which passes along the lesser curvature to the pylorus, but he recommends duodenal intubation in pyloric stenosis only as an aid to diagnosis, and not as a therapeutic agent. Kuhn, in two elaborate articles, describes spiral elastic sounds for dilatation in benign stenosis. Ulcers counterindicate their employment. Cases of moderate stenosis, Kuhn thinks, may be very favorably influenced by the introduction of these sounds. He further states that they glide along the large curvature of the stomach very readily, arching out towards the fundus. When the position of the stomach is rather vertical, the tip of the instrument will strike the large curvature nearer the pylorus, and the entire manipulation will become more simple. Kuhn does not prove his contentions by any clinical data, nor have I been able to find any cases of successful dilatation of the pylorus by way of the mouth.

Resection of the Pylorus.—Since Rydygier, in 1881, first

excised the pylorus for ulcer, this operation has been frequently done for non-malignant disease, *i.e.*, for the complications of ulcer with stenosis, or for either of these two conditions by itself. For all such cases combined, Haberkant, in 1894, computed a mortality of 34.4 per cent. Mikulicz, in a study of Billroth's, Czerny's, and his own cases operated on since 1891, has three years ago reduced the mortality to 27.8 per cent. In studying Haberkant's thirty-two cases of total resection of the pylorus just quoted, I find that seventeen were done for uncomplicated stenosis, with three deaths, *i.e.*, 18 per cent. These cases include cicatrices after simple and traumatic ulcers and one case of hypertrophy of the pylorus. It would seem from this that total resection, in cases of uncomplicated stenosis, is a safer procedure than total resection in cases complicated by ulcer. In looking over the publications of late years, it becomes apparent that total resection for benign obstruction is being entirely abandoned; its only indication being an open ulcer, with a suspicion of malignant degeneration. Stendel, for example, reports eight pylorotomies from Czerny's clinic, during 1895, 1896, and 1897, all for malignant disease, and none for benign stenosis.

Divulsion of the Pylorus.—Divulsion for stenosis has been practised by two methods,—the one, known as Loreta's, deals with the stricture after incision of the stomach wall from within; the other, Halm's, seeks to accomplish the same object by invaginating the stomach wall into the lumen of the pylorus without incision, thus doing away with the risk of infection. It is not more than ten years since divulsion still had warm adherents, but now the method has met with the same fate as total resection. In the later statistics of prominent European surgeons, the operation does not figure any more. Nevertheless, individual cases are still described up to the present day, mostly by English surgeons. There we find the old story of frequent failures and a large mortality, which had been variously estimated in former years by Haberkant, Billroth, and others, at from 30 per cent. to 40 per cent. Cases most favorably influenced by divulsion are those of spasm of the pylorus, with hyperchlorhydria. Carle, in 1893 and 1894, operated

on two such cases by Hahn's method, which showed no recurrence after three or four years. The good results in these cases, and those observed after stretching of the sphincter ani for painful contraction, due so often to small fissures, are analogous. I have found recurrences after divulsion, after a lapse varying from five days to one and a half years; and still I have also found many reports of permanent cures after an observation of only several months in the literature of the past ten years. The reasons for the rejection of resection and divulsion in cases of benign obstruction are apparent.

Pyloroplasty has appeared on the scene, and the technique of gastro-enterostomy has been perfected in many ways. The mortality of both operations has been vastly reduced, and it has been shown that the remote results, both as regards the prevention of relapses and the restoration of normal gastric function, are, at least, as good as those after resection and divulsion.

