PERFORATED DUODENAL ULCER: A Collective Report on a Series of 200 Cases of Perforated Duodenal Ulcer treated in Edinburgh between 1896 and 1912. Compiled from Data furnished by F. M. Caird, J. M. Cotterill, C. W. Cathcart, Alexis Thomson, James Hodsdon, David Wallace, H. J. Stiles, Alexander Miles, J. W. Dowden, A. A. Skirving, W. J. Stuart, J. W. Struthers, George L. Chiene, H. Wade, E. Scott Carmichael, D. P. D. Wilkie, Lewis Beesly, and Cuthbert Paul.

In response to a suggestion that it might be of interest to investigate all the cases of perforated duodenal ulcer which have been observed and treated in Edinburgh within recent years, a small committee* was formed to collect and study the available records, and the following report embodies the results of the inquiry.

It was hoped that the study of a large number of cases, occurring in the practices of a number of surgeons, would bring out the salient features of the condition in truer proportion to each other than the records of individual surgeons, dealing with a relatively small number of cases, could do, and that thereby valuable information might be gained. All the surgeons in Edinburgh who have had experience of the condition have kindly put their records at the disposal of the committee, with the result that all cases occurring between 1896 and 1912, 200 in number, have been collected and analysed.

In presenting the report no attempt has been made to give a detailed systematic account of the symptoms, signs, and treatment of perforated duodenal ulcer. The intention has rather been to emphasise the relative frequency and importance of the usual features of the condition, to draw attention to the number and characters of atypical cases, to show how favourable results usually follow the early application of surgical treatment, while delay almost invariably means disaster, and to bring out the points of importance as regards the operative treatment actually carried out. The number of cases at the disposal of the committee has allowed fairly definite conclusions to be arrived at along these lines.

Recent Increase in the Number of Cases.—Before proceeding to analyse the case reports it is of interest to note the remarkable

* The committee consisted of Professor Caird (convener), Messrs. J. W. Struthers, W. J. Stuart, D. P. D. Wilkie, and the Editors.
increase in the number of cases coming under observation in recent years. Thus, in the first 7 years of the period under review, from 1896 till 1902, only 12 cases were recorded; during the next 5 years 43 cases were treated; while in the last five years, from 1908 till 1912, 145 cases were operated on. It was thought

| Year       | Cases |
|------------|-------|
| 1896-1902  | 12    |
| 1903-1907  | 43    |
| 1908-1912  | 145   |

at first that this might be at least partly explained by cases having been classed as perforated gastric ulcers at a time when the frequency of duodenal ulcer was not fully recognised. The difficulty in distinguishing the exact relation of a perforation to the pylorus on the operating table is well known, and it seemed possible that cases of duodenal ulcer might have been classed as gastric ulcer. Examination of the figures of cases treated in the Royal Infirmary does not, however, bear out this view, for in the years 1910, 1911, and 1912, which showed a very marked increase in the number of duodenal perforations, there was no corresponding decrease in the number of gastric perforations, the number of these coming for treatment being well up to the average for former years. We have no reason to suppose that the incidence of duodenal ulcer and its perforation have increased in recent years, and it must be admitted that in all probability some cases passed unrecognised.

In the last 5-year period 145 cases were recorded, i.e., an average of twenty-nine cases a year. These came from Edinburgh, Leith, and the surrounding district, with a population which we may estimate roughly at half a million. From this a rough idea of the actual incidence of perforated duodenal ulcer may be gained, and no surprise need be felt that such a rare condition was occasionally overlooked at a time when the actual existence of the condition was only beginning to be recognised.

Method of Investigation.—In making the inquiry the committee adopted the plan of drawing up a schedule (p. 407) on which each case could be fully abstracted. These schedules were filled up by the operator in each case, and were then analysed and tabulated by the committee. In this way the work of investigation was very much facilitated and information on definite points was readily obtained with greater accuracy than could have been attained had the committee attempted to analyse the original case records. In what follows the headings are taken mainly from those tabulated in the schedules.
Schedule. Inquiry re Perforated Duodenal Ulcer.

