RECONSTRUCTIVE SURGERY FOR DUMPING: AN ASSESSMENT OF THE EFFECTIVENESS OF DIFFERENT SURGICAL PROCEDURES BY USE OF A PHYSIOLOGICAL TEST MEAL

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SUMMARY

The present paper reports the results of a clinical trial designed to assess the efficacy in eliminating dumping syndrome of isoperistaltic jejunal interposition, versus Lawrence technique of revisional surgery, versus Lygidakis method[1] by use of a physiological test meal. Two out of five patients who underwent revisional surgery by isoperistaltic jejunal interposition were cured, the remaining three being left with their pre-revisional symptoms unaltered. Three out of five patients with a Lawrence type of reconstruction were improved but were complaining of newly-presented post-cibal symptoms of fullness and regurgitation. The remaining two were re-operated because of incapacitating post-revisional symptoms due to pronounced pouch retention and underwent further surgery by the new method with satisfactory results. All five patients who underwent a Lygidakis type of reconstruction were cured and remained free of symptoms from a period of 1 to 7 years. The Lygidakis technique has been proved from the results of this study to be simple in performance, safe in terms of mortality and morbidity and satisfactory in both short and longterm results. It seems therefore reasonable to recommend this procedure for the surgical treatment of **dumping syndrome**.

RESUMO

Cirurgia Reconstrutiva para a correcção do sindroma Dumping:
Avaliação da eficácia de diferentes técnicas cirúrgicas por meio de uma refeição fisiológica

Neste trabalho são referidos os resultados obtidos com um teste clínico levado a efeito com o objectivo de verificar a eficácia de 3 técnicas cirurgicas na correcção do sindroma **dumping**, post-gastrectomia distal, utilizando uma refeição fisiológica. As técnicas em confronto são A) A Interposição isoperistáltica de ansa jejunal, B) A técnica de LAWRENCE e C) O método de LYGIDAKIS. Em 5 doentes operados segundo A), apenas 2 foram aliviados dos sintomas preoperatórios. Num outro grupo de 5 doentes corrigidos segundo B), 3 melhoraram, embora permanecessem sintomas de enfartamento e regurgitação post-prandial, enquanto os restantes 2 necessitaram nova correcção pelo método C), devido a sintomas incapacitantes, secundários a uma acentuada retenção alimentar na bolsa criada. Todos os 5 doentes reoperados segundo C) se sentem curados, permanecendo assintomáticos num período de 1 a 7 anos. De acordo com os resultados deste estudo prova-se que a técnica imaginada pelo Autor é de execução simples, segura em termos de morbilidade e mortalidade e satisfatória nos resultados a curto e longo prazos. Parece, portanto, razoável recomendá-la para o tratamento cirúrgico do sindroma **dumping**.

INTRODUCTION

Dumping has been a well known complication after surgery on the stomach and duodenum.[2, 3] There remains however a controversy regarding its pathogenesis. There are those who support the hypothesis of hypovolemic shock[4, 5] and those who argue on excessive serotonin release.[6-9] Furthermore, its incidence varies and it is estimated that 10 % of the patients after surgery on the stomach or duodenum experience severe symptoms which are controlled after strict dietary regime and administration of different drugs.[10]

In 1 % or less of these patients the vasomotor symtoms and gastrointestinal complaints are so pronounced that post-cibal weakness, weight loss anaemia, abdominal cramps and diarrhoea, cause severe incapacity. Re-operation is necessary for this category of patients and the operations devised have all attempted to prevent the rapid passage of foodstuffs from the gastric remnant to the small intestine.[10-13] Nevertheless it seems likely that there exists a controversy regarding the efficacy of so-called revisional techniques in the treatment of this syndrome.[12, 14] Moreover it has been a turnover between enthusiasm and scepticism throughout a long period of time and facts become fancies for many of the above mentioned methods.[10, 11, 13, 14]

The present study represents an attempt for an answer to how and why each of the method used for the treatment of dumping syndrome result. The results are discussed and an assessment is made as to what should be expected after different surgical revisional approaches in patients with severe and incapacitating dumping syndrome.