Pyloroplasty and Gastro-Enterostomy.—The mortality of the two operations was found by Mikulicz and by Carle to be about equal. Mikulicz bases his calculations on the results of Czerny's, Billroth's, and his own clinic. If the statistics of some other surgeons who have operated on a number of cases be added, we get the following figures for operations in benign obstruction:

Operator.	Pyloroplasty.		Gastro enterostomy.	
	Operations.	Deaths.	Operations.	Deaths.
Billroth	97	15	91	21
Czerny				
Mikulicz				
Doyen	3	2	32	4
Carle	14	1	26	1
Morrison	11	0		
Cavazzani	5	1		
Lentaigne	7	2		
Page				
Gould				
Mills	7	2		
Selenkow				
Lange				
Carre	3	0		
	4	0		
	154	23	149	26

or a mortality for pyloroplasty of 15 per cent. and for gastro-enterostomy of 17.5 per cent. But these percentages do not represent the actual death-rate of to-day. The mortality of gastro-enterostomy has been much reduced, especially by those surgeons who have employed the Murphy button. Carle, in 1898, states that he has done twenty-three gastro-enterostomies during the past two years without a single death. Czerny says his mortality has been reduced 20 per cent. during the three years in which he has employed Murphy's button; and Kausch has only lately published twenty cases of pyloroplasty with one death and eleven gastro-enterostomies with no deaths. We may, therefore, safely assume that the mortality following gastro-enterostomy is not greater to-day than that following pyloroplasty, where, however, a like improvement is visible, owing to a more judicious selection of cases. Pyloroplasty has been frequently attempted, but has had to be abandoned on account of the presence of perigastric adhesions. In such an emergency, resection of the pylorus has occasionally been done, but when death has resulted from this procedure, it has not always been laid at the door of pyloroplasty, as should have been the case. Thus, Morrison a year or two ago published eleven consecutive cases of pyloroplasty, with no death; but he does not include two operations in this number in which, owing to extensive adhesions, resection was substituted in one and gastro-enterostomy in the other, both cases ending fatally. Such experiences have, no doubt, induced most surgeons to resort to gastro-enterostomy instead of pyloroplasty when adhesions are present. Adhesions may occasionally be the sole cause of obstruction, and many cases have been reported in which simple division has led to a permanent cure. I have in one case succeeded in entirely relieving a young woman of all her symptoms by this procedure. Obstruction of the pylorus was complicated, in her case, by severe jaundice; still, simple separation of extensive adhesions of the gall-bladder to the pylorus, and of both to the surrounding organs, caused the jaundice and obstruction to disappear, and have led to the re-establishment of perfect health for the past eight years.

Broad adhesions very likely form again after their separation, and, as the viscera will generally remain in contact with one another, such adhesions may become the cause of renewed obstruction. These cases, however, are few in comparison to those in which the trouble is primarily located in the pylorus, and gradually involves the peritoneal investment of the latter, forming adhesions with the adjacent organs. Cases of this latter kind call for additional surgical interference after separation of the adhesions; and if pyloroplasty is now added, the result must necessarily be very uncertain. Alex has called attention to the displacement of the pylorus in an upward, outward, and backward direction, and also to its fixation at a point most unfavorable for the evacuation of the stomach, following retraction of adhesions, due to cholelithiasis. The presence of extensive adhesions must, therefore, be regarded as a counterindication to the performance of pyloroplasty. Nor should pyloroplasty be attempted when much infiltration and thickening of the anterior wall of the stomach, in the neighborhood of the pylorus, exists, owing to the difficulty and uncertainty encountered in the application of sutures.

No such restrictions obtain in gastro-enterostomy for benign stenosis. I do not know of any case in which this operation has been attempted, and has had to be abandoned.

