pilocarpine, strychnine, quinine, phosphoric acid, and syrup of the glycerophosphate of calcium is useful at any time. If there be any respiratory distress, pain, or insomnia we should not hesitate to give a hypodermic injection of omnopon or morphine. I have never prescribed quinidine, because I think the patient runs sufficient risks without the additional one of poisoning. In these cases there is always a deficiency of calcium, and some absorb it very badly, so you should regularly examine the urine for lime salts. Ringer's solution containing about double the usual amount of calcium chloride and two ounces of the syrup of glucose to the pint is an excellent beverage which should be drunk freely or used for diluting milk.

Enormous numbers of cases of heart disease got rapidly well after the armistice. How is it that since then not only the incidence but the mortality from diseases of the circulatory system has so increased that they have now become, in Osler's language, "the captain of the men of death"? Cardiac failure is now the medical explanation of sudden death; but why does the heart suddenly fail? It is a wonderful self-repairing pump, which can execute an enormous amount of extra work, and will not give out on slight provocation.

In conclusion, I strongly advise you to maintain a healthy and efficient circulatory system, and the heart will take care of itself. Your studies must be along the lines of biophysics and biochemistry. Look at the enormous strides which have been made in physics during the present century. If you wish to move in the van of progress you must educate yourselves; if you trust on the medical schools you are leaning on a broken reed. Associate with

physicists and you will learn something worth knowing. There is one book which I would like you to read, *The Bipolar Theory of Living Processes*, by George W. Crile, the great American surgeon. Be constantly on the lookout for something true, whether new or not. "Receiving a new truth is adding a new sense," though "there are few persons to whom the truth is not a sort of insult." I have often said to my professional brethren, Do not advertise: cure your patients and they will advertise you. It has been often said, with more or less truth, young men kill their patients, old men allow them to die. I counsel you to steer a middle course and keep them alive. Not only keep them alive, but keep them for ever in your debt by the maintenance of their health. Patients are not so ungrateful as some people imagine.

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ACUTE PERFORATION OF THE STOMACH AND DUODENUM.

A CRITICAL REVIEW OF THE RESULTS OF OPERATION.

BY

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FINALITY has by no means been reached in the discussion on the best routine treatment of perforated gastric and duodenal ulcer, and it may therefore not be out of place to consider the results obtained in a series of cases in which the conditions of technique and after-treatment were constant.

The series comprises 154 cases. The method of treatment was to invaginate the perforation by two layers of suture and to strengthen them by an omental graft. At the pylorus and in the duodenum the suture line was made to lie in the transverse axis of the bowel. Immediate gastro-enterostomy was not practised as a routine, and was, in fact, only performed in three of the cases. In one patient the perforation was converted into a gastrotomy by the insertion of a tube drain. Peritoneal drainage—usually suprapubic—was employed in about one-third of the cases, and more frequently in the earlier than in the later ones. All the patients were admitted to the Manchester Royal Infirmary, and it is to the members of the honorary surgical staff of that hospital that I am indebted for the opportunity to operate upon and report these cases. The series is consecutive in the sense that it includes all those patients whose condition warranted laparotomy and on whom it fell to my lot to operate during the years 1924-27. Their number is one which may perhaps fairly be said to indicate the average results of a uniform method under present-day conditions, when early diagnosis is the rule. It is to general practitioners who make this early diagnosis that any improvement shown in modern mortality figures is largely due.

Symptomatology.

One or two features of the clinical picture merit mention. Many writers—Moyrhan¹ most insistently—have emphasized the point that a rapid pulse rate is not necessary for the diagnosis of perforation, yet a normal pulse rate

certainly continues to cause hesitation, which may have disastrous consequences. There may occur an actual slowing of the pulse rate, which has been ascribed by Krecke² to stimulation of the vagus. In 40 of 129 cases of this series in which the pulse rate was recorded it was from 60 to 80 beats per minute. The absence of acceleration is perhaps specially evident during the "delusive interval," which occurs typically, though by no means constantly, between the fifth and twelfth hours after perforation.

Adamson, Oehlecker,³ Morley,³ and others have described shoulder-tip pain as a help in differentiating perforated ulcer from other acute conditions. Of 108 patients in this series in whom this point was investigated, shoulder pain was present in 74 and absent in 34. In only 52, however, was the pain at the point of the shoulder on one or both sides. In the others it occurred in the clavicular region, in the neck, or between the shoulder-blades. De Bruine Ploos van Amstel⁴ places little reliance on this symptom, and it may be admitted that it is neither constant nor pathognomonic. Yet the typical rigidity and dramatic onset may fail, as Cuendet⁵ and others have pointed out. In just such cases I have found shoulder pain a useful and comforting help in deciding on laparotomy.

