in bed with sedation. The average lying blood pressure was of the order of 220/135 and the standing figure 190/120. The pulse rate remained fairly constantly in the region of 80 a minute whether standing or lying.

Attempts were made to assess renal function on very many occasions during the course of this treatment. In general, the findings of the urea-clearance test were extremely erratic, and the impression is that technical errors were of such magnitude as to render the results worthless. The blood-urea figures were:

January 10	52 mg./100 ml.
" 31	57 "
February 22	Sustained course of oral C6 begun.
March 4	71 mg./100 ml.
" 14	61 "
" 17	52 "
" 25	54 "
May 19	46 "
June 30	45 "
July 11	50 "
October 6	59 "
November 24	50 "

Lowering of blood pressure was not associated with diminution of renal efficiency.

Ophthalmoscopic Findings

The eye grounds were examined on numerous occasions by Professor W. J. B. Riddell and Dr. R. Leishman. In general, they showed no striking change. Reports at the beginning and the end of the course of treatment are as follows:

February 25.—"The optic disks show fibrous veils of congenital origin. The A/V ratio is 1:2, accounted for by diminution of calibre in the arteries, which are of copper-wire appearance and show marked calibre variation. There is concealment of the veins at A/V crossings. There is no oedema of the disks, but there is oedema of the retina along the course of the main vessels. There are no haemorrhages or exudates and no pigment disturbance. In the left eye, about 2 p.d. above and temporal to the disk, there is an area of collateral vessel formation, probably the result of previous branch thrombosis in a venule. The appearances are those of hypertension in the retinal vessels."

October 7.—"O.E. Right: The disk is normal in colour. The physiological depression is present. Fibrous tissues of congenital origin are seen on the disk surface. The disk margins are well seen. The A/V ratio varies between 1:2 and 2:3. The arteries show a colour change. Light reflex is broad and dull. There is well-marked concealment of the veins at A/V crossings. The arteries show calibre variation. There is a slight degree of oedema of the retina along the course of the main vessels. O.E. Left: The findings are similar. These appearances suggest hypertension in retinal vessels which are affected by arteriosclerosis. There is no evidence of significant vascular breakdown."

Side-effects

The most constant side-effect was constipation, which gave trouble throughout treatment. On dosage near the upper limit of comfortable tolerance, visual disturbance with failure of accommodation was troublesome. On the heaviest dosage of 3 g. daily the patient was almost incapacitated, with marked weakness and giddiness, especially on rising in the morning. Appetite was poor, and she was troubled with smarting and watering of the eyes and running of the nose. On occasion she was compelled to remain in bed most of the day. In general, however, side-effects were not a serious inconvenience, and for the greater part of the time that she was on oral C6 therapy she was able to do all her own housework in comfort and to travel from the country to hospital once a week to spend a whole day in the wards for continuous observations on blood pressure and pulse rate.

In late September, 1950, the patient began to complain of extreme dryness of the scalp and falling of the hair. At the same time she noticed that she tended to perspire much less than formerly. This disturbance of the hair and scalp responded to simple measures. It may or may not have been a direct result of methonium therapy.

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A CLINICAL STUDY OF THE EARLY POST-GASTRECTOMY SYNDROME

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The description of the syndrome which follows is based on the records of cases studied in a follow-up clinic at Bristol Royal Infirmary and Southmead Hospital, Bristol.

When the routine study of post-gastrectomy cases was begun it was soon obvious that patients who exhibited symptoms after meals fell into two major groups, as described by Adlersberg and Hammerschlag (1947). These were as follows:

Group 1.—Cases in which symptoms occurred towards the end of a meal or within a few minutes of its completion. This group corresponds to the "dumping syndrome" of most authors, but we prefer the term "early or immediate post-gastrectomy syndrome."

Group 2.—Cases in which the symptoms occurred during the second or third hours after meals—to be referred to as the "late or delayed post-gastrectomy syndrome."

