placed under the same conditions, and samples of each were examined at hourly intervals. In the former, lactic acid was found after incubation for one hour, and the amount increased in each subsequent specimen examined. In the latter no lactic acid was found in any specimen up to four hours, when the experiment was discontinued. This procedure was repeated on several occasions, and identical results were obtained. This would suggest that organisms capable of producing lactic acid exist in the normal stomach, and that these can be destroyed by boiling.

These findings did not, however, exclude the possibility of enzyme action, as an enzyme would be similarly affected by boiling. Several specimens of fasting gastric juice, free of lactic acid, were passed through a Seitz filter. These were then added to the usual gruel meal and incubated, controls, in which the juice added had not been filtered, being put up at the same time. It was found that after the process of filtering the gastric juice no longer possessed the power of producing lactic acid, whereas in the unfiltered controls abundant lactic acid was produced as previously. We concluded, therefore, that lactic acid in the gastric contents was derived from carbohydrate fermentation brought about by non-filter-passing organisms ordinarily found in the healthy stomach. The hypothesis of enzyme action was discarded, since there is no reason to believe that an enzyme would fail to pass through a Seitz filter. This bacterial action takes place best in a neutral or slightly acid medium, but may go on, though generally to a considerably less extent, in the acidity commonly found in a case of hyperchlorhydria—namely, 0.3 to 0.4 per cent. hydrochloric acid.

THE CAUSATIVE ORGANISM

We next tried to discover whether an organism capable of producing lactic acid fermentation could be obtained from a normal healthy stomach. A sample of fasting gastric juice was obtained from a perfectly healthy subject showing an isosecretory curve. This sample contained no lactic acid, but, when added to a gruel meal and incubated, lactic acid was produced. With this gastric juice McConkey's neutral red lactose medium and sterile litmus milk were inoculated. At the end of twenty-four hours acid and gas production was observed in both media, and these showed a variety of organisms. These cultures were then submitted to Dr. Ernest Dunlop, clinical bacteriologist to the Western Infirmary, for further investigation. We are greatly indebted to him for his report and for furnishing us with pure cultures of the organisms. He isolated four types: (1) a bacillus showing all the characteristics of *B. acidi lactici*; (2) *B. coli*; (3) a streptococcus; and (4) a yeast. Of these it was found that only the first fermented lactose to an appreciable extent, although slight fermentation was produced by the *B. coli*. Therefore we concluded that the production of lactic acid in gastric contents was probably due to the presence of *B. acidi lactici*.

Finally, we thought it desirable to compare the action of the pure culture of this bacillus with the action of fasting juice when added to a gruel test meal in the incubator. We could not, of course, use the usual lactose culture medium, since this would have involved adding lactic acid to the meal; we therefore obtained a suitable growth on agar. A saline suspension of a forty-eight-hour culture was added to a test meal in exactly the same way as with the fasting gastric juice. At the end of four hours' incubation the thiophene test showed that a large quantity of lactic acid was present. This was considerably in excess of the amount found on incubation with fasting juice.

SUMMARY

1. An investigation of test meals from fifty subjects, pathological and normal, showed the presence of lactic acid in 74 per cent. While occurring more frequently in cases of hyposecretion, it may be present even in hypersecretion. The presence of lactic acid had apparently no clinical significance.

2. The production of lactic acid was almost certainly due to the action of *B. acidi lactici*, which was found to be present in the perfectly normal stomach.

Since this paper has been prepared for publication a very interesting historical monograph, entitled *Gastric Acidity*, by Dr. J. D. Robertson, has appeared. This contains a particularly full account of the relevant literature. A bibliography has therefore been omitted from the present communication.

JEJUNOSTOMY AND WITZEL'S OPERATION IN THE TREATMENT OF VICIOUS CIRCLE VOMITING

BY

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Vicious circle vomiting, which was something of a burning question in the early days of the operation of gastro-jejunosomy, is now an uncommon condition. It still occurs from time to time, however, its incidence being probably between 2 per cent.¹ and 0.4 per cent.² The following three cases are recorded because an apparently sound treatment failed for no very evident reason in the first case, and because the second patient seemed to have been saved by a method which is easy, was sponsored by Witzel,³ and, if it has not been completely discarded, is at least little heard of. It is unusual for one surgeon to be called upon to operate on three patients suffering from this condition in three months—perhaps I may be forgiven for saying that on only one was the first operation done by myself.