When pyloroplasty has been successfully done, the immediate result is generally good. The obstruction has been, for the time, at least, removed, and the stomach wall, having retained and perhaps increased its motor power, is fully able to expel the contents of the stomach through the enlarged outlet. After gastro-enterostomy the relation of the parts to one another is changed, and, as a result of this, certain disturbances may arise immediately after operation. The one most feared is regurgitation and vomiting. It is usually met with in malignant disease, and not so often when gastro-enterostomy has been done for benign obstruction. Regurgitation is ascribed to kinking and twisting, and especially to the formation of a spur at the site of the anastomosis. Much has been written about the latter. It seems to occur more frequently after an-

terior than after posterior gastro-enterostomy, and is due to the sharp bend in the intestine at the anastomosis and to the parallel position assumed by the legs of the intestinal loop after the former operation. The recumbent position of the patient during the first week or two after operation is another factor unfavorable to anterior gastro-enterostomy, as it necessarily retards evacuation of the stomach. The formation of a spur seems, furthermore, to occur more easily when broad peritoneal surfaces of the stomach and intestine have been united by sutures. Such, at least, has been my personal impression during the years in which I practised gastro-enterostomy with Senn's plates, Abbe's rings, but most frequently by making a large opening in the stomach and small intestine, and suturing with two rows of continuous sutures on each side. After application of the suture, one often notices the flat appearance of the small intestine at the site of the anastomosis, indicating that its mesenteric border is very near the opening itself. Many of these cases died from persistent regurgitation and vomiting, for which, at the time, I, as well as many others, could offer no explanation. If I contrast with this my experience of the past two years,—eleven posterior gastro-enterostomies, with Murphy's button, two for benign and nine for malignant obstruction,—the improvement in my results is very gratifying. In none of these cases have I observed the clinical symptoms of regurgitation. Two of them died,—one from pneumonia, and the other from simple exhaustion, the patient's condition hardly warranting any operative interference. In one patient the button passed on the twenty-eighth day, in three others it was never found, but caused no symptoms. My own more limited experience thus entirely agrees with that of Carle and Czerny, who also have never observed persistent vomiting since their adoption of the posterior operation with Murphy's button. Doyen does the posterior operation, but does not use the button. Mikulicz, who only shortly favored the button in gastro-enterostomy, has again abandoned its use, and has returned to the anterior operation. He had previously performed posterior gastro-enterostomy in forty-

three cases, but had frequently observed regurgitation. I venture to believe that the latter symptom was perhaps due to the employment of the suture, and might have been avoided if the button had been used, for Chlumsky, in reporting Mikuliez's cases, also speaks of the prevention of spur-formation by the use of the button. As Weir has only lately pointed out, it is this that we must seek to avoid, not so much the reflux of bile and pancreatic juice, which, according to all observers, takes place as well after anterior as after posterior gastro-enterostomy, and is not the cause of vomiting. But this is, I think, more readily accomplished by posterior gastro-enterostomy, on account of the easy apposition of the small intestine to the posterior wall of the stomach. I agree with Keen when he says that most all the modifications of gastro-enterostomy unnecessarily prolong the operation, and increase the danger of infection. Why should we recur to them, when gastro-enterostomy with the button accomplishes the same object with less risk? In the application of the button, I have always followed Carle and Fantino in the eleven cases above mentioned, substituting for the purse-string suture one or two simple sutures at each side of the cylinder of the button after the latter has been forced into the intestine through an incision as small as possible. Carle points out that the folds caused by tightening the purse-string suture are thus avoided, and the contact of the serous surfaces being perfect, better union takes place. Another advantage accrues, I think, from this procedure. When closed, the button is likely to exert more uniform pressure on all the constricted tissues than when a purse-string suture has been employed. The latter leads to an uneven puckering of the folds radiating from the cylinder. This is especially the case with the thick wall of the stomach. Thus, when the button is closed, some of the tissues caught between the constricting edges escape sufficient pressure to cause necrosis. I feel confident that the cases in which the button has remained *in situ* at the anastomosis are precisely such cases in which constriction was insufficient at some point. Of the fact, that the button frequently falls into the stomach instead of the jeju-