Early or Immediate Post-gastrectomy Syndrome

This variety of the post-gastrectomy syndrome is rather more common than the delayed type. It occurred in 79 of the 660 cases reviewed (11.97%). In our opinion it constitutes the major problem, as it accounts for the most severe cases. Typically, there is quite a sudden onset, the patient often "bracing himself up" in his chair as the syndrome starts. There is a feeling of fullness and distension in the epigastrium, associated with nausea and lassitude. Vomiting is rare, but should it occur it affords considerable relief, the patient often going on to resume and enjoy a full meal. The epigastric sensation is sometimes described as "painful," and may radiate to the back. The onset of the abdominal symptoms is associated with a spreading sense of warmth or cold, and accompanied by perspiration, as a rule most marked on forehead and face. There is usually definite pallor, and frequently a "goose-flesh" appearance of the skin. The patient complains of palpitations and occasional throbbing in the head and neck, and often expresses a desire "to get to an open window or out

into the fresh air." Some patients experience borborygmi and have diarrhoea, whilst others have eructations. Initially the onset of these symptoms causes the patient marked apprehension, but this becomes less evident as the attacks are repeated.

On the average, the attack lasts from 30 to 45 minutes. A rise of pulse rate and of blood pressure accompanies

TABLE I.—Relative Frequency of Symptoms and Signs in 79 Cases of Early Syndrome

Epigastric fullness and distress	..	..	79
Pallor	..	..	76
Failure to gain weight	..	..	73
Sensation of warmth and sweating	..	..	72
Nausea	..	..	64
Palpitations	..	..	50
Vomitus of bile-stained fluid	..	..	41
Diarrhoea	..	..	10
Eructations	..	..	9
Borborygmi	..	..	8
Vomiting of food	..	..	5
Sensation of cold	..	..	3

the symptoms. In no case was there a profound hypotension as noted by Perman (1947). With regard to the relationship of the symptoms to coincident changes in the blood-sugar level, it was repeatedly observed that this early syndrome occurred whilst the blood sugar was rising to its peak.

All the patients noted that the symptoms started very soon after the operation, usually before leaving hospital, when they began to take solid food again. The late onset noted by some authors may be accounted for by the delayed resumption of normal feeding following operation.

Of the 79 patients, 71 noted that their attacks usually occurred after the heaviest meal of the day. "It occurs after a cooked dinner" was a frequent response. Most patients co-operated well in recording their attacks, and it was evident that no particular foodstuff was culpable; it was the bulk of the meal that constituted the chief factor in precipitating an attack. So true is this that patients know exactly how much they can eat with safety. They know that "the extra slice of bread" or the "extra spoonful of food" will cause an attack. The addition of a drink, especially a hot drink, at the end of a meal also often precipitates the syndrome. It is probable that these voluntary restrictions of food intake on the part of the patient account for the persistent failure to gain weight after the operation. The very nature of the condition precludes taking more food, in contradistinction to the late syndrome, in which marked relief occurs if more food is taken.

Of the 79 patients, 41 (51.8%) complained of vomiting a bile-stained fluid after meals. This type of vomiting may occur independently of the early post-gastrectomy syndrome, but when it occurs with it it has an interesting relationship. The vomiting is usually precipitated by changes of posture, especially stooping down, and it occurs about 30–40 minutes after meals. It does not happen every day, but two or three times weekly, or perhaps once every three weeks or so. The attacks usually decrease in frequency and completely disappear within one to two years of operation. The occurrence of bile vomiting with the early syndrome is usually associated with considerable relief, and the patient can take much larger meals without ill effect.

After a few days the patient finds that smaller and smaller meals cause symptoms, and this goes on until the next vomiting attack, which again brings relief. This often gives the early syndrome a cyclical character.

It must be stressed that it is the combination of abdominal symptoms and vasomotor phenomena that constitutes the syndrome. Virtually every patient who has had a gastrectomy performed gets a sensation of fullness in the epigastrium after meals, but only a minority have associated vasomotor features.

The area to which the abdominal sensations are referred is worthy of notice. Nearly all post-gastrectomy patients refer the feeling of distension to the periumbilical area (Fig. 1, A). Cases presenting the syndrome, however, refer the sensation first to a position high up in the costal angle (Fig. 1, B1), then more generally to the epigastrium (Fig. 1, B2).

Most patients showing the early syndrome state that lying down affords them considerable relief, and they may occasionally fall asleep. We have been very impressed by this, and by the clinical fact that some patients have to lie down to take their meals.

FIG. 1.—A: Indicating site of reference of sensation of fullness in most cases of gastrectomy not exhibiting the early post-cibal syndrome. This is the area of reference of fullness in the tests with jejunal distension. B1: Indicating the initial site of reference of the sensation of fullness in cases with the early post-cibal syndrome. This is the area of reference of fullness when a mercury-loaded bag is in the gastric remnant. B2: Indicating the spread of the area of reference of the sensation of fullness in cases with the early post-cibal syndrome—i.e., a summation of A and B1.