Received: September 7, 1981

MATERIAL AND METHODS

Fifteen patients, 12 men and 3 women with severe dumping were operated upon between 1973 and 1980. The age range of the patients was 28-62 years with an average of 46 years. In all patients initial operation had been for duodenal ulcer and was a polya gastrectomy. All were referred and none is included in a series of patients reported previously by the author.[15] All had had a long history of symptoms ranging from 6-12 years (mean 9 years) after initial operation. Disability was severe and included both vasomotor and gastrointestinal symptoms. Bouts of diarrhoea, post-cibal fullness, sweating, weakness, tachycardia and dizziness were the cardinal symptoms, and there was also anorexia and diminished working capacity in 12 patients. An average of 23 kgs of pre-operative weight loss was found in all patients.

Diagnosis was made by the clinical picture and was supplemented by barium contrast studies and a test meal. In the present study a mixture of Raybar — a barium suspension that is resistant to floculation, and Galactomine — 18 which is a solution of various basic food ingredients has been used to evaluate gastric emptying and small intestinal motility as a test meal. The groups of patients studied are recorded in Table I. It has to be noted that all experienced severe dumping syndrome pre-operatively.

TABLE 1 **Methods Used for Remedial Surgery in 15 Patients with Dumping Syndrome**

Procedure	No. of Pts.
Lygidakis	5
Lawrence	5
Isoperistaltic jejunum interposition between stomach and duodenum	5

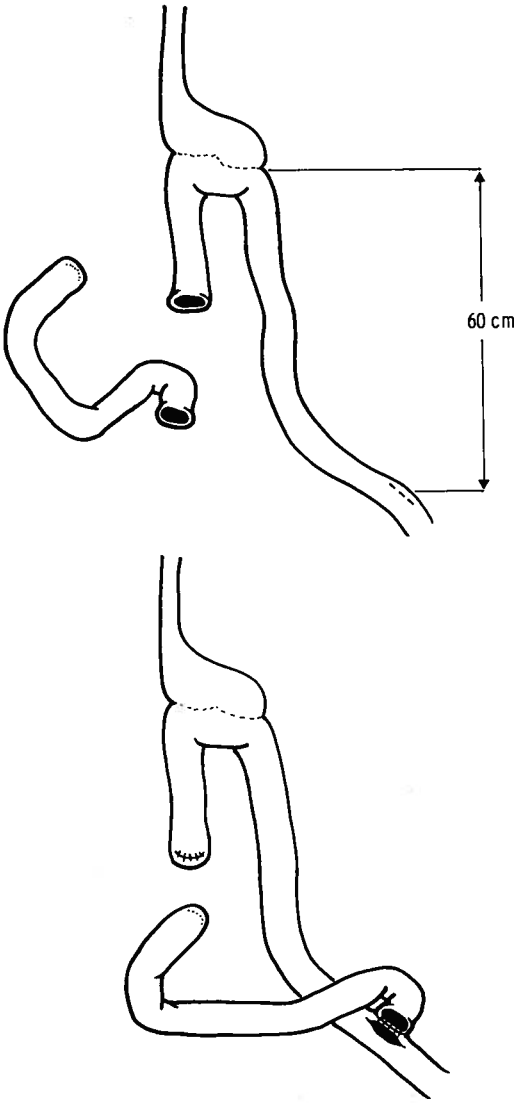
The Galactomine and Raybar meal was given to all the 15 patients pre-operatively and this test was repeated after revisional surgery in all the patients 1, 3, 6 and 7 years post-operatively. Reduced fat Galactomine-18 (Cow and Gate) was used as the food component of the test meal. One hundred grams of Galactomine-18 contains 18 G of protein, 14.4 G of fat in the form of vegetable oils, 58.3 G of liquid glucose and 3.5 G of various mineral salts.