num, there can be no doubt. I have not found many cases in which this has caused trouble. Kocher mentions two in which he had to resort to gastrotomy for removal of the button, in one of which the latter was firmly caught at the pylorus, one and a half years after gastro-enterostomy. Halm says the button may pass into the afferent loop of the jejunum and cause grave symptoms, or into the stomach, causing much pain and even hæmorrhage. In his statistics following this statement, I cannot find any such cases. The cases in which the retained button gives trouble must, therefore, be very rare. Another complication of gastro-enterostomy should be mentioned,—the constriction of the transverse colon by the attached loop, or *vice versa*, of the loop by the colon. We often read of it, but very little proof of its existence is forthcoming. Doyen gives an excellent illustration of compression of the colon by the attached jejunum after anterior gastro-enterostomy. But this was due to faulty technique, the point of attachment having been chosen too near the duodenum. Chlunsky, speaking of posterior gastro-enterostomy, says, "At Mikuliez's clinic I have observed a case in which the distended transverse colon compressed the legs of the loop attached to the stomach in such a manner that evacuation was impossible." One can conceive the possibility of such an occurrence in anterior gastro-enterostomy, where the loop of small intestine between its attachments to the spinal column and the stomach wall almost encircles the transverse colon. But it is difficult to imagine compression of either colon or jejunum in posterior gastro-enterostomy, where the relation of these parts to one another has scarcely been changed. This must be extremely rare, and is due, perhaps, to the formation of adhesions, an occasional unpleasant sequel of any laparotomy. I, therefore, believe that posterior gastro-enterostomy, with Murphy's button, is the safest and quickest way of establishing an anastomosis in benign obstruction of the pylorus.

In attempting to ascertain the remote results of pyloroplasty and gastro-enterostomy, we must first inquire into the frequency of relapses. The latter may result after pyloro-

plasty, from a further contraction of cicatricial tissue at the pylorus, or from cicatrization of an ulcer, open at the time of operation, or they may be due to the formation of adhesions of the previously movable pylorus in an unfavorable and high position, leading to dilatation, sagging, and valve-formation. Some authors attribute occasional failures to dilatation, followed by weakening of the muscular coats of the stomach. This condition is certainly very rare in benign stenosis, in which, on the contrary, we know that muscular hypertrophy of the stomach wall usually coexists, commensurate with the degree of obstruction to be overcome. In long-standing cases of stenosis and dilatation, atrophy of the muscular tissue can finally supervene. Carle and Fantino report three cases, which may be mentioned here. They were cases of atony, all accompanied by moderate, though well-marked, stenosis of the pylorus, and in all of them pyloroplasty was soon followed by a recurrence of symptoms.

After gastro-enterostomy, a relapse can only occur from narrowing of the anastomotic opening. No doubt the opening contracts with the stomach, as the latter resumes its normal size and shape. Chlunsky speaks of ten antopsies after gastro-enterostomy by suture, and in one of them only were the conditions found satisfactory, as regards the size of the opening. He attributes this contraction mainly to inaccurate suture of the mucous membrane. Perhaps it may also be due, in case of suture, to the broad area of apposition which is avoided by the button, especially when applied according to the method of Carle and Fantino. I have not had occasion to examine a button anastomosis between the jejunum and the stomach. But I have closely examined two implantations of the ileum into the colon, by the aid of the button, nine and fifteen months after operation, and have found most perfect union, and not the slightest contraction. This may be otherwise in the case of the thick wall of the stomach, but certainly the clinical reports do not prove it. A new sphincter apparently forms after gastro-enterostomy, gradually becoming stronger in the course of several months, permitting evacuation

of the stomach only at certain intervals. Ample proof of its existence has been given by Dmin, Carle, and Kansch, who have inflated the stomach without noticing an escape of gas into the small intestine. That the pylorus also resumes its function after pyloroplasty hardly needs mentioning, and even after resection of the pylorus for benign stenosis, a new sphincter probably forms (v. Imredy).

