is impossible to cover more than one or two points in the time at hand.

In his title he lays particular stress only upon those cases of prostatic obstruction in which there is overdistention or complete retention. I am a strong advocate of suprapubic drainage in these cases, particularly those with an uninfected urine, as clinically they do better under this method than any other. I have employed it a number of times and have never regretted having done so, while on one or two occasions where I have not employed it. I have been sorry. I think the chances of renal infection are much diminished and the patient more easily brought to a state of stable equilibrium.

Another very important point is the use of fluids before and after operation and the early recognition of the symptoms calling for their administration, that is, the slight abdominal distension, hiccoughs, mental haziness and vomiting. Much can be done for these patients by the prompt administration of salt solution by mouth, or if the patient is delirious or unconscious, by rectum or under the skin. I remember two recent cases of my own where adequate pre-operative treatment could not be given because the prostate had to be removed for hemorrhage, and was of such size as to prevent preliminary suprapubic drainage. These cases both became delirious, with dry tongue and other signs of renal insufficiency, but made a good recovery after forced administration of salt solution; one patient receiving a subpectoral infusion five times at intervals of six hours.

ACUTE AND SUBACUTE PERFORATIONS OF THE STOMACH AND DUODENUM AT THE MASSACHUSETTS GENERAL HOSPITAL.*

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THE following paper is based on the acute and subacute perforations of the stomach and duodenum at the Massachusetts General Hospital, 104 in number, occurring in 103 patients. Cases of chronic perforation, walled off by adhesions, showing neither acute peritonitis nor abscess formation, have not been included. This series includes the total experience of the hospital from the first operation in 1896 through 1915, a period of twenty years, which may be subdivided into two periods of ten years each, the first including the development of diagnosis and operative measures, the second, a more or less standardized treatment. Both periods are included, for although the first period may not give a true idea of the present operative results, yet it contributes to a consideration of incidence and symptoms, and provides a few surviving cases in which the late results are known.

The purpose of the paper is to consider the results of operative treatment with especial attention to the advisability of a primary gastro-

enterostomy as well as closure of the perforation, although the statistics afforded by this group of cases have also been included.

There were 90 operations for perforation in 89 cases, one duodenal case re-perforating at the end of three months. These operations were performed by 23 surgeons, the largest number falling to any one man being 11. 14 patients died without operation. Of this latter group of 14 cases, 5 were moribund on admission, operation was considered inadvisable in 3, and error in diagnosis occurred in 4 cases, while 2 cases gave no clinical evidence of perforation, which was discovered unexpectedly at autopsy. The clinical diagnosis was confirmed by autopsy 11 times in this group. Five of the cases were gastric and 6 were duodenal. It is fair to assume, from the clinical history and examination, that the remaining cases also had gastric or duodenal perforation.

Of the operated cases, 76 showed an open perforation without walling-off, 6 a diffuse peritonitis although the perforation appeared sealed at the time of operation, and 8 a more or less local abscess.

The operative cases were classed at the time of operation as either gastric or duodenal. These, together with the non-operated cases confirmed by autopsy, gives a group of 100 patients, of which 43 had gastric and 57 duodenal perforations. This grouping, especially in the earlier operated cases, is necessarily somewhat inaccurate; nevertheless, of 8 cases classed as gastric coming to autopsy following operation, 6 were gastric and 2 duodenal, while all of the duodenal group coming to autopsy following operation were found to be duodenal. Consequently I feel that although the gastric group may include duodenal cases, nevertheless, there is sufficient preponderance of gastric cases to make any difference between the two groups real and not apparent. Since the gastric and duodenal perforations are by no means identical in clinical course or amenability to treatment, these two groups are analyzed separately, except where the location of the perforation was indifferent to the fact considered.

In sex there is a marked difference between gastric and duodenal groups. The gastric cases include 24 men and 19 women, or 55.8% of men. The duodenal cases include 54 men and 3 women, or 94% of men.

The average age of gastric cases is 33 years, of the men 36.8, of the women 27.7 years. The youngest was 18, and the oldest 72.

The average age of the duodenal cases in men was 33.4 years. The youngest was 21 and the oldest 67.

Arranged by decades:

	GASTRIC		DUODENAL	
	MEN	WOMEN	MEN	WOMEN
Under 20	1	1		
20-29	3	11	13	2
30-39	3	3	16	
40-49	7	1	13	

* Read before the Southern Surgical Society, Dec. 12, 1916, and before the Boston Surgical Society, Jan. 10, 1917.