Duration of the Syndrome after Operation

In this series of 79 patients, 18 had recovered by the time the investigation was carried out, whilst the remaining 61 (77.2%) had persistent symptoms for 2 to 11 years. This observation seems to be contrary to the generally accepted view that the condition usually disappears in one to two years. This long duration of the early syndrome has been noted by two authors only: Custer *et al.* (1946) considered that all but the mildest of cases lasted indefinitely; and Smith and Jordan (1948) observed that this syndrome persisted for more than five years in 50% of their cases.

Perhaps the most interesting observation in this series is that all the symptoms do not disappear at the same rate. The sensation of fullness invariably disappears first, the vasomotor phenomena persisting for several years afterwards. In the 18 cases in which the syndrome had disappeared, the epigastric fullness had ceased by the end of the second year after operation in 11, whilst in 7 it persisted until three years had elapsed. In every case the vasomotor features continued for a further period varying from two to four years.

Severity of the Syndrome

In any review it is very difficult to assess degrees of severity. In this series the simplest possible classification of severity has been adopted, and the cases are divided into two groups as follows: (1) severity sufficient to cause economic loss to the patient; and (2) symptoms present, but the patient able to follow his occupation.

It was found that 31 of the 79 cases were severe enough to cause periodic loss of work, whilst the remainder could manage their daily occupation. These 31 cases represent 4.7% of the 660 cases reviewed. Table II shows a comparison of groups presented by various authors.

TABLE II.—*Comparison of Groups of Mild and Severe Cases of Early Syndrome*

	Present Series	Tanner (1948)	Custer <i>et al.</i> (1946)
Total No. of gastrectomy cases ..	660	91	500
No. of cases with early syndrome ..	79 (11.97%)	26 (28.5%)	28 (5.6%)
Severe cases	31 (4.7%)	7 (7.6%)	16 (3.2%)
Mild cases	48 (7.27%)	19 (20.8%)	12 (2.4%)

We are confining our attention here to the early syndrome and leaving the clinical details of the delayed syndrome for discussion in a later article. In order to clarify the clinical differences between them, however, we include a comparative summary of the essential clinical features of the early and delayed post-gastrectomy syndromes (Table III).

TABLE III.—*Comparative Summary of Essential Features of Early and Delayed Post-gastrectomy Syndromes*

	Early Syndrome	Delayed Syndrome
Incidence	12%	5.15%
Relation to meals ..	Immediately after meal	During second or third hour after meal
Duration of attack ..	30–40 minutes	30–40 minutes
Long-term duration ..	Severe cases indefinitely	2–5 years
Relief by	Rest by lying down	More food
Aggravated by	More food	Exercise
Chief precipitating factor	Bulk of meal	Carbohydrate content of food
Chief symptoms	Epigastric fullness; sweating; sensation of warmth; tachycardia	Tremor; giddiness; epigastric emptiness; nausea
Probable nature	Mechanical	Hypoglycaemic

General Statistical Review

Our study of this subject was started in 1947 and has continued to the present time. In addition to the determination of the incidence of post-gastrectomy symptoms after gastrectomy in general, a major point in the investigation was to ascertain if there was any variation in the incidence following the different types of operation in common practice. For this purpose a series of patients surviving consecutive operations of partial gastrectomy was collected. Owing to the kindness of our colleagues, 660 cases were available for study, all having been in the Bristol Royal Infirmary, the Bristol General Hospital, or Southmead Hospital during the 17-year period 1933–49. The criteria of selection were simple: (a) the operation was performed for benign peptic ulcer; (b) adequate operation notes were necessary; (c) the patients lived within a short distance of Bristol, so that follow-up was possible. Table IV shows the incidence of both the early and the delayed syndrome following the various types of gastrectomy practised in this centre.

TABLE IV.—*Analysis of Cases*

Type of Operation	No.	Early Syndrome	Delayed Syndrome
A. Billroth I	102	0	5 (4.9%)
B. Polya-antecolic without valve ..	109	15 (13.7%)	6 (5.5%)
C. Polya-antecolic with valve ..	168	27 (15.7%)	8 (4.7%)
D. Polya-retrocolic without valve ..	104	14 (15.6%)	6 (5.7%)
E. Polya-retrocolic with valve ..	57	8 (14%)	3 (5.2%)
F. Polya-Moynihan	120	15 (12.5%)	6 (5%)
Total	660	79 (11.97%)	34 (5.2%)