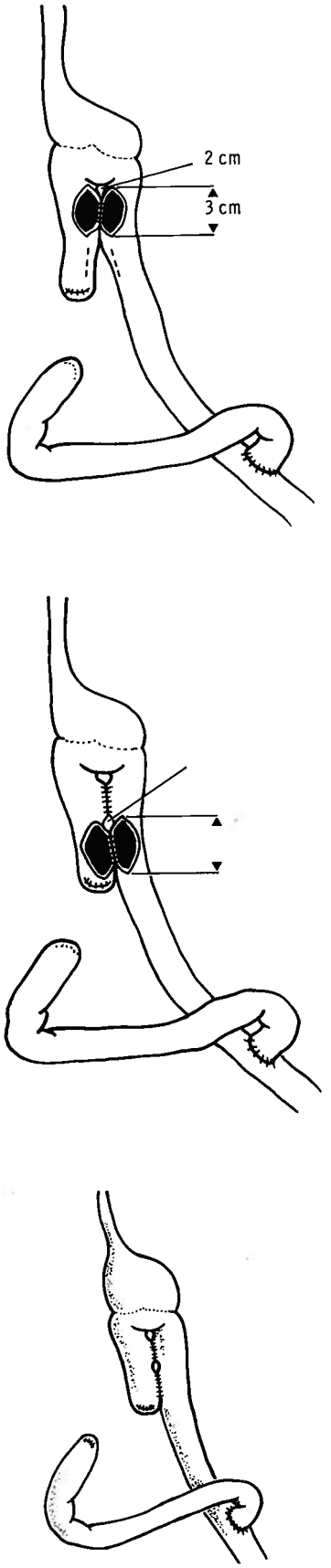
The test meal was prepared by mixing 120 G of Galactomine-18 with 50 ml of water and adding 150 ml Raybar. The result is a thick creamy mixture with a total volume of 250 ml and containing a good balance of the normal food components. The osmolality of the mixture is 520 mosmol/kg which is hypertonic but within the range of osmolality expected from stomach contents after a standard meal.

The patients stood while eating the meal with a spoon. The upper alimentary tract was radiographically screened during ingestion of the meal and appropriate undercouch radiographs were exposed. Standard overcouch radiographs of the abdomen were then taken with the patient lying supine, immediately after the meal and 15', 30', 45', 50', 60', 100', 120', 180', abd 240', minutes later. In those patients where the meal could be seen in the stomach until 240', additional radiographs were taken until its disappearance in two hourly intervals.

In addition radiographs were also routinely taken in the erect position immediately and at 15' after the meal, but also at other stated times if there were any prevailing symptoms or if fluid levels were present on the preceding erect radiography. Great care was given to the prompt and accurate recording of the time of onset, duration, and nature of any symptoms which occurred after ingestion of the test meal. The following features were recorded:

1. *Gastric emptying time*: The stomach was judged to be empty when only a trace of the meal remained among the gastric image.
2. *Small intestinal transit time*: This was the time taken for the head of the barium column to reach the terminal ileum.
3. *The time of entry of the contrast column into the caecum.*
4. *The presence or absence of any dilution of the meal within the small intestine.* The signs of dilation were an obvious thinning of the contrast density, blurring of the mucosal pattern and a furry cottonwool appearance. The most pathogenic and most pronounced evidence of excessive intraluminal fluid was the presence of fluid levels within the small intestine.
5. *The time of onset and the nature of any post-cibal symptoms.*





Figures 1-5: Revisional surgery by Lygidakis method.

At follow-up, which was 100 % and from 1 to 7 years, a history was taken including a detailed history of abdominal pain, anorexia, dizziness, tachycardia, sweating, post-cibal fullness, regurgitation and post-prandial weakness. A physical examination was carried out and all the patients were weighed — a comparison being made between the pre-operative weight and post-operative weight as this was obtained on admission to the clinic of every patient, and post-revisional weight at intervals of 4 months. These findings were assessed each year and for seven years in all the patients.