	GASTRIC		DUODENAL	
	MEN	WOMEN	MEN	WOMEN
50-59	5	1	9	1
60-69	4	2	3	
70+	1			
TOTAL	24	19	54	3

The striking thing from these figures is the predominance of duodenal perforations in men, and the occurrence of gastric perforations in women, particularly between 20 and 30. Both types of perforation in men are well spread out through middle life, the duodenal occurring slightly earlier than the gastric. Given an acute perforation in a woman, these figures would suggest that it is six times as likely to be gastric as duodenal.

Perforation was in all instances, as far as observed, single. The location of the perforation was determined by autopsy in 17 duodenal and 11 gastric cases, and approximately noted at operation in 24 gastric and 29 duodenal.

The gastric perforations found at autopsy were located as follows:

Anterior wall—8 cases.

- 1 anterior wall near lesser curvature 2 cm. above pylorus.
- 1 2 cm. above pylorus.
- 1 anterior wall of stomach.
- 1 anterior wall, 3½ cm. above pylorus, in anterior part of saddle ulcer of lesser curvature.
- 1 anterior wall 10 cm. above pylorus.
- 1 anterior wall 10 cm. above pylorus.
- 1 anterior wall of lesser curvature near middle of stomach.
- 1 anterior wall, middle of stomach, near greater curvature.

Posterior wall—3 cases.

- 1 posterior wall at pylorus, perforating anteriorly through lesser omentum.
- 1 posterior wall, upper part of lesser curvature.
- 1 posterior wall, midway between greater and lesser curvature, 7 cm. from oesophageal opening.

The location of the gastric perforations, observed at operation but not confirmed by autopsy, was stated as follows:

Anterior wall—22 cases.

- near pylorus—10.
- lesser curvature, near pylorus—4.
- middle of lesser curvature—1.
- high on lesser curvature—2.
- near cardiac end—2.

Posterior wall—2 cases.

These figures show the predilection for the anterior wall near the pyloric end and along the lesser curvature to be expected. Perforation on the posterior wall occurs sufficiently often to be a possibility worthy of consideration.

Location of duodenal perforations as shown by autopsy cases was:

Anterior wall, superior aspect—5 cases.

- anterior superior aspect, immediately below pylorus—4.
- anterior superior aspect, 1 cm. below pylorus—5.
- anterior aspect, 1.5 cm. below pylorus—1.
- superior aspect—1.

Posterior wall—2 cases

The greatest distance noted below the pylorus was 1.5 cm.

Operative findings as to the location of the duodenal perforations not confirmed by autopsy were stated as follows:

1st part, unspecified—12 cases.

1st part, anterior wall—8 cases.

1st part, superior aspect—4 cases.

1st part, inferior aspect—1 case.

anterior wall, 8 fingers below pylorus—1 case.

posterior wall, 1st part—2 cases.

posterior wall, upper second part—1 case.

These figures emphasize what a small area of the duodenum is usually penetrated by these ulcers, and the great vulnerability of a point on the anterior superior aspect, within one or two centimeters of the pyloric ring. A common type of lesion at autopsy was a transverse ulceration close to the pylorus, involving the posterior and superior wall of the duodenum, and perforating at its anterior end through the anterior aspect of the duodenum.

The process tended to become localized about equally in both gastric and duodenal cases. The omentum appeared to close or partly close the perforation 5 times in gastric cases. This was not noted in the duodenal cases. In these when apparent sealing took place it was due to fibrin or adhesion to neighboring organs.

Many cases gave at the time of perforation a history of antecedent indigestion. This was considerably more frequently true in the gastric than in the duodenal cases. These symptoms may be classified in three groups,—first, digestive symptoms suggestive of ulcer; second, digestive symptoms too indefinite or too slight to suggest the source; and third, no digestive symptoms whatever. In 33 gastric cases, symptoms suggestive of ulcer, 49%; indefinite digestive symptoms, 36%, no digestive symptoms, 15%. The duodenal cases showed digestive symptoms suggestive of ulcer, 16%, indefinite digestive symptoms, 54%, no digestive symptoms, 30%.

Duodenal perforations, consequently, appear more likely to occur without any previous warning in the way of digestive symptoms than gastric perforations. In only a small proportion of duodenal cases is the history previous to perforation sufficiently definite to be an aid in differential diagnosis. In gastric perforations, how-

ever, the previous history would appear a definite help in about one-half of the cases.

Premonitory symptoms preceding perforation occurred in a considerable number of cases, in the form of definite increase in pain, tenderness, or distress following eating. The exacerbation of symptoms usually preceded perforation by three or four days, rarely as much as two weeks, and is probable attributable to peritoneal irritation from thinning of the ulcer base.