In this table, the subgroups B to E denote operations in which the anastomoses were antiperistaltic in type. Type B was the procedure usually referred to as the Balfour operation, but which was first performed by Kroenlein in 1888, in which the stoma was the full width of the end-to-side gastro-jejunal anastomosis. Type C, a modification of B, incorporated a valvular anastomosis of the "Hofmeister-Lake" type to restrict the size of the stoma. In this series, the stoma was large enough to admit two fingers. Type D was really the original Polya-Reichel-Bergmann operation, in which a retrocolic gastro-jejunal anastomosis was made. Type E represented the Finsterer modification of D, incorporating a valvular anastomosis again. Type F, the Moynihan modification of the Polya operation, was antecolic but with an isoperistaltic anastomosis.

Further analysis showed that the site of the ulcer—that is, duodenal or gastric—and the age and sex of the patient did not affect the incidence of the syndrome.

The important factors which emanate from this analysis, therefore, are as follows: (1) the incidence of the early post-gastrectomy syndrome is 11.97%; (2) the incidence of the delayed syndrome is 5.2%; (3) the early syndrome does not occur after the Billroth I operation, but does occur after any modification of the Polya operation; the particular modification does not affect the incidence; and (4) the delayed syndrome occurs with equal incidence after any type of gastrectomy.

Effect of Posture

Observations were made on these patients during the time they consumed the main meal of the day—that is, the meal which caused symptoms most frequently. In hospital it was the midday meal which was responsible and therefore observed. The effect of posture was studied in the following ways:

1. Lying Down Immediately After the Onset of Symptoms

Each of the 61 patients studied in hospital was observed on three or four occasions while he ate his heaviest meal. When the syndrome occurred he was instructed to lie down immediately and the effects were observed. In 54 (89%) of the 61 cases the effect of this change of posture was very marked, and may be described as follows: (a) The vasomotor symptoms, the tachycardia, the pallor, and the feeling of warmth and sweating disappeared first, all within five minutes. (b) The sensation of fullness, initially spread over the upper abdomen, disappeared more slowly, taking 10–15 minutes. The fullness in the subcostal angle disappeared first, but the similar sensation around the umbilicus persisted longer. (c) The duration of the whole syndrome was thus reduced from 30–45 minutes to 10–15 minutes.

In the remaining seven cases, although the symptoms were reduced in intensity, the duration was reduced only very slightly, by about five minutes.

2. Effect of Taking Meals Lying Down

This particular test was applied on three or four occasions to each of the 61 cases. The effect of this position was noted only while the main meal of the day was being eaten. In 41 cases (67%) the patient complained of fullness referred to the umbilicus, while the remainder were symptom-free. In two patients who complained of fullness there was co-existent tachycardia and sweating lasting for 5–10 minutes.

3. Effect of Lying Down Before a Meal

The 61 patients under observation were instructed to lie down for a period of half an hour before the main meal.

The meal itself was eaten with the patient sitting up. In 49 (80%) the syndrome did not occur. They had mild transient fullness around the umbilicus, but no other symptoms. In addition they could consume 3–9 oz. (85–255 g.) more food without ill effect. In the remaining 12 cases the syndrome occurred with its normal intensity. During the period prior to the meal when the patients were supine, nine vomited clear bile-stained fluid in amounts varying from 9 to 15 oz. (255–425 ml.).

In order to clarify this interesting observation the tests were repeated with a Ryle's tube in position while the patients were lying down. It was noted that in the erect position

TABLE V

No. of Cases	Amount of "Bile" Aspirated
8	16–23 oz. (454–653 ml.)
39	10–15 oz. (284–425 ml.)
14	6–9 oz. (170–255 ml.)

either no "bile" at all or only about 1 oz. (28 ml.) could be aspirated via the stomach tube. During the period of lying down, however, large amounts of bile-stained fluid could be aspirated with ease, the amounts being shown in Table V. This indicates that if the afferent loop can be emptied before a meal the chances of the early syndrome occurring are very much reduced and a much larger meal can be taken in consequence. In the erect position, the afferent loop loaded

If it is full and therefore heavy, the syndrome readily occurs; whereas if the loop is emptied and its weight reduced the syndrome is far less likely to occur. This explains the finding that patients with retrocolic short afferent-loop anastomoses can eat larger meals before symptoms occur as compared with patients with long-loop antecolic anastomoses.