The influence of resection of the pylorus, pyloroplasty, and gastro-enterostomy upon disturbed motility and secretion following benign obstruction, has been studied by Mintz, Rosenheim, Dunin, Koevesi, Muendler, Stendel, and especially by Carle and Fantino, and by Kausch. Upon the results of like investigations, after resection of the pylorus for benign obstruction, I will not enter further than to say that several investigators have found a perceptible decrease in dilatation and acidity, entire disappearance of motor insufficiency, and sometimes even a complete return to normal conditions.

The results of such investigations after gastro-enterostomy are, to a certain extent, conflicting. They can, however, be made to harmonize, when we consider that the observations have been made at various intervals after operation. It is not unusual to find immediately after gastro-enterostomy that motor insufficiency continues for weeks and even months; but this condition fortunately disappears later on, and the patients regain perfect health. If, therefore, the examination is made early in the case, we will not get a fair estimate of the final result. Mintz seems to have fallen into this error when he states that evacuation of the stomach is retarded after gastro-enterostomy for benign stenosis; though another investigator (Rosenheim), who examined four post-operative cases, finds motor function permanently retarded. Later observers, however, who have made by far the largest number of investigations (Carle and Fantino, Kansch), assert that the motor function of the stomach is increased; in other words, that the contents of the latter are voided into the small intestine at an earlier period than under normal conditions. Hyperacidity, which is almost always present in benign stenosis, is concur-

rently influenced with motor insufficiency, by gastro-enterostomy. It also disappears, and hydrochloric acid is found in normal, and very frequently in subnormal quantities only. On the other hand, it has been shown that gastro-enterostomy is followed by a reflux of bile, and perhaps of pancreatic juice, into the stomach. Carle and Fantino speak of this as existing for many months, but Kausch has observed it years after operation, and even asserts its presence when entero-anastomosis has supplemented gastro-enterostomy. Others have lately found that entero-anastomosis entirely side-tracks the bile from the stomach. Kausch mentions, however, only one case in which reflux of bile caused any disagreeable symptoms, and that was in a highly neurasthenic individual. Finally, all observers agree that the capacity of the stomach is reduced after gastro-enterostomy, but the latter never regains its normal size.

After pyloroplasty, the motor function and the secretion change in a different ratio. On the whole, it may be said that the resumption of normal motor function is slower than after gastro-enterostomy, and that hyperchlorhydria, in consequence, also disappears more slowly. But the quantity of hydrochloric acid is never reduced below the normal. The dilated stomach never entirely regains its normal size, and less frequently approaches it than after gastro-enterostomy. Immediately after the operation, large quantities of bile may pass through the pylorus into the stomach for a few days, but this reflux ceases very quickly until, according to some, no bile is found in the stomach, according to others, at times, only a very small quantity.

Are we justified in drawing conclusions as to the value of both procedures? I feel we may say that in well-selected cases the final results of pyloroplasty are as good as those of gastro-enterostomy, both immediate and remote. In cases in which there is no fixation of the pylorus, and where the latter is not the seat of much inflammatory thickening, in which, also, there is not too much dilatation of the stomach and weakening of its walls, pyloroplasty is as safe an operation as posterior gastro-

enterostomy with the button: safer, perhaps, than gastro-enterostomy with sutures. It is, furthermore, free from post-operative complications, which are immediately traceable to the abnormal intestinal circulation established by gastro-enterostomy, such as the well-known vicious circle, and the compression of the intestines by one another,—all complications which, however, nowadays are very rare, or do not affect the final result. But pyloroplasty has one regrettable feature,—the uncertainty of the result, in some cases, in which its employment might appear indicated. Aside from the further shrinkage of cicatricial tissue at the pylorus and the contraction following cicatrization of an open ulcer after operation, peripyloric adhesions may form where none have previously existed. The musculature of the stomach may be weakened, and, although the pylorus has become patent enough, a certain amount of motor insufficiency will obtain, and with it an imperfect operative result. When the results of two operations are about equal, and one of them offers greater assurance of success in every case, it should always be the operation of choice.

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