The onset was sudden in 90% of the cases. Occasionally there was a sense of something giving away. The pain was described as sharp, knife-like, agonizing, excruciating, prostrating. In contra-distinction to the pain of appendicitis, which is usually first general and then becomes local, the pain in perforation tends more to be local at first, becoming more diffuse with the spreading of the extravasated fluids. The commonest location was in the epigastrium and right hypochondrium. The principal tenderness corresponded in general with the principal pain. In duodenal cases, the greatest tenderness was referred particularly to the right side, principally the right hypochondrium, but frequently extending down the right flank into the right iliac fossa. In gastric cases, the pain and tenderness although usual in the epigastrium and on the right, might show its maximum on the left and extend down the left flank. The greater tenderness was on the left in about 15% of the gastric cases.

Spasm was commonly general, frequently board-like in character, the greatest spasm usually corresponding in location to the greatest tenderness.

Occasional vomiting occurred in 83% of the cases. It was usually not a prominent or persistent symptom.

Elevation of temperature was usually slight in this series. It was normal or subnormal on admission in 35% of the cases. The highest temperature on admission was 103°.

The leucocyte count on admission was noted in 62 cases. The minimum count was 6,000, the maximum 56,000, both occurring in fatal cases. The average count of the fatal cases was 18,500, of those recovering 19,800. The white counts in both series, those recovering and those dying, showed very similar variations, and no general conclusion as to a prognostic value in the white count could be drawn.

Liver dullness was said to be obscured in 15 cases, and diminished in 11 more. While this physical sign may occur, it seems that these figures tend to exaggerate its frequency. Its presence in a few instances is of little value in the diagnosis of the average case.

Distention was present only as a late development. The abdomen was usually flat, occasionally retracted. When present it is a bad prognostic sign. 18 cases in which more than slight distention was noted gave an operative mortality of 72%.

At the present time the matter of diagnosis needs little discussion. The fact that there is a surgical emergency demanding operation is reasonably clear in all cases.

Confusion with appendicitis occurs especially in the duodenal cases, in which the gravitation of the duodenal contents down the lumbar gutter between the ascending colon and the right flank may give rise to an apparent maximum of tenderness and spasm in the right iliac fossa. In such cases at operation the character of the peritoneal fluid, usually thin and odorless, and considerable in amount, in combination with an appendix, which if abnormal at all, shows only superficial injection without tenseness or necrosis, or possibly adherent fibrin, which it shares with other peritoneal surfaces, should make exploration of the stomach and duodenum an obvious necessity. Disease of the gall-bladder which gives sufficient disturbance for confusion with perforated ulcer should be obvious on exposure of the gall-bladder. At operation the same incision fortunately gives access to the duodenum and pyloric end of the stomach.

A probable preliminary diagnosis of appendicitis, as shown by the location of the first opening in the peritoneum was made in 31% of the duodenal cases. In only two cases coming to autopsy, however, was the source of the peritonitis apparently not suspected at operation. This confusion occurred principally in the earlier cases. In the gastric cases the first peritoneal opening was less frequently low.

Of 90 perforations in 89 cases treated by operation, 32 died, a general mortality of 35.5%. If we include 14 cases dying without operation, the total mortality of the cases admitted is 44.2%. Eight cases, all of which recovered, showed a more or less local abscess at the time of perforation. This leaves 82 cases, 48 duodenal and 34 gastric, which showed a diffuse peritonitis at the time of operation. Of the duodenal cases 15 died, a mortality of 31%; of the gastric 17 died, a mortality of 50%.

These figures, including a period of twenty years, do not give a fair idea of the mortality of perforation with diffuse peritonitis at the present time. If they are divided into two periods of ten years, the second period will more nearly represent the present mortality.

From 1896 through 1905 inclusive, the gastric cases were 11 in number, of which 7 died, and 4 recovered, a mortality of 64%. The duodenal cases were 7 in number, of which 5 died and 2 recovered, a mortality of 77%.

From 1906 to 1915 inclusive, there were 23 gastric cases, of which 10 died and 13 recovered, a mortality of 43.5%. The number of duodenal cases was 41, of which 10 died and 31 recovered, a mortality of 24.4%.

The following table gives an analysis of the mortality for five-year periods.