As a result of these studies the following conclusions may be deduced: (1) Change from the erect to the supine position readily relieves the early post-gastrectomy syndrome, the vasomotor component of this syndrome being more readily and speedily relieved than the abdominal counterpart. (2) In the erect position, kinking of the afferent loop of an antiperistaltic gastro-jejunal anastomosis readily occurs, rendering emptying difficult. This causes periodic retention of its contents, which is an important factor in the causation of both the early post-gastrectomy syndrome and the "bile" vomiting. If the afferent loop is emptied the early syndrome does not occur so readily.

Incidence after Gastro-enterostomy

During the performance of these tests it became evident that rapid emptying of the stomach was not the major factor in the causation of the syndrome. It was accordingly decided to review a series of cases in which simple short circuit had been performed, without gastric resection—that is, simple gastro-enterostomy. This operation is not often performed here, and only 73 cases were readily obtained for study. Clinically, 19 cases (26%) noted fullness after meals, again referred to the central abdomen. Only in two cases (2.7%) did patients note nausea, sweating, palpitations, and a sensation of warmth immediately after meals. Radiological examination showed that in 51 cases (69.8%) the emptying time was within 80 minutes, the remainder within two hours.

It therefore seems that the early syndrome is very rare after simple gastro-enterostomy, and this finding has been confirmed by Avery Jones (1948, personal communication).

Discussion

The results of these clinical and experimental studies (see Butler and Capper, 1951) permit the following deductions:

1. The syndrome did not occur after 102 consecutive cases of the Billroth I operation. This finding has been confirmed by personal communication in 1949 with Professor Grey Turner, and with Dr. J. M. Waugh, of the Mayo Clinic, where a Billroth I procedure is done whenever possible for this very reason. Further, Perman (1947) advocates conversion of Polya gastro-jejunal anastomoses to the Billroth I type as the treatment of the "dumping syndrome."

2. The syndrome is very rare after simple gastro-enterostomy.

3. The syndrome occurs with equal incidence after all forms of the Polya operation, whether antecolic or retrocolic, antiperistaltic or isoperistaltic, and whether or not there is an anastomosis of a valvular type. The syndrome occurs, however, with smaller meals in antecolic anastomoses compared with retrocolic anastomoses.

4. Jejunal distension tests give rise to a sensation of fullness referred to the umbilicus, and it is very rare for jejunal distension to cause vasomotor upset. Further, there seems to be no difference in the sensitivity of the jejunum between cases with the syndrome and those without it.

5. Change from the erect to the supine position greatly relieves the syndrome, the upper abdominal sensation of

FIG. 2.—Illustration of kinking of the afferent loop of the anastomosis at its upper angle.

with bile and pancreatic secretions tends to be kinked at its upper angle, where it joins the lesser curvature of the stomach in antiperistaltic anastomoses (Fig. 2). This impedes free emptying of the afferent loop. At a second operation after gastrectomy the afferent loop can usually be distinguished from the efferent loop, the former being dilated and hypertrophied, no doubt owing to its difficulty in emptying. Occasionally we have found it is the efferent loop which is dilated, especially when there is a short loop with a retrocolic anastomosis. When the patient lies down the kinking effect is reduced and the afferent loop can empty itself more readily. In other words, it seems that the actual weight of the afferent loop is a factor in producing the early syndrome.

fullness and nausea together with the vasomotor features disappearing first, the central abdominal fullness disappearing later.

6. Cases of gastrectomy with the syndrome have fullness high in the costal angle after meals, the sensation spreading to the whole of the upper abdomen afterwards. Cases of gastrectomy without the syndrome, but with fullness after meals, usually refer this sensation to the umbilical area.

7. If and when the syndrome disappears completely all the symptoms do not go at the same rate. The central abdominal sensation of fullness disappears first, followed several months or years later by the vasomotor symptoms.

8. Both clinically and experimentally, the chief factor in causing the syndrome, especially the upper abdominal heaviness, the nausea, and the vasomotor features, appears to be the weight of the meal, and the syndrome can be reproduced experimentally by inert factors such as barium emulsion and a mercury-loaded bag in the gastric remnant (Butler and Capper, 1951).

9. Emptying of the afferent loop greatly reduces the incidence of the syndrome. Further, experiments indicate that the state of the afferent loop and the weight of the meal are complementary. If the loop is relatively empty or short a heavier meal can be taken than when the loop is full and distended. It is felt that the weight of the afferent loop is an important feature in its relation to the weight of the meal.