CASE I

A postman, aged 43. Two years' history of indigestion; radiograph showing duodenal deformity. *Operation 1* (July 10th, 1931).—Infolding of ulcer and posterior no-loop gastro-jejunosomy. Eight days later 45 oz. of bile-stained fluid was vomited. Gastric lavage, small feeds, etc., were begun, with temporary improvement. Onset of severe tetany on October 25th. *Operation 2* (October 25th).—Jejunostomy 12 inches below stoma under local anaesthesia; immediate feed. The tetany, which had not improved with intravenous calcium chloride or subcutaneous salines, disappeared in one hour. However, the patient's condition, which had forbidden any major procedure at the time of operation, gradually and steadily deteriorated. He rapidly wasted; five days after operation he developed a purpuric eruption and haematuria; two days later he became febrile; and nine days after operation he died. Most of this time he had frequent fluid stools containing curds. His diet was constructed on the basis of the experimental work of Armour and others,⁴ and consisted of six pints of pancreatized milk with added glucose, salt, and peptone. He was also given three pints of saline, subcutaneously, daily. The following urine and blood changes were noted after the second operation: his urine excretion was kept up to between 30 and 40 oz. a day; it constantly contained albumin; chlorides were noted to be present on several occasions; acetone was noted the day after operation; sugar appeared once. His blood calcium just before operation was 7.6 mg. per 100 c.cm.; three days later it was 8.6. His blood urea was 340 mg. per 100 c.cm. two days after operation; five days later it was 510. Post mortem, the significant findings were: considerable dilatation of the stomach without pyloric stenosis, no peritonitis, normal kidneys, suppurative broncho-pneumonia.

CASE II

A fitter's assistant, aged 29. Eleven years' history of indigestion; radiograph confirmed diagnosis of duodenal ulcer. *Operation 1* (August 4th, 1931).—Duodenal ulcer, posterior no-loop gastro-jejunostomy with vertical stoma, appendicectomy. Course at first satisfactory till onset of copious vomiting on August 13th. Treatment by change of position, gastric lavage, and repeated aspiration of stomach contents through Rehfuess tube of no avail. *Operation 2* (August 16th).—Exploratory laparotomy under general anaesthesia; duodenum very dilated; sharp spur present at stoma. It was not easy to understand the failure of the stomach to empty via the efferent loop; a finger could be quite easily invaginated through the gastric wall down this loop, albeit somewhat obliquely. There was no marked gastric dilatation. Owing to the shortness of the proximal loop the only procedure that seemed feasible was an enteroplasty; this had to be done without clamps. After this operation the patient was no better, and was, indeed, very emaciated. His urinary output and chlorides were constantly watched all this time, and salines were administered to maintain their level. *Operation 3*.—Under local anaesthesia a large rubber self-retaining suprapubic tube (Malacot type), conveniently stretched on an introducer, was inserted into a small opening in the stomach, and guided through the stoma down the efferent bowel for 6 to 8 inches. The operation was then completed as a Senn gastrostomy. An immediate feed was given, and in twenty-four hours ordinary feeding was also started. The patient's condition at once began to improve. Seven days after this operation the tube was found to be loose, and accidentally came out. There was no material leaking from the stoma, and the patient went home, on September 10th, with his wound healed and free from indigestion.

CASE III

A man, aged 54. Two and a half months' history of loss of weight and appetite, with some epigastric pain and vomiting; radiograph confirmed diagnosis of carcinoma of stomach. *Operation 1*.—Inoperable carcinoma of stomach; anterior gastro-jejunostomy. Approximately seven days later vomiting of high obstructive type began, and was not relieved by lavage and change of posture. Care was taken to keep up the quantity of urine secreted and its chloride content. *Operation 2* (September 19th, 1931).—Under local anaesthesia the abdomen was reopened and a lateral anastomosis done between the afferent and efferent loops. The site of the previous anastomosis was high up under the costal margin, and could not be examined. The stomach was not grossly dilated. Convalescence was satisfactory; the man was discharged on October 10th.