	GASTRIC			DUODENAL		
	R	D		R	D	
1896 to 1900	1	3—75 %	died	2	100 %	died
1901 to 1905	3	4—57 %	"	2	3—60 %	"
1906 to 1910	10	6—37.5%	"	12	5—29.4%	"
1911 to 1915	3	4—57 %	"	19	5—20.8%	"
	17	17—50%	died	33	15—31.2%	died

This table shows a steady lowering of the mortality of duodenal perforations while that of gastric perforations remains high. It also shows an increasing frequency of duodenal as compared with gastric ulcers, probably due in large measure to more accurate localization. In spite of any such error in localization, it would seem assured that gastric perforation carries a considerably higher mortality than duodenal.

The following reasons may partly explain this difference. Duodenal perforations occur in a limited area, while gastric perforations may occur over a wide extent of stomach. A duodenal perforation may therefore be found more quickly and with less manipulation. The possible greater accessibility of duodenal perforations may also favor ease and rapidity of closure. The pyloric sphincter may lessen the outpouring of gastric content through a duodenal perforation, the leakage from which might be limited chiefly to the duodenal contents. The anatomical situation of the duodenum, and its relation to surrounding structures, may limit the dissemination of fluid from the perforation to a greater extent than in perforation of the body of the stomach.

The chief factor in mortality in cases with diffuse peritonitis is distinctly the elapse of time from perforation to operation. Thus the elapse of time after perforation in 27 duodenal cases recovering was 14°, in 11 fatal cases, 25°. The elapse of time in 15 gastric cases recovering was 17°, in 16 fatal cases 19°. Cases which showed a localization of the peritonitis have not been included in these figures.

In this connection, the cases which died in the hospital without operative interference are of some interest. Of 14 cases dying without operation, 8 gave a sufficiently definite history to enable one to estimate the duration of life from the time of perforation to the time of death. The longest survival from perforation to death was 51°, the shortest 24°, and the average 32°. Consequently, if a case is operated on toward the end of the second day, the margin of resistance is naturally extremely small. One may conclude in cases that survive much beyond the second day, that localization of the peritonitis

has occurred, aided presumably by sealing of the perforation or by its small size or position.

Age is an important factor in mortality. In considering this point, I have taken only the second decade, since technical errors are less important as a factor in mortality in this period. The average age of the duodenal cases recovering in 1906-1915, was 36 years, of those dying, 50 years. The average age of the gastric cases recovering was 32 years, of those dying, 51 years. The influence of age on mortality is more clearly shown by decades.

GASTRIC CASES

60-67	3 cases	100 %	died
50-59	4 "	100 %	"
40-49	4 "	25 %	"
30-39	3 "	0	"
19-29	9 "	22.2%	"
23 cases		43.5%	died

DUODENAL CASES

60-67	3 cases	100 %	died
50-59	6 "	33.3%	"
40-49	10 "	30 %	"
30-39	12 "	16.6%	"
21-29	10 "	0	"
41 cases		24.4%	died

The conclusion seems clear, therefore, that age is an extremely important factor in prognosis. The increase of mortality with age should be borne in mind in connection with operative procedures.

The principal cause of death was peritonitis. Of 32 deaths, 17 occurred within three days, due presumably chiefly to this cause. Six of these 17 cases, all gastric, died within 18°, while the shortest survival in the duodenal cases was 24°. I should take this as further evidence that gastric perforation is a more desperate condition than duodenal. Peritonitis as a principal cause was confirmed by autopsy in 5 instances. One case showed also lobar pneumonia, a second, dying on the third day, subdiaphragmatic abscess, and a third, clinically dying from diabetic coma, a chronic pancreatitis.

Three additional deaths occurred in the first week, and four during the second. Autopsy in three cases showed peritonitis; peritonitis and focal pneumonia; and in a case dying on the tenth day, subdiaphragmatic abscess with perforation of the diaphragm, right empyema and extension into the lower lobe of the right lung with abscess formation.

Of 8 cases dying after the second week, 6 developed subdiaphragmatic abscess as shown once by operation, and in the remaining cases by autopsy. Death occurred on the 16th, 33d, 38th, 40th, 44th, 54th days. Two cases were drained by operation, one case apparently recovering from the abscess after multiple operations when obstruction developed. In a third case, a resulting empyema was drained, but an undrained subdiaphragmatic abscess was found

at autopsy. In these 6 cases, there was an accompanying empyema in 3 cases, and an abscess of the lung in one, in two instances due to direct perforation of the diaphragm. Of the total 8 cases of subdiaphragmatic abscess, 6 followed duodenal and 2 gastric perforation.

The remaining two cases died on the 15th day, one of suppurative nephritis, the other of perforation of the descending colon with peritonitis.