Prevention

If the major factor causing this syndrome is traction on the gastric remnant by a heavy afferent loop, plus the weight of food, then it should be possible to prevent the syndrome occurring by ensuring adequate support for the stomach at operation. In addition to reconstructing peritoneal supports for the stomach, it is necessary to arrange the anastomosis so that the weight of the heavy afferent loop is not borne by the stomach, because, as has already been shown, the loaded afferent loop is a contributory factor in causing traction.

With the above aims in view, a series of operations was begun in March, 1948, in which a serious attempt was made in each case to correct the factors mentioned. This was done in the following ways:

1. *Support of the Gastric Remnant.*—During the operation a stout silk ligature (or double-thickness linen thread) was passed around the left gastric artery at its highest point on the lesser curvature of the stomach. The ligature was firmly tied so that it included the stout thickened peritoneum of the left extremity of the lesser omentum

FIG. 3.—Diagram illustrating the method of supporting the gastric remnant. A=The higher of two ligatures on the left gastric artery, passing through the strong peritoneal support of the stomach. B=A long suture at the highest point of the anastomosis. A and B are tied together, thus giving the gastro-jejunal junction full support. The afferent loop J is sutured to the highest part of the gastro-hepatic omentum, which is usually thickened. Below this the lesser omentum is very thin—and is shown dotted. The greater curvature at C can be reattached to the gastro-splenic ligament. Although not a major support, this reattachment prevents rotation of the gastric remnant and the jejunum.

FIG. 4.—Illustrating reconstruction of supports to the gastric remnant. (1) Afferent loop supported by suturing it to upper edge of the lesser omentum. (2) Attachment of upper angle of anastomosis to point of ligation of left gastric vessels. This is the most important support. (3) Greater curvature supported by reattachment of gastro-splenic ligament.

in addition to the artery. The ends of the ligature were left long (ligature A in Fig. 3). The left gastric artery was divided between ligatures below this level for the resection. Later, on completing the anastomosis, a similar double-thickness thread suture was introduced at the upper angle of the anastomosis (ligature B). These two ligatures were then tied together, so that the upper end of the anastomosis was anchored to strong peritoneum as illustrated in Fig. 4. In addition, the gastrosplenic ligament was reattached to the greater curvature of the gastric remnant.

2. *Support for the Afferent Loop.*—This was sutured at three or four points, as shown in Figs. 3 and 4, to the thick rim of peritoneum at the upper edge of the lesser omentum. In this way the afferent loop was slung under the liver and its weight taken off the stomach remnant. The operation performed in each case was an antecolic antiperistaltic Polya operation with a Hofmeister-Lake valvular anastomosis. To date, 128 of these have been performed. A series of 113 of our own cases of the same type was also available, but in this series no attempt at reconstruction has been made.

TABLE VI

		No.	Early Syndrome Cases
Series 1	Polya-Hofmeister. No gastric or afferent loop supports	113	15 (13.2%)
Series 2	Polya-Hofmeister with reconstruction of supports	128	1 (plus 1 doubtful) (1.5%)

Table VI shows the results in these two series. In series 1 the incidence of the early syndrome was 13.2% (15 cases out of 113), whilst in series 2, in which reconstruction had been carried out, there was a marked reduction in the incidence of the early syndrome to 1.5% (1, and 1 doubtful, out of 128).

The difference in the incidence is significant. The case mentioned in series 2 was a very definite instance of the early syndrome. X-ray films showed considerable descent of the stoma, and it was therefore assumed that the reconstruction at operation had been inadequate. With reference to the doubtful case it was very difficult to decide whether it was a true case or a functional disorder; the patient had many symptoms but no signs except marked afferent-loop reflux. The post-operative x-ray follow-up of the cases in series 2, however, confirmed that descent of the stoma was reduced after reconstruction of anatomical supports of the stomach. Fig. 5 illustrates this fact.

Surgical Treatment of Early Post-gastrectomy Syndrome

As a result of the information obtained from the preceding investigations it was considered worth while to advise surgical intervention in those cases in which severe

FIG. 5.—Illustration of control of stretch of the stomach remnant by adequate support; there is no descent when the patient changes from supine to the erect position.

and crippling disability existed. Only cases in which the syndrome was reproduced by the mercury-loaded bag were operated upon, and to date eight such cases have been treated by surgery. The steps of the operation were essentially those already described in the prevention of the syndrome, and are briefly as follows:

The abdomen is opened through a midline or upper left paramedian incision. There is usually a moderate amount of filmy or even thick adhesions between the anterior surface of the stomach and the liver. At first it may be thought that these would give the required support to the stomach, but on dividing them it is obvious that the lesser curve is all the time hanging almost vertically from the cardia, the stomach being rotated to the left. After the adhesions have been divided the mass of tissue around the left gastric vessels is isolated and ligated by a strong piece of thread, leaving the ends long. The remains of the lesser omentum are then displayed, and especially the thickened fringe of the omentum which lies immediately under the liver. This will give a firm bite for sutures to act as a support to the lesser curve.