DISCUSSION

The life of the second patient appeared to be saved by Witzel's procedure of introducing a tube through the stomach down the efferent jejunum, a procedure drawn to my notice by Mr. Bernard J. Ward. A patient suffering from vicious circle vomiting is a poor surgical risk, and is none the better for forty-eight hours of gastric lavage. He is ill fitted for general anaesthesia and such procedures as undoing the anastomosis or plastic operations on the jejunum at the stoma. It is suggested that the intubation operation of Witzel is a suitable treatment for this dangerous complication.

On the question of the aetiology of *circulus vitiosus*, summarized recently by Armitage,⁵ two facts emerge from a study of Case II. First, that the efferent jejunum seemed not to be obstructed; secondly, that the introduction of a tube down this path enabled the stomach to empty itself. It is fair to presume that there was obstruction of outflow from the stomach by this route which was not apparent on palpation. It seems right, also, to be critical of any other explanation of the condition than that there is a mechanical interference with the emptying of the stomach down the efferent bowel.

The first patient, whose life was not saved by jejunostomy, was in desperate condition when this pro-

cedure was carried out. Conclusions cannot safely be drawn from this case, especially because of the extraneous factors of a probable enteritis and a certain suppurative broncho-pneumonia. Nevertheless, although he lived for nine days after the jejunostomy was made, there was a steady deterioration in his condition.

Reference to the literature on the prolongation of life of dogs by jejunostomy feeding below an obstruction shows that almost invariably the animals seem to die (thirty-three days, White and Fender; twenty-nine days, Matsukura). Armour and others⁴ emphasize a loss of weight which treatment could not prevent.

It seems fair to ask the question: Will jejunostomy ever improve the condition of a patient suffering from a high intestinal obstruction? If jejunostomy is the only procedure that a patient in such a condition can stand, will he ever improve sufficiently for further intervention?

The third patient exemplifies the wisdom of always doing an entero-enterostomy when a gastro-jejunostomy is done for carcinomatous pyloric obstruction.⁶

Finally, as pointed out by Armour and others, while non-operative treatment is being carried out, measures must be instituted to ensure an output of 30 to 40 oz. of urine, and to ensure that this contains chlorides. This can be done effectively, if uncomfortably, by the subcutaneous administration of saline.

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IDIOPATHIC CONGENITAL DILATATION OF THE COMMON BILE DUCT

BY

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Mr. James H. Saint's instructive article in the *Journal* of February 6th on a case of that rare and very interesting condition, cystic dilatation of the common bile duct, has reawakened in me a desire to place on record some details of a similar case with which I was confronted a few years ago. Although a reader of the usual textbooks and the more recent current literature in surgery and surgical pathology, I could not, at the time, recall any reference to this condition. In consequence, the task of doing what was best for the patient, and more particularly of dealing with the biliary fistula produced by the first operation, was beset with a considerable degree of anxiety.

CASE HISTORY AND TREATMENT

The patient, a married woman, aged 29, came for treatment as a possible case of gall-stones. Her history was a long one, dating from childhood. She had been told that her trouble started after an attack of jaundice which she could not remember. All her life she had had recurrent attacks of upper abdominal pain, accompanied by vomiting and much flatulence, but there had never been any further suspicion of jaundice; the attacks lasted a few days, and in the intervals she felt comparatively well, apart from some "indigestion." She was a fairly healthy-looking woman, although rather thin; she was not in any pain, but there was definite tenderness in the epigastrium and right hypochondrium. A "fullness" was palpable, but it was, unfortunately, largely ignored, and ascribed to muscular resistance. Her history seemed sufficiently definite to justify an exploratory operation for possible gall-bladder trouble, and no confirmatory investigations were proceeded with.