| Date of operation. | Clinical Features of Perforation. | Operation. | Result. |
|--------------------|----------------------------------|------------|--------|
| Name or initials.  | Pain at onset.                   | Time since perforation. | Recovery. |
| Sex.               | Severity.                        | Anesthetic used.       | Date of last report. |
| Age.               | Site of maximum.                 | Nature of fluid in abdomen. | Source of information. |
| Occupation.        | Radiation.                       | Distribution of.       | Condition then as to indigestion. |
| Length of journey and means of transport to hospital. | Pain when seen by surgeon. | Amount of. | Condition then as to pyloric obstruction. |
| History of indigestion. | Severity.                      | Food matter. | Any subsequent treatment necessary— |
| Duration.          | Site of maximum.                 | Ulcer— | Medical. |
| 1. Marked. (Detail symptoms.) | Temperature when first seen. | Site of. | Surgical. |
| 2. Slight. (Detail symptoms.) | Pulse when first seen.           | Size of. | Fatal. |
| 3. None.           | Respiration when first seen.     | Evidence of other ulcers. | Time of death after operation. |
| Was Ulcer diagnosed, and when? | Vomiting— | Adhesions. | Cause of death. |
| Haematemesis.      | Time.                            | Method of dealing with perforation. | P. M. Report. |
| Melena.            | Severity.                        | Suture alone. | Operator's Remarks. |
| Signs premonitory of perforation. | Material.                      | Effect on calibre of duodenum. | Committee's Remarks. |
| Possible factors determining perforation. | Blood.                          | Suture with omental graft. | |
| Relation to last meal. | Tenderness— | Excision of ulcer. | |
| Any other important facts antecedent to perforation. | Site of maximum. | Pyloroplasty. | |
| Food or medicine taken after perforation. | Riggidity— | Gastro-enterostomy. | |
| Was morphia given after perforation? | Site of maximum. | Why done? | |
|                     | Liver Dulness—                  | Means of cleansing peritoneum. | |
|                     | Present.                        | Drainage— | |
|                     | Diminished.                     | Site. | |
|                     | Lost.                           | Duration. | |
|                     | Tympanitis.                     | Convalescence. | |
|                     | Blood Examination.              | Healing of wound. | |
|                     | Shock—                          | Post-operative complications. | |
|                     | Intensity.                      |                | Any other important facts regarding operation or convalescence. |
**Sex and Age Incidence.**—Of the 200 cases, 179 were males, 21 were females, a ratio of 8.5 males to 1 female. Except for the fact that men are so much more often affected than women, the records show no differences of note in the condition as it affects the two sexes. The history given of indigestion previous to perforation, the features attending perforation, and the results of treatment, were precisely similar, and no facts emerged in any way explaining the relative infrequency of perforated duodenal ulcer in women.

**Table II.**

| Age Group | Number of Patients |
|-----------|--------------------|
| Under 20  | 11                 |
| 20-30     | 47                 |
| 30-40     | 44                 |
| 40-50     | 34                 |
| 50-60     | 44                 |
| 60-70     | 15                 |

The youngest patient treated was a boy of 14, the oldest a man of 69. The main incidence of the affection was between the 20th and 50th years; 47 cases occurred between 20 and 30; 47 cases between 30 and 40; and 44 cases between 40 and 50. As there were 11 patients under 20, 34 patients between 50 and 60, and 15 patients between 60 and 69, the disease is by no means rare in the young and elderly. A striking feature noted with regard to age incidence was that in patients under 30 there was a marked absence of a history of severe indigestion before perforation. Whether this is due to the fact that young people are apt to note their symptoms less accurately and to pay less attention to them than older subjects, or that ulcer in young subjects is prone to perforate rapidly after it begins, cannot be accurately determined from the data at our disposal. The important point to bear in mind is that it is quite common to meet with cases of duodenal perforation in young patients who give no history of painful dyspepsia previous to the onset of the acute illness associated with perforation. This feature is also, though distinctly more rarely, met with in elderly people.

**Occupations of Patients.**—Examination of the occupations of the patients in the record shows that they were of the most varied description. Manual workers indoors and out of doors, those living active and sedentary lives, dwellers in town and country, were all represented in the list, and it seemed quite clear that a patient's vocation had no influence whatever in determining the incidence of ulceration or the occurrence of perforation. This is a point of some importance as bearing on possible claims.
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for compensation under the Workmen’s Compensation Act, and will be referred to again.

**CLINICAL FEATURES.**

*History of Indigestion Previous to Perforation.*—The symptoms associated with duodenal ulcer are so often marked and characteristic that great stress is naturally laid on the presence of a characteristic history as an aid to diagnosis in cases of possible perforation peritonitis. In analysing our cases we find considerable variations in the nature of the histories recorded, and in drawing conclusions or inferences from such cases it must be borne in mind that the histories were elicited from patients suffering from a severe illness, usually attended with violent pain, who could not be closely cross-questioned or be expected to recount their previous symptoms with perfect accuracy.