A successful result was judged if there was abolition of attacks of dumping on an unrestricted diet, a weight gain of at least 14 kg, a return of normal appetite and normal working capacity and an elimination or even abolishment of vasomotor and gastrointestinal symptoms after a physiological test meal.

Operative Techniques

All fifteen patients underwent remedial operation by use of a new method, by Lawrence pouch, or by isoperistaltic jejunum interposition between the stomach and duodenum (Table 1). The new method was also used as a revisional procedure in two patients who were losing weight and incapacitated 2-3 years after a remedial operation by use of Lawrence pouch.

New Method

The basic technique involves the creation of a Roux-en-Y limb of jejunum of 50-60 cm length. The proximal end of the Roux loop is closed and doubled upon itself, the *hockey stick* so created being anastomosed by means of two separate 3 cm jejunojejunal anastomoses created within the double-backed loop of jejunum, each anastomosis being separated by a distance of 2 cm both from one another and from the gastrojejunal anastomosis which is made to the apex of jejunal loop (Figs. 1-5).

In patients with truncal vagotomy and pyloroplasty or with a Billroth I reconstruction following gastrectomy the jejunum is transected some 10-15 cm distal to the ligament of Treitz and the loop referred to above is constructed. For patients with an initial polya gastrectomy or truncal vagotomy and gastrojejunostomy the afferent loop is transected 10-15 cm from the gastroenterostomy and used to construct the pouch as referred to above. Where the afferent loop is not long enough the required length can be obtained by proximal dissection towards the duodenum starting from the ligament of Treitz. If stomal ulceration is present (this was not so in any of the cases reported here) then the vagotomy should be completed and if not previously performed then antrectomy should be considered.

Lawrence Technique

The method of creating the pouch is essentially that described by Lawrence[12] and the construction of the jejunal pouch as a conduit between the gastric remnant and the duodenum is similar to the procedure reported by Woodward and Hastings.[13] The main important difference in Lawrence's modification is the maintenance of the previously established gastroenteric stoma. Thus in patients who had a previous B_{II} gastrectomy the afferent limb is transected just proximal to the gastroenterostomy (Figs. 6), and the gastric side of the lumen is closed in two layers. The efferent limb of the gastroenterostomy is divided distally

and the distal portion of the lumen of this divided jejunum is used for anastomosis with the proximal portion of the lumen of the afferent limb of jejunum. The length of the efferent limb used for the interposed pouch is approximately 18 inches. The interposed jejunal pouch is then constructed as shown in Fig. 6. Finally isoperistaltic jejunal interposition is carried out by dividing the efferent jejunal limb 15 cm below the gastrojejunostomy (Fig. 7). Its proximal end is anastomosed to the opened duodenal stump. The efferent jejunal limb is divided close to the gastrojejunostomy and the end of the stoma is closed. The other end is anastomosed to the distal part of the afferent limb, thus restoring intestinal continuity. The length of the interposed segment is 12 cm and it is interposed retrocolically in all the 5 patients in the larger curve of the stomach.

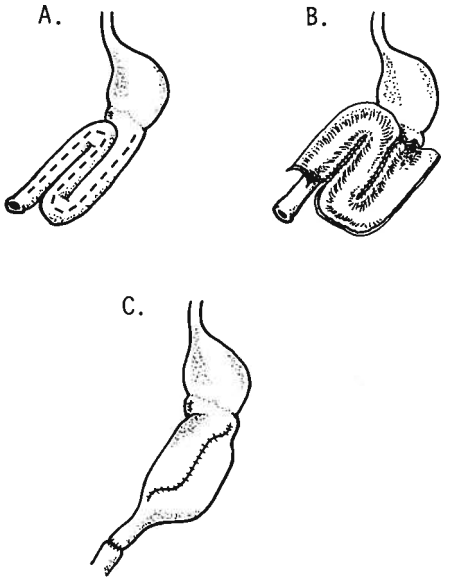


Figure 6: Revisional surgery by Lawrence method.