It seems to me that the occurrence of subdiaphragmatic abscess is a matter of particular importance. It developed eight times in 32 cases, or in 25% of the deaths. It was only recognized clinically, and operated on in two cases, both of which ultimately resulted fatally. Extension of the process through the diaphragm occurred five times, in 3 cases by direct perforation. These facts emphasize the importance of careful study by clinical examination and x-ray in cases of unexplained temperature, and the necessity for exploration on the suspicion of abscess.

Of the 82 cases with diffuse peritonitis, 70 were treated by closure or drainage of the perforation alone, and 12 had a posterior gastroenterostomy added. Of these 12 cases, 4 gastric and 8 duodenal, 2 died, one from diabetic coma and one with delirium tremens. This would appear to give a lesser mortality to those cases in which gastroenterostomy was done, but it should be noted that these cases were favorable ones at the time of operation.

The cases treated by drainage or packing without suture showed a higher mortality than those closed by suture. Of course this was largely due to the employment of this measure in the particularly bad conditions where speed was important, or in perforations difficult of access, or having much surrounding induration. However, the difference is so great that I feel that even in such cases a greater expenditure of time and more manipulation is justifiable to secure good closure. The use of an omental flap sutured over the perforation may be important in this connection.

General irrigation with salt solution was employed in the majority of the earlier cases; its use in the latter cases was much less frequent. The impression given by this series is that the expenditure of time and increase of shock its use requires hardly justifies it as a routine measure. In this connection, culture of the peritoneal fluid obtained at operation is of interest. In 35 cases, culture gave a growth 7 times and no growth 28 times.

Drainage of the neighborhood of the perforation was almost universally employed. Judging from the results of culture of the peritoneal fluid, drainage might have been omitted in a larger proportion of cases. However, as it is difficult to tell at operation just in which cases it may be helpful, its use in so many cases, even if occasionally unnecessary, would at least seem

justifiable. A tube to the bottom of the pelvis through a supra-pubic stab-wound was used in a small proportion of cases. It is hard to estimate the effect of this measure. At any rate, it would seem advisable only in the case of a considerable collection of definitely purulent fluid in the pelvis.

The great question is, of course, whether gastroenterostomy is advisable as a general procedure. This will be taken up particularly in discussing the late results. As far as the immediate recovery from perforation is concerned, it is not obvious how a further employment of gastroenterostomy would have benefited the mortality. The cases did not die from inability of the stomach to pass food into the intestines. They died of shock and sepsis. In looking over the records, it is hard to see that the obstruction caused by infolding through suture of the ulcer excited any bad influence on the mortality. It may be argued that gastroenterostomy relieves tension on the sutured perforation, and so both lessens the danger of leakage and promotes healing. But if the perforation is reasonably well closed, the leakage does not seem likely to occur. It seems to me that the question of gastroenterostomy at the time of closure of the perforation is a question of its effect on the remote results of the operation to the patient, but not of aiding the immediate likelihood of recovery from perforation.

The question is, are the late results following the closure alone of perforated ulcers sufficiently good to make the additional time needed for a posterior gastroenterostomy an unnecessary risk? An attempt has been made to find out the late condition of the patients with especial reference to this point. The cases recovering from subacute perforations have been included, since the effect of perforation and closure on the gastric and duodenal wall should be approximately the same in either case.

Of the total cases surviving, 57 in number, 12 cases have no bearing on this question, since a gastroenterostomy was performed at the time of the primary operation. Of these 12 cases, 5 gastric and 7 duodenal, 8 cases have been heard from at periods of from one to eight years. Two gastric cases were both well. Four duodenal cases were well, one duodenal case when last heard from had recurrent haemorrhage beginning five years after operation, and one had died after 19 months apparently from urinary sepsis following stricture.

Of the remaining 17 gastric cases which recovered following closure or drainage without gastroenterostomy, 12, or 70%, have been heard from. Two cases have required a secondary gastroenterostomy, 1 at the end of two months, the other at the end of two and a half years. The first case required a third operation after 6 years, freeing of gastric adhesions. Both cases were well when heard from, 1 year following the last operation. Two cases had definite

gastric symptoms. One of these was strongly alcoholic, and died four years following operation. Six cases were free from gastric symptoms. One of these developed phthisis at the end of four years, dying eight years after operation. A second, after freedom from gastric symptoms for eleven years, developed an obstructive carcinoma of the esophagus, for which gastrostomy was done. Two cases at the end of three years were in fair health, but required limitations of diet. Thus, to sum up, 6 cases, or one-half, were apparently as completely relieved as they would have been with an additional gastroenterostomy; two cases, while not completely relieved, had tolerable symptoms, while in 4 cases, two of which required further operation, the late results were definitely bad.