Continental writers have described a pre-perforation stage with severe and uncontrollable epigastric pain as its main symptom. This is regarded as an absolute indication for surgical intervention, yet Schoemaker⁶ had a patient perforate on the night following a prophylactic gastro-enterostomy. In four of the cases here reported the history suggests that such a pre-perforative stage had existed. But it seems doubtful if this condition is more than an exaggeration of the ordinary "attack of ulcer" which frequently heralds perforation, as it did in 64 out of 77 cases in which a note on this point was made. In 10, perforation was the first sign of the existence of an ulcer.

One visualizes the "perforated" patient as suddenly and completely incapacitated. This is not always the case. After the onset of the excruciating pain, four of these patients walked varying distances of from eighty yards to one mile, three "walked home," one continued to work for a few minutes and then climbed down from a roof, and one drove a motor car for three miles.

Of importance in the matter of workmen's compensation is the influence of strain as a causative factor. In one patient (carcinoma of the stomach) the ulcer gave way

during a fit of coughing. Another patient, whose ulcer was in the duodenum, was in the act of lifting a heavy weight when seized with the classical pain. I have seen at least two other cases in which the relationship of effort appeared to be indisputable. This relationship has previously been described by many writers,* (Powers⁷), but the connexion must be immediate and undeniable before effort can be admitted as an etiological factor. It is interesting, but out of place here, to speculate on the mechanism of its action.

Sites of Perforation.

Owing to inflammatory infiltration it is not always possible to say whether a perforated ulcer is proximal or distal to the pyloric vein. Stenbuck,⁸ Fermaud,⁹ and Cuendet have drawn attention to this difficulty. The matter is not one of merely academic interest. Many Continental writers seem to classify pyloric ulcers as gastric. This may lead to erroneous conclusions in assessing mortality, and considerable difference of opinion apparently exists on the relative dangers of leakage from the stomach and the duodenum. Iserlin states that duodenal perforations have a better prognosis; Petren and Brunner hold the opposite view. Glaessner and Rosenthal,⁶ and Meyer and Brams,¹⁰ say that there is no difference. In order to be clear on this point I have classed all those perforations at the pylorus which were not definitely in the duodenum as pyloric. All the duodenal ulcers were in the first part, and no case of jejunal perforation is included in the series. One duodenal ulcer was on the posterior wall, and one lesser curve ulcer had opened into the lesser sac—in both cases the escape of fluid was minimal. This lesser curve perforation, one duodenal, and one pyloric perforation, were the second from which the respective patients had suffered. Whether in any of them the same ulcer had given way for a second time could not be determined, but a report of Borszaky's¹¹ demonstrates the possibility of such an occurrence.

Mortality.

Of the 154 cases, 20 died, making a mortality of 12.9 (say 13) per cent. The lesion was in the duodenum in 100 cases (8 deaths, 8 per cent.), at the pylorus in 33 (5 deaths, 15.1 per cent.), and in the stomach in 21 (7 deaths, 33.3 per cent.). Six of the stomach cases were malignant.

TABLE I.

Time between Perforation and Operation.	Number of Cases.	Deaths.	
		Number.	Percentage.
A. Perforated Duodenal Ulcer.			
Twelve hours or less	81	6	7.4
More than twelve hours	19	2	10.5
B. Perforated Pyloric Ulcer.			
Twelve hours or less	29	3	10.3
More than twelve hours	4	2	50.0
C. Gastric Perforations.			
Twelve hours or less	17	4	23.5
More than twelve hours	4	3	75.0
D. All Cases.*			
Six hours or less	75	4	5.3
Six to twelve hours	52	9	17.3
More than twelve hours	27	7	25.9

* This section shows the importance of the time factor.

In the twelve-hour groups the cases of duodenal and pyloric perforations treated without gastro-enterostomy show an almost identical mortality, between 7 and 8 per cent. Probably nearly all the pyloric ulcers were in fact duodenal. No attempt will be made here to force conclusions from small groups of case reports, but the figures support the view that gastric perforations are considerably more lethal than those in either of the other two situations—a matter of common knowledge to any experienced hospital sister. It is also interesting to note that the group of perforated carcinomata (6 cases under twelve hours) showed a better operative recovery rate than that of the non-malignant gastric perforations (11 cases under twelve hours).