RESULTS

Pre-operatively in all the 15 patients the test meal provoked symptoms of dumping, which were similar to symptoms after ingestion of normal meals. There was a gastric emptying time of 25' ± 15' and small bowel transit time of 13' ± 4' and colonic emptying time of 36' ± 10' and in all the patients severe small bowel dilation and fluid levels in the erect films were observed. The presence of small bowel dilation lasted until the disappearance of symptoms, while fluid levels were seen to occur at the height of the symptomatic phase when dumping symptoms were induced but had disappeared by the time dumping symptoms had abated.

Operative Results

There were no operative deaths. Post-operative complications included one patient with deep venous thrombosis and one with respiratory infection, both of whom underwent reconstruction by Lawrence's technique.

Operative time was an average of 1 hour for Lygidakis method, 2 ½ hours for Lawrence's approach and 2 hours for isoperistaltic jejunal interposition. Blood intra-operative loss was 200 ml, 800 ml and 400 ml respectively. Hospital stay was 10 days ± SD2 after Lygidakis method 20 days ± SD3 after Lawrence's method and 15 days ± SD2 after isoperistaltic jejunal interposition. (Table 2).

TABLE 2 **Average Operative Time, Blood Loss and Hospital Stay in 15 Patients Who Underwent Different Types of Reconstruction for Dumping Syndrome**

Procedure	No. Pts.	Operation Time	Blood Loss	Hospital Stay (Days)
Lygidakis	5	1 hour	200 cc	10
Lawrence	5	1 ½ hours	800 cc	20
Jejunal interposition	5	2 hours	400 cc	15

Late Results

a. 5 Patients who underwent reconstruction by Lygidakis method were rendered completely symptom free on an unrestricted diet and did not experience severe dumping after challenge with the provocative physiological meal. Gastric emptying times was at 120' ± 30', small bowel

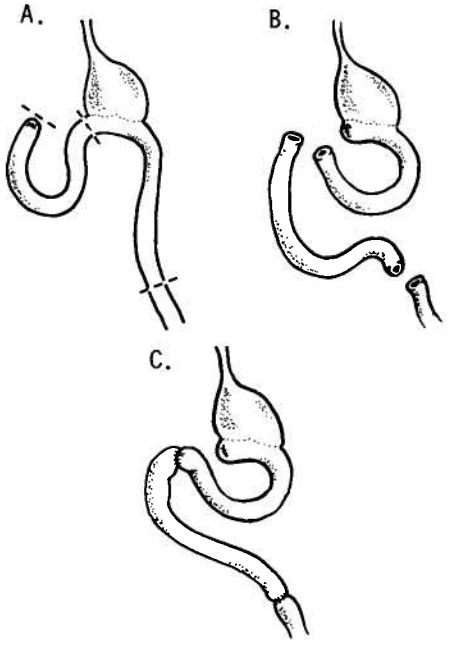


Figure 7: Revisional surgery by isoperistaltic jejunal interposition.

transit time 110' ± 20', colonic emptying time 124' ± 15', and there were no fluid levels or small bowel dilution observed in the radiographs (Fig. 8).

b. *5 Patients with a Lawrence type of reconstruction* were presented improved clinically and there was a significant elimination of their pre-illness symptoms. Nevertheless two out of the five developed severe stoma obstruction with incapacitating vomiting and weight loss two to three years after surgery because of pouch dilation. Both underwent further surgery by the Lygidakis method with satisfactory results. Provocative physiological test resulted in the appearance of vasomotor and gastrointestinal severe symptoms in 2 patients, to whom these findings were persistant all over the periods of repeated tests. There was a gastric emptying time of 240' ± 40', and a small bowel transit time of 140' ± 20' and colonic emptying time of 110' ± 20' for those who did not develop dumping. These features were 220' ± 10' emptying time, 30' ± 15' small bowel transit time and 60' ± 20' colonic emptying time for these two patients who developed dumping syndrome. There also were present fluid levels in more than one of the radiographs, and the known picture of severe small bowel dilution.