Of 27 surviving duodenal perforations treated without gastroenterostomy, 20, or 74%, have been heard from. One of these cases had a second perforation three months following the first, at a point one-half inch distal to the original perforation on the superior aspect of the first part of the duodenum. A gastroenterostomy was done as well as closure, and the patient reported well two years later. Four other cases had a subsequent gastroenterostomy. One of these was done one month after closure by advice as a preventive measure, although the patient had no definite digestive symptoms. One case was free from disturbance for ten years, when he developed moderate digestive symptoms, for which appendectomy and radical cure of right inguinal hernia was done. Of the remaining 14 cases, 11 reported themselves well at periods of one to twelve years. Two cases had slight symptoms at the end of one year, and one case developed moderate symptoms at the end of five years of freedom.

To sum up, in these 20 cases, there was one re-perforation, four cases had a secondary gastroenterostomy, two cases had moderate, and two cases slight digestive symptoms, while eleven cases were apparently relieved following closure of the perforation. The results were apparently good in 11, or 55%, of the cases when heard from, and tolerable in 13, or 65%, of the cases.

In both duodenal and gastric cases, it is plain that a primary gastroenterostomy might have avoided a considerable number of secondary operations. At the same time, about one-half of the cases followed reported themselves well and free from symptoms. It is possible, of course, that symptoms may develop later in these cases. At the same time, as long as freedom from trouble persists for a considerable period in so many cases, it is well to be conservative in adding a method of treatment which prolongs considerably the time of the primary operation. It is not fair, either, to consider that an additional gastroenterostomy would give 100% of cures. There is no question but that gastroenterostomy may be safely added at the

primary operation in young people operated on shortly after perforation. Whether or not the added gastroenterostomy will unfavorably influence the operative mortality will depend on the surgeon's judgment in selecting cases, and his speed and skill in carrying it out.

The present series of cases suggests the following contra-indications to gastroenterostomy. It should not be performed in ulcers definitely gastric. The mortality of closure alone, 43.5%, is too high. In addition, closure of such ulcers is less likely to cause pyloric obstruction, and the benefit of gastroenterostomy is likely to be less marked than in ulcers of the duodenum.

In perforated duodenal ulcer in cases beyond middle age gastroenterostomy should be rarely added, since the mortality of closure of the perforation alone is high in cases at this time of life.

For the remaining duodenal cases, it is a matter of individual judgment. If there is the least question as to the patient's power of resistance to the peritoneal infection, it should be omitted, since he has at least an even chance of future freedom from symptoms without it. At the worst, it may be done as a secondary measure. It is true, that many people prefer to get along with discomforts rather than go to the time, trouble and expense of a second operation, and much might be saved in these cases. At the same time, the main aim should be reduction of the primary mortality, and other considerations should remain entirely secondary to this.

In conclusion, I should like to note the following points:

This series gives no evidence that pyloric obstruction is a factor increasing the primary mortality which might be avoided by an immediate gastroenterostomy.

Gastric perforations carry a distinctly higher mortality than duodenal.

The mortality of both gastric and duodenal perforations is high after middle life.

One-half the cases of perforation, treated by suture alone, were apparently cured following operation.

Therefore, an additional gastroenterostomy may well be avoided in cases of gastric perforation, in patients beyond middle life, and in any case where the general condition or elapse of time since perforation suggests possible death from peritonitis.

This series suggests, that for the average surgeon, at least, the rule should be to close the perforation, and the exception to add a gastroenterostomy.

DISCUSSION.

DR. I. J. WALKER (by invitation): In a previous paper on this subject, read before the Massachusetts Medical Society, June, 1915, I summarized and derived certain conclusions from a study of the cases from the surgical records of the Boston City Hospital from 1905 to 1914 inclusive. These were 78 in number. There have been 53 cases since then up to Jan. 1, 1917, making a

total of 131 in twelve years. A completed study of these cases has added really nothing new in the way of etiology and diagnosis of this condition. One hundred and twenty-two were males and 9 were females. The average age of the males was 34.25 years and the females 26 years. The youngest patient was seven years of age and the oldest seventy-one. The site of the perforation was in the stomach in 75, in the duodenum in 52 and at the pylorus itself in 4. In all except three the perforations of the stomach were found within two inches of the pylorus. In the latter the openings were near the cardiac end. The perforations of the duodenum were all upon the first portion and anterior wall except two, the latter being upon the posterior wall of the first portion.