Inquiry was made in the schedule as to whether a history of previous indigestion was obtained or not; whether any previous symptoms were marked or slight, and what the individual symptoms were. The information obtained allowed of a division of the cases into three groups—those in which there had been no previous symptoms at all, those in which the symptoms had been slight and indefinite and apparently not specially characteristic of duodenal ulcer, and those in which the previous symptoms had been

**Table III.**

| Previous History of Indigestion or Duodenal Ulcer. | None | Slight | Well marked | Insufficient Data |
|---------------------------------------------------|------|--------|-------------|------------------|
| 17.                                               | 55.  | 90.    | 38.         |

well marked and suggestive of the presence of ulcer. There were 17 cases in group 1. That is to say, in nearly 10 per cent. of the total number of cases recorded there had been no symptoms sufficient to attract the patient’s attention before the occurrence of perforation. In group 2, with slight indefinite symptoms, there were 55 cases. While it is evident, bearing in mind the conditions under which these histories were obtained, that too much stress must not be laid on their value, it seems legitimate to suggest that they are evidence in support of the view that duodenal ulcer may be present without giving rise to any very characteristic symptoms. Examination of the records did not show that there was anything revealed at operation in these cases to distinguish them from cases in which a characteristic history suggestive of ulcer
had been present. Here again, however, too much stress cannot be laid on the information given, for a careful systematic examination of the duodenum cannot be made in the course of an operation for perforation, and the changes in the duodenal wall round a perforation, owing to the prompt inflammatory reaction which occurs, probably mask to a considerable extent the condition present before perforation occurred. In group 3, with well-marked symptoms previous to perforation, there were 90 cases, while in 38 cases the information given did not allow of the cases being definitely grouped. It was noteworthy that in the majority of cases giving a definite history of dyspepsia, the symptoms had been present for a year or more before perforation occurred.

Premonitory Signs of Perforation and Factors Determining its Occurrence.—Inquiry under this head elicited the fact that there is apparently no sign or symptom which gives warning that perforation may be imminent. We found no record of anything which could be regarded as a premonitory sign, and similarly it was found impossible to conclude that there were any noteworthy factors determining the occurrence of perforation. In one or two cases, strenuous physical exertion immediately preceded the onset of symptoms, but such cases were so few that it seemed impossible to determine any definite relation between physical exertion and the perforation of an ulcer. It would seem therefore justifiable to state that manual workers suffering from duodenal ulcer are not specially liable to perforation, and that perforation occurring in a manual worker cannot fairly be ascribed to the nature of his or her occupation. As noted above, this is of importance from the point of view of claims for compensation by working men.

A question was asked in the schedule as to the relation of the time of onset of symptoms to the last meal, and from the answers given it seemed that there was a tendency for perforation to take place about 1½-3 hours after the ingestion of food, i.e., at the time when the pain of duodenal ulcer tends to be most acute.

Signs and Symptoms following Perforation.—Of the signs and symptoms following perforation, pain is, as is well brought out by the records, the most characteristic. It was present in all the cases, and this regularity of method of onset is of great value as a diagnostic feature in distinguishing perforation of an ulcer from appendicitis, the condition with which duodenal perforation was in our cases most often confused. A patient with a duodenal perforation is felled at once by agonising pain, while the pain of
appendicitis begins more moderately, and gradually increases to a maximum reached some time after its onset.

*Site of Pain.*—In the great majority of cases the pain was felt most severely above the umbilicus, and in rather more than half of these it was described as being worst to the right of the middle line. It should be noted, however, that in 8 cases pain was felt most severely, at its onset, in the right iliac region, while in 6 cases it was described in general terms as being worst in the lower abdomen. No explanation of these exceptional occurrences was forthcoming, and no great stress need be attached to them, except in so far as they indicate that there are occasional departures from the typical history as regards the initial site of the pain. In answer to a query as to radiation of pain in any special direction, it was stated in 7 cases that the pain shot through to the back, below the right shoulder, thus resembling the pain of gall-bladder affections. Otherwise there was no note of any definite radiation of the pain from its site of onset.