c. *In 5 Patients with reconstruction by isoperistaltic jejunal interposition* the results were considered as curative in two patients where gastric emptying time was recorded to be 40' ± 20', small bowel transit time 100' ± 10', and colonic emptying time 90' ± 30'. There were no fluid levels and no small bowel dilution in those two patients. However in the remaining three patients dumping was developed during the physiological test meal. There the gastric emptying time was 20' ± 15', the small bowel transit time 12 ± 10', and the colonic emptying time 45 ± 10'. The features of fluid levels and small bowel dilution were also present.

The weight changes after different procedures are shown in Figure 9.

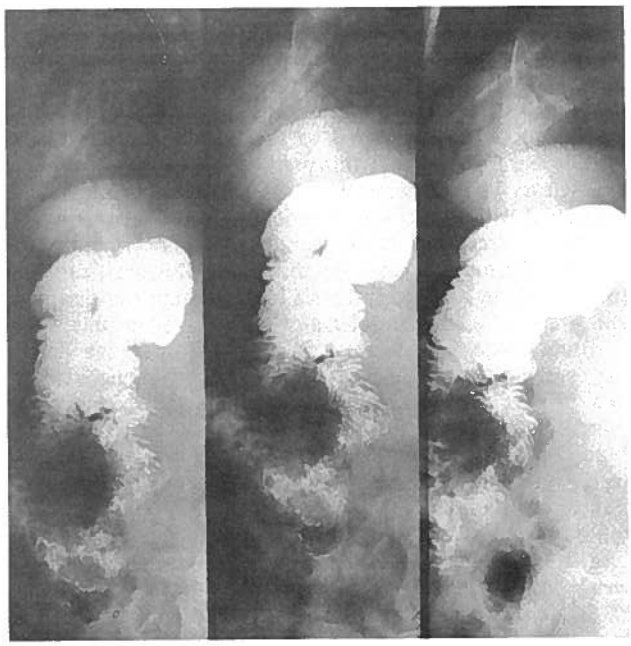


Figure 8: Physiological test meal studies in a patients after revisional surgery by Lygidakis method. The gradual emptying of the pouch is shown.