It would seem that the most important point for discussion would be along the lines of treatment, which really narrows down to two questions. First, as to the necessity of drainage. It has been rightly said that drainage is not always necessary in those cases seen soon after perforation, since the contents of the stomach and duodenum are relatively sterile and what infection there is present will be cared for. In 34 cases of various duration, cultures were taken from the fluid in the peritoneal cavity, of which 14 showed bacterial growth and 20 were sterile. However, there is no way of determining macroscopically in a given case whether or not the fluid is sterile and, if not sterile, what may be the number and virulence of the organisms. In this series 6 cases were closed without drainage, with 5 recoveries and one death, the latter from general peritonitis. I think we must admit that while cases do recover without drainage the safest procedure would be drainage in every instance. Secondly, I wish to refer to operative measures in addition to closure of the perforation, such as gastroenterostomy. Theoretically, as in chronic ulcer, we should like to excise, cauterize or enfold the ulcer and do a gastroenterostomy in every case. Practically, however, this has up to now not seemed advisable owing to the condition of the patient or to the danger of spreading the possible existing infection. I think that we must all agree that gastroenterostomy becomes a necessity where the lumen of the pylorus or duodenum is narrowed as the result of closure of the perforation. In this series, and for this reason, gastroenterostomy was done in seven cases with a recovery in each instance. Gastroenterostomy becomes a matter of judgment in a small group of cases seen soon after perforation where the infection is slight and the patient in good condition. It is not a necessity in this group as we well know that patients recover with closure of the perforation alone. However, while we are quite sure that a certain number of patients are cured of ulcer symptoms by simple closure of the perforation, we are also sure that certain others have recurrence of their troubles. I am not in a position to give statistics on this question but hope to later when these cases have been followed up thoroughly. I do believe that the average surgeon will have a lower mortality in a large series of cases, by simply closing the perforation and later doing a gastroenterostomy, if necessary.

Results. There were 129 cases operated upon by 18 surgeons with a mortality of 34.3-8%. Two cases died without operation, the diagnosis being confirmed at autopsy. Five of the cases operated upon were practically moribund at the start and

died within two hours. The average duration of the perforation was 27.7 hours. Eliminating 12 who were operated upon more than 48 hours after perforation, we find an average duration of about 17 hours. Of 30 operated upon during the first four hours only one died. This death occurred on the sixth day after operation from a secondary hemorrhage in an arteriosclerotic individual. Of those operated upon from five to twelve hours after perforation, the mortality was 12.1%. Of those 13 to 24 hours after perforation, 36.3%. Of those 25 to 48 hours after perforation, 83.1%. Twelve were operated upon, in which the perforation had existed more than 48 hours, with five deaths and seven recoveries. Of those who recovered in this group it should be said that each had a walled-off abscess.

Conclusions. Simple closure of the perforation, with drainage of the peritoneal cavity is the safest procedure in the majority of cases.

Certain cases, who have recovered from perforation, are cured of ulcer by simple closure of the perforation. Unquestionably, others have recurrence of their troubles. It would be well that investigation be carried out in order to give accurate statistics in regard to the question of recurrence of ulcer following simple closure of the perforation.

The mortality in cases of perforation can be greatly lowered by early operation.

DR. CHEEVER: I approve very heartily of Dr. Richardson's and Dr. Walker's disapproval of the routine performance of gastroenterostomy in operating for acute perforation of the stomach and duodenum, since it seems certain that, in serious cases, this would contribute to the mortality.

In this connection as tending to explain the comparatively low mortality in the gastroenterostomy cases reported by Dr. Richardson, I should like to ask him whether this procedure has not only been carried out on well-selected cases, but whether it has not been performed only in the most recent years and therefore under the most improved technique?

As to the comparative mortality of acute perforation of the stomach and duodenum, I wish to direct attention to the fact that the amount of extravasation, which must be a very important factor, is much greater in the gastric than in the duodenal lesion, the reason being that the peritoneal irritation of impending or actual perforation, according to all analogy, must cause a reflex spasm of the pylorus which prevents the escape of gastric contents and limits the extravasation to the comparatively scanty contents of the duodenum itself. No such mechanism exists evidently in the case of the gastric perforation. Moreover, my experience has been that gastric ulcers, as a rule, are larger than duodenal ulcers, which still further increases the tendency to copious escape of contents.