A series of thread sutures are then put in every 0.5 cm. between the lesser curve and its supporting structures—that is, first of all the right crus of the diaphragm and from there to this thickened edge of lesser omentum. These are tied in order, and finally the upper angle of the anastomosis is brought up to the stitch which was left long around the left gastric vessel. From this point the afferent loop of the jejunum (in the antecolic Polya operation) is supported by stitching it similarly to the right half of the remaining lesser omentum until the fascia over the common bile duct is reached. By this means there is adequate support both for the lesser curve of the stomach, and for the afferent loop of jejunum.

It is wise to keep the patient lying flat for fourteen days. The post-operative course is usually without incident, and the patient should be encouraged to eat a full three-course meal between the fourteenth and twenty-first days. It is refreshing to see the change in outlook towards food that rapidly develops, and

very soon the patient can take large heavy meals with confidence.

The results are presented in Table VII. Of the eight cases treated seven have been cured.

Summary and Conclusions

Investigations have been made into the causation of the early post-gastrectomy syndrome, and as a result the following conclusions are drawn:

1. All the symptoms constituting the syndrome are not due to the same cause.
2. The sensation of fullness after meals referred to the umbilicus, both in cases with the syndrome and in post-gastrectomy cases in general, is due to rapid emptying of the stomach, with jejunal distension.
3. The remaining symptoms that constitute the early post-gastrectomy syndrome—that is, the severe symptoms—are due to traction on the gastric remnant, such traction being due partly to the weight of the meal, and partly to

TABLE VII.—Results of Operations for Treatment of Early Post-cibal Syndrome (8 Cases: 7 Successes, 1 Failure)

Case No.	Age and Sex	Original Operation	Pre-operative Test with Mercury-loaded Bag Amount of Mercury Producing Syndrome	Operation for Relief of Syndrome	Post-operative Mercury Test	Remarks
1	58 M	Polya-Hofmeister for G.U. 18/7/49	7 oz. (198 g.)	31/10/49	15 oz. (425 g.) without symptoms	Excellent result. Patient able to eat as large a meal as he desires. Weight increasing rapidly
2	40 F	Balfour for D.U. April, 1948	8 oz. (227 g.)	30/11/49	17 oz. (482 g.) without symptoms	Absolutely symptom-free. Very pleased with result; can now eat any size meal without difficulty. Gaining weight at rate of 3 lb. (0.0 kg.) weekly
3	40 M	Balfour for D.U. January, 1949	8 oz. (227 g.)	15/12/49	16 oz. (454 g.) without symptoms	Unsatisfactory. Although patient could take larger meals, he complained of symptoms two hours later, associated with hypoglycaemia. Regarded as a failure
4	49 M	Polya-Hofmeister for D.U. 1939	6 oz. (170 g.)	10/1/50	16 oz. (454 g.) without symptoms	Excellent; patient well pleased. No symptoms since operation for syndrome. Can eat whatever he likes, as much as he likes. Increased weight by 1 st. (6.3 kg.) in three months
5	52 M	Polya-Finsterer for G.U. 1947	9 oz. (255 g.)	4/2/50	15 oz. (425 g.) without symptoms	Patient very well pleased. Can take full meals much larger than before, and symptom-free, since operation for syndrome
6	50 F	Balfour for G.U. 1947	6 oz. (170 g.)	17/2/50	17 oz. (482 g.) without symptoms	Excellent; symptom-free and increasing in weight
7	46 M	Polya-Finsterer for D.U. 1946	9 oz. (255 g.)	26/2/50	16 oz. (454 g.) without symptoms	Although retrocolic anastomosis—afferent loop still long. No vasomotor symptoms since operation for syndrome, but occasionally central abdominal fullness, though much less. Patient very pleased; is putting on weight, and is now back at his original work as engine driver
8	51 F	Polya-Hofmeister for G.U. 1947	7 oz. (198 g.)	3/3/50	17 oz. (482 g.) without symptoms	Very good result; patient highly pleased. Now symptom-free

the weight of the afferent loop suspended on the gastric remnant.