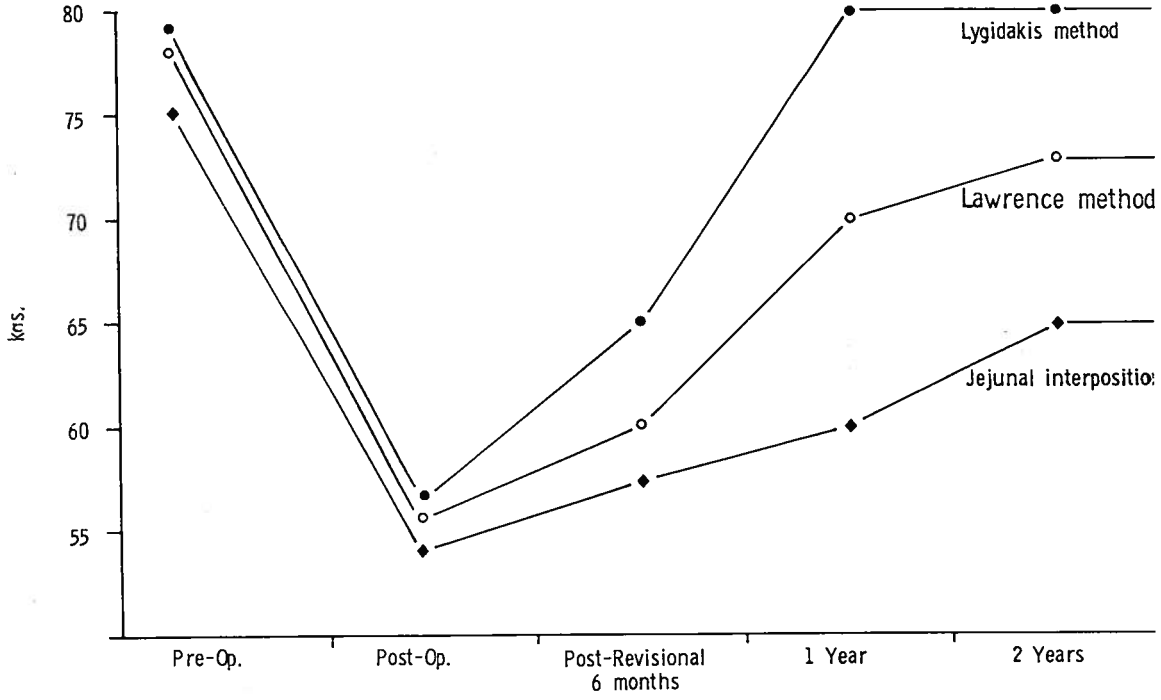


Figure 9: Weight changes after revisional surgery in patients with dumping by Lygidakis method, by Lawrence method, and isoperistaltic jejunal interposition.

DISCUSSION

The obtained results in this series of patients may well be accepted as indicative criteria that Lygidakis approach in the treatment of dumping syndrome offers a multiplicity of advantages when compared to the other methods. It has already been shown that this method is simple in technical terms, easy in performance for the average surgeon, and is associated with a minimum of morbidity and a short hospital stay as a result of its simplicity and its short operative time.[1] Furthermore it has been shown to offer most satisfactory results in a longterm basis in abolishing the disability and the troublesome problems of dumping syndrome.[15]

Radiological investigation in the post-operative period has demonstrated a delayed but effective emptying time for the new procedure and no dilatation within the reconstructed pouch. These findings were in striking contrast to the other procedures where emptying was either undesirably delayed with regurgitation and pronounced dilation of the jejunal pouch, or complicated by precipitate emptying and bile reflux into the stomach. The most striking feature of the results, however, was the maintenance of weight and indeed weight gain in all the patients who underwent reconstruction by Lygidakis method and the ability of them to return to a normal working life. These features were nor seen in patients who underwent reconstruction by use of either Lawrence's or jejunal isoperistaltic interposition remedial re-operations. Indeed although there was a weight gain in some of them, none had a weight gain equal to his pre-operative weight.

Finally, physiological test meals revealed a picture of real improvement in all patients who underwent reconstruction by Lygidakis technique, and only in a proportion of patients who underwent reconstruction by the other methods. The precise reasons as to why the new procedure appears effective are difficult to elucidate. Certainly there is delayed emptying and maintenance of pouch size.

It may well be that the creation of the two anastomoses allows the development of a circuitous peristaltic movement consequent on the maintenance of normal contractility between the two stomata. This circuitous movement appears to delay passage of food sufficiently, without allowing undue delay. The radiological studies reported in this paper support this view but experimental work would be necessary to assess electrical activity and motility to prove the point. Support for the hypothesis is that the maintenance of normal contractility in the two interposed segments of jejunum between the two jejunojejunostomies can be found from the work of Lawrence[12] and Woodward.[13] Indeed both had attributed to an impaired intestinal motility the observed progressive enlargement of interposed jejunal pouch, and they considered that this was due to a significant decrease in the motility of this intestinal segment after the incisions required to produce the plicated pouch, according to their method.

In conclusion it would seem that the newly devised procedure does indeed produce an actively emptying reservoir with a sufficient delay in emptying time to allow avoidance of the consequences of rapid emptying of food into the distal bowel. Furthermore it has been shown to be associated with a more gradual passage of nutrients through the bowel with a better chance for absorption and with avoidance of a passively dilated pouch with the consequent results of regurgitation and post-cibal fullness.

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