The recent collective investigation into the after-history of gastro-enterostomy¹² undertaken by the British Medical Association showed the mortality in 112 cases of perforated duodenal and pyloric ulcer in which gastro-enterostomy was performed to be 13.6 per cent. Unfortunately no details are given of the stage after perforation at which operation was done, and comparison is therefore difficult.

Late Results.

Of the cases treated without gastro-enterostomy, 163 have been followed up for periods varying from eighteen months to four years and nine months from the date of operation. All those in the "quite free" class have been followed up for at least two years. Of the 163 patients, three have died, two from carcinoma of the stomach and one (duodenal) from an unknown cause. The remaining 160 cases may be classified as follows:

TABLE II.

	Duodenal.	Pyloric.	Gastric.	Total.
(a) Quite free from any kind of stomach trouble.	27	5	0	32
(b) Have or have had slight symptoms, certainly or possibly attributable to ulcer, but not justifying operation.	19	6	2	27
(c) Have ulcer symptoms which do or might by some be held to indicate operation.	15	10	1	26
(d) Have had a second operation for ulcer ...	9	4	2	15
Total	70	25	5	100

In Class (a) 21 patients have been free from symptoms for from two to three years, 10 have been free for from three to four years and nine months. An ulcer patient must always be liable to the risk of recurrence of symptoms, and the two-year period was taken for purposes of this follow-up for the following reason. Of 48 patients in whom recurrence took place and who stated the period of respite, in only 4 was it more than one year and nine months. It seems likely, then, that any return of symptoms after simple closure of a perforation will take place within two years.

Of the 100 patients, 65 have worked regularly since operation, 15 have been unemployed or have lost work but not on account of symptoms ascribable to ulcer, 20 have lost work on account of ulcer symptoms.

The Question of More Extensive Immediate Operations.

In this country controversy has centred on the advisability of immediate gastro-enterostomy. The question is one on which it is impossible to dogmatize. Much depends on the views of the operator as well as on the condition of the individual patient. Gastro-enterostomy has been said to diminish the death rate in the acute stage. Radoïévitch,¹³ in a thoughtful paper, says that simple closure of perforated ulcers gives a higher initial mortality—23.5 per cent. within the first twelve hours and 61.4 per cent. after that interval—than any of the more extensive procedures, including partial gastrectomy. Grey Turner¹⁴ and Dunbar¹⁵ state that primary gastro-enterostomy increases the mortality, and Zachary Cope¹⁶ uses this method less than he formerly did.

Various other advantages have been claimed for the extended operation in the acute stage, notably that it does away with the danger of stenosing the pylorus. I have been able to observe some hundreds of cases of perforated ulcer, operated upon by different surgeons, and do not remember ever having seen pyloric stenosis in the immediate post-operative period unless it had previously existed; but Rayner¹⁷ and Radoïévitch cite indisputable cases of this complication after suture alone. Many writers have pointed out its rarity, and the elaborate methods necessary to attain occlusion of the pylorus when it is deliberately undertaken make their statements easy of credence. The fear of stenosis should not be a reason

for systematic gastro-enterostomy at the primary operation. The supervention of pyloric stenosis as a remote complication will be mentioned later.

That a short-circuit may relieve tension on the suture in large callous (especially gastric) ulcers appears probable. The technical difficulties of closure in certain of these cases are very great and time-consuming—a fact used with some force by those who press for radical measures in the acute stage.

Most British writers advise suture alone as the routine procedure (Berry, Rowlands, Legg,¹⁴ Adams,¹⁸ Pannett, etc.); and even the advocates of anastomosis (Mills,¹⁹ Evans,²⁰ Sherren,¹⁴ and others) point out that it is not a method for every operator. The condition of the patient has an obvious importance, though the necessity for extreme speed in operating may have been exaggerated.

But perhaps the most attractive argument for immediate gastro-enterostomy is contained in the statement that its remote results surpass those of simple closure. Dunbar, however, did not find any great permanent benefit to follow the combined operation, and it is interesting to note that its alleged unsatisfactory end-results have been advanced against gastro-enterostomy by those who favour immediate resection of the stomach (Nyström,²¹ Kreuter²²). It has also been claimed¹³ that reperforation, of which three cases are here reported, would be prevented by complementary gastro-enterostomy. Platou²³ records three cases of reperforation within one year of simple closure of the original perforation.