DR. JOHN B. BLAKE: About twenty-five of the City Hospital cases, almost all of them young or middle age men, came to the first Surgical Service. In a large majority of these a history of previous gastric disturbance was not obtained, unless eructations of gas alone are to be considered signs of definite stomach lesions. My impression has been that we are more apt to get a history of previous stomach trouble in cases more than forty years of age. It is somewhat puzzling to conjecture where these cases were ten years ago. They cannot be an entirely new development, yet they seem to me

many times more numerous now than formerly, and, as they present positive operative indications in almost every instance, we could not have missed them all even ten years ago.

I should like to congratulate Dr. Richardson upon an excellent and very thorough bit of surgical work; and Dr. Walker for a careful compilation of the Boston City Hospital cases.

DR. E. P. RICHARDSON (closing): In regard to apparent stricture of the pylorus as an indication for gastroenterostomy, it seems to me that the matter should be judged not by the degree of constriction of the pylorus but whether the patient is likely to survive his peritonitis or not. If the patient gets over his peritonitis, there is time before he starves for further measures to avoid pyloric obstruction, either a secondary gastroenterostomy, or possibly a jejunostomy under local anaesthesia. My impression from these cases is that food is more successful in passing the pylorus than one would judge from the condition found at operation. I think the question of gastroenterostomy should be judged from the probable outcome of the peritonitis and not from the apparent condition of the pylorus.

In differential diagnosis, the important question is whether there is a definite history of ulcer. An indefinite history of indigestion, which may come equally well from other conditions in the abdomen, does not help in diagnosis. It is very probable that many of these histories were inaccurately taken. The point which I wish to make, however, that there is a difference between gastric and duodenal ulcers in the frequency of definite ulcer symptoms, is sufficiently suggested by these cases, since any inaccuracies would presumably affect both groups equally.

In reply to Dr. Cheever's question, whether primary gastroenterostomies were not done in the later cases, while I have no definite figures, I feel sure that the majority were done in the past ten years. The description of the size of the perforation was so loose that I was unable to determine whether gastric perforations tended to be larger than duodenal.

Original Articles.

APPENDICITIS.*

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APPENDICITIS is like many other subjects in various fields of work in that the more we see of it, the less we know of it, or more properly speaking, the more we see of it, the more we realize that we are only learning about it. Said quickly, it sounds very common and uninterest-

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ing, and suggests pain in the lower abdomen, vomiting, fever and tenderness. But said slowly and with reflection of past experience, we realize that appendicitis is much more than this, and the greater the experience, the larger the number of perplexities and mistakes.

The condition was first described by Heister in 1755, who noted while dissecting the body of a malefactor in November, 1711, "the vermiform process of the caecum preternaturally black and adhering closer to the peritoneum than usual."

The symptomatology was first described by Mestivier in 1759. A pint of pus had been liberated from the right lower quadrant by incision. The wound healed, but the patient died, and autopsy showed a gangrenous appendix containing a large, very rusty pin.

Mellier, in 1827, was the first to suggest that the condition was probably not rare,—that the appendix suppurated and bursted, and was the cause of abscess in the right lower quadrant. He failed to receive the glory which he deserved because Dupuytren, who was the great surgical authority of the day, strongly ridiculed his views. But to Mellier really belongs the credit of first formulating correct conclusions as to the existence of inflammation of the appendix in a chronic form, of recognizing the causal relationship between this chronic affection and suppurative tumors in the right iliac fossa, and of first suggesting the possibility of surgical interference.

Sporadic articles occurred in the literature from this time forward to the valuable contribution of Fitz in 1886. Fitz was the first to recognize that the various abdominal disorders known as perityphlitis, typhlitis, caecitis were but manifestations of primary inflammation of the appendix. He also was the first to urge very early operation, at least as early as the third day. His, furthermore, is the first publication in which the word appendicitis was used.

Hall of New York, on May 8, 1886, operated for strangulated hernia, and found the sac full of pus from a ruptured appendix. This he tied off and removed; then, through an enlarged incision, manually explored the abdomen, breaking up adhesions and emptying pus cavities. The patient recovered. This is the first case of perforative appendicitis successfully treated by laparotomy and removal of the appendix.

On April 27, 1887, Morton of Philadelphia successfully removed an appendix and drained the abscess. The preoperative diagnosis, however, was intussusception, or perityphlitic abscess. The first case in which a preoperative diagnosis of appendicitis was made and operation successfully done for its relief was by Sands of New York, on December 30, 1887. The patient made an excellent recovery.

So much for a brief résumé of the history of the subject. Let us now consider more particularly the signs and symptoms of acute and chronic disease of the appendix.