*Vomiting.*—In 88 cases vomiting occurred soon after perforation, while in 53 cases it was definitely stated not to have occurred. Most frequently the vomiting took place once or twice shortly after perforation, and did not recur, and no diagnostic or prognostic significance could be attached to its occurrence in this manner. Severe and frequent vomiting was noted in some cases, and analysis of the ultimate results showed that this was a grave symptom, as also was the rare occurrence of hæmatemesis. Perhaps the most interesting finding in connection with the occurrence of vomiting was that it bore no relation to the presence of food material in the peritoneal cavity. Food material, recognisable as such, was very rarely found on opening the abdomen, and not more often in cases attended by vomiting than in those in which no vomiting had taken place.

*Febrile Reaction after Perforation.*—Little of note was elicited in analysing the records of pulse-rate and temperature. The absence of a marked febrile reaction in the early stages after perforation was the rule in the great majority of cases, helping to distinguish the condition from others of a more decidedly infective nature, such as appendicitis. In a certain number of cases, however, while the temperature was subnormal the pulse-rate was comparatively high, and examination of the results revealed that this was usually of grave import. A subnormal temperature with a pulse-rate over 110 should be regarded as an ominous sign at any stage after perforation.
Examination of Abdomen; Site of Maximum Tenderness.—It was noted above, in discussing the location of the subjective pain, that in a slight majority of cases it was felt to the right of the middle line. The records show that the site of maximum tenderness is more often an accurate guide to the location of the lesion, for in the great majority of cases it was found to be over the upper half of the right rectus muscle. In 14 of the 200 cases, however, it was definitely stated that the maximum tenderness was not in the usual situation. In 2 of these it was in the left epigastric region, in 11 in the right iliac region, and in 1 in the right loin.

Site of Maximum Muscular Resistance.—Variations in the degree of muscular resistance are not easily appreciated in a condition which usually involves the greater part of the peritoneal cavity by the time it comes under observation, and consequently it was found that the attempt to ascertain the site of maximum resistance gave little information. The general conclusion arrived at was that while the resistance tended to be more marked in the right side of the abdomen, especially in cases seen early, it was in approximately half the cases generalised over the abdominal wall.

Modification of the Liver Dulness.—Considerable interest attaches to the frequency of modifications of the liver dulness. In 147 cases definite information was given on this point, and it was found that liver dulness was absent in 43 cases, i.e., in rather less than one-third. It was distinctly diminished in 46, and was unaffected in 58. From these figures it is clear that while modification of the liver dulness was present often enough to be frequently of value as a diagnostic sign, the absence of any change cannot be relied on as valid evidence against the possibility of perforation.

The Influence of Morphia on Signs and Symptoms.—Various opinions have been expressed from time to time as to the value or otherwise of the administration of morphia in cases of perforation. In a large number of the cases investigated morphia had been given, and with the exception of a few in which the symptoms were masked by the relief following the administration of morphia, so that operation was dangerously delayed, the ultimate results were rather better in the cases in which morphia had been given than in those in which it had been withheld. It would appear, therefore, that morphia may be given with advantage and certainly without fear of doing harm, once the diagnosis has been made and operation been decided on.
Abatement of Symptoms resulting in a "Reaction Period."—As was pointed out some years ago by Miles, a definite reaction sets in in some cases a few hours after perforation, characterised by abatement of pain and shock, and general improvement so marked as to throw doubt on the accuracy of the diagnosis. Information was asked in the schedule of inquiry on this point, and it was found that 43 cases showed this feature and that it was independent of the administration of a sedative. Whatever the explanation of its appearance may be, the figures show that this reaction period is a possibility to be reckoned with in a considerable number of cases, amounting in the present series to about 20 per cent. Our information was not full enough to allow us to ascertain exactly the actual causes of the reaction. Sealing of a perforation by omentum or by lympy exudate or by adhesion to surrounding parts, and dilution of the acrid fluid escaping from the duodenum by peritoneal exudate, suggest themselves as possible explanations. It is important to note that in some cases this reaction was so marked, and attended by a feeling of such comparative wellbeing in the patient, as to make him unwilling to submit to operation.

Operation.

Anaesthetic.—In the majority of cases chloroform alone, or chloroform followed by ether, was the anaesthetic employed. In a few cases ether alone was used, and in one instance the operation (which included a gastro-enterostomy) was successfully conducted under local anaesthesia. The rapid and complete relaxation obtained with chloroform anaesthesia, and the consequent gain in speed and in access to the perforation, would appear to more than counterbalance the risks peculiar to this drug