4. The early post-gastrectomy syndrome can be prevented by suitable reconstruction of anatomical support for the stomach and the anastomosis.

5. In cases in which the syndrome is severe, surgical intervention is worth while and is curative.

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PHAGE-TYPING AND EPIDEMIOLOGY OF SHIGELLA DYSENTERIAE SONNE

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Sonne dysentery continues sporadically, with epidemic outbursts, in this country, and is a recurring nuisance in mental homes, hospitals, and other institutions. The hardness of the organism when excreted leads to its persistence in unexpected situations. Green and MacLeod (1943) recorded its survival for longer periods than *Bact. coli* in a chlorinated water, and Hutchinson (1947) isolated it from utensils washed in hotel kitchens. The large numbers of ambulant cases with very mild symptoms in any outbreak result in the existence of many unrecognized sources of infection in the community. With this disease, therefore, it becomes more important than in the more severe enteric infections to be able to trace individual strains of organisms from patient to patient, and to identify a particular infection as originating from one particular source among a number of possible alternatives.

Serological methods—so useful in the *Salmonella* group—are unable to distinguish different strains of Sonne dysentery, and biochemical methods have offered little further success. The phage-typing of Sonne strains, however, by Hammarström (1947), in Sweden, was claimed to have achieved this differentiation. We had found the phage-typing of typhoid strains of considerable use in a Bristol outbreak (Cooper, 1950) because of the number of different types capable of identification (Felix and Pitt, 1934), though the phage-typing of paratyphoid B strains in 1941 (Davies *et al.*, 1942) was of no assistance owing to the widespread incidence of the strain concerned. One of us had previously compared the serological typing of *Ps. pyocyanea* (Mayr-Harting, 1948) with the method of phage-typing (Mayr-Harting, 1949), and it was felt that in Bristol we were in a particularly favourable position to examine the possibility of using Hammarström's phage-types for epidemiological purposes. Hammarström very kindly sent us his type strains and type phages.

Experimental Results

The following is a preliminary report on seven months of phage-typing, with these phages, on strains of Sonne

dysentery isolated in Bristol. Even in this brief survey we hope to show that (a) new infections occurring during the whole of this period in certain blocks of a mental home, well isolated from the introduction of outside infection, were all of one type; (b) that an outbreak in a hospital due to one type was completely cleared up, but the introduction of a patient with a different type at a later date resulted in a new outbreak of this new type; and (c) that sporadic apparently unconnected cases in the city often yielded still further types of infection.

The types found and their distribution were as follows:

Type	No. of Strains	Type	No. of Strains
3	30	17a	1
81	13	Coleman	1
66	2	Powell	1
82	2		
			50

Types 81 and 82 had so far not been isolated in Sweden and have been given their numbers by Dr. Hammarström. The types "Coleman" and "Powell" have not yet been compared with the Swedish types.

Early Outbreak

We found a very marked difference in the distribution of types before and after the summer holidays. All strains of type 81 were isolated early in summer. Four of them were from people unconnected except in so far as they all lived in the more crowded eastern districts of the city. One of these patients was transferred to hospital, and within a few days there was an outbreak in another ward of this hospital involving about a dozen people. A member of this staff has subsequently given a history suggestive of infection, and, though no proof has been obtained of the method of transfer, no other strain of this type has been isolated since early summer except the nine cases typed at that time.

Isolated Infections

After the summer holidays five other types were found in the city which had not been isolated in the few months preceding the holidays.

(1) Type 66 was isolated from a young man who fell ill with dysentery the day after his return from a cycling tour through France. A few months later the same strain in mixed infection with paratyphoid B was isolated from a little girl. The source of both infections in this child is rather obscure, but one factor deserves consideration: the diet of the household included large quantities of mussels and other shellfish.

(2) Strain 17a was isolated from a girl and probably was imported from Weymouth. Some time before the onset of the girl's illness her mother fell ill with diarrhoea after a visit to Weymouth, and from then onwards there was a chain of infections of gastro-enteritis in the family. Dr. Hammarström informs us that he has not isolated this type in Sweden, but that he has obtained a strain of this type from Czechoslovakia.

(3) The two strains of type 82 were isolated from a little boy and his father. This family had not been outside the Bristol district for weeks.

(4) and (5). The Coleman and Powell strains were both isolated from students in a teachers' training college, and were of different types. But the movements of the students concerned and the time-table of their illness allow the possibility that their cases are not connected