If it had been possible to undertake the combined procedure in the 100 cases mentioned in Table II, and if they had all remained quite free from symptoms, at least 32 of them would have undergone an unnecessary gastro-enterostomy for the benefit of the remainder. Each individual surgeon's practice will be governed by the answer which he finds to the question implied in this fact: assuming the improved mass end-results, is one justified in obtaining them by submitting a considerable minority of patients to an operation which is, to them, unnecessary? It may be argued, not illogically, that one is justified. It may also, with at least equal logic, be argued that one is not justified in submitting any patient unnecessarily to an operation of which Hurst²⁴ has said that it is the commonest gastric disorder of the day, even though one may not take such a gloomy view of it as he does. Pannett²⁵ has pointed out that patients whose ulcers perforate, seem prone to the formation and perforation of anastomotic ulcers, and Bolens²⁶ instances some striking examples of repeated perforations at the anastomotic line. (See also Riess,²⁷ Ashcroft, Ehrlich, Porzelt, Butler, Robinson, and Nixon²⁸ and Lowry.²⁹)

Should one decide that the ability of the patient to bear it should not be the sole indication for something more than mere closure of the perforation, are there any guiding factors to help one in the selection of cases? Existing pyloric stenosis, and the probability that it will occur in the process of healing, are obvious indications. The later development of pyloric stenosis certainly occurs frequently enough to demand consideration. Induration of the ulcer and chronicity of symptoms (by no means synonymous terms) are also indications, but do not point the way quite so clearly. K. P. Brown,²⁸ in opposition to most writers, finds that patients without previous symptoms have worse late results than those with long-standing dyspepsia. The following tables have a bearing on this point. In them are analysed 22 cases classed in Table II as quite free from stomach trouble.

TABLE III.—Total Duration of Dyspepsia.

	Cases.
No note	8
"Some"	5
Up to one year	5
Two to nine years	7
Perforation during first attack of dyspepsia	7

TABLE IV.—Induration.

	Cases.
No note	9
Absent	8
Present	15

The numbers are too small to allow any generalization, but it is clear that neither induration nor length of history affords an infallible guide as to whether suture

alone will cure or not. It seems justifiable to suggest that, in the absence of stenosis, the selection of cases for primary gastro-enterostomy demands careful and mature judgement.

Of the more radical operations in the immediate treatment of perforated ulcer (excision or cauterization of the ulcer with or without gastro-enterostomy, sleeve resection, partial gastrectomy) I have no experience either as an operator or as an observer. The results claimed by Continental surgeons²⁹ seem to justify radical extirpation of an operable perforated carcinoma of the stomach if the general condition of the patient allows. Indeed, it was in such circumstances that Keetley³⁰ in 1902 first demonstrated the possibility of radical measures. If there is a class of non-malignant case in which the more extensive methods appear indicated in competent hands, it is that of the large indurated gastric ulcers in which faulty closure is only overcome by wide infolding, often after the expenditure of much time and with gross deformity of the stomach as a result. The mortality of suture in these cases is high, and it is conceivable that it might be reduced by the certain approximation of healthy tissues after removal of the infiltrated area. Much more rarely, extensive and callous duodenal ulcers call for similar treatment (Grimault,³¹ Dunbar).

Conclusions.

1. The immediate mortality of treatment without gastro-enterostomy in 125 cases perforated for twelve hours or less was 9.6 per cent.; and in 26 cases perforated for more than twelve hours 26.9 per cent. It is suggested that these figures fairly accurately represent the average under present-day conditions.

2. In a two-year follow-up, 32 per cent. of patients stated themselves to be quite free from any kind of stomach trouble after suture without gastro-enterostomy.

3. The immediate results after suture alone in pyloric and duodenal perforations are practically identical. Secondary operation finds more frequent indication in pyloric perforations.

4. Closure must be safe. In exceptional cases safety may demand something more radical than mere suture, with or without gastro-enterostomy. If in a given case such extensive methods are unjustified, careful apposition of the edges of the perforation by suture and the reinforcement of this by an omental graft are preferable to the infolding of a wide area of stomach wall.

5. Apart from the cases mentioned under 4, gastro-enterostomy should usually be reserved for those cases in which stenosis is either actually present or likely to result from healing. In view of the fact that in other cases it is unnecessary in one out of three, it should not be done as a routine. The presence of an unnecessary gastro-enterostomy is not without risk, and it is better to await results and do it later if it should be necessary. Its systematic performance at the time of perforation without definite indication is certainly not likely to diminish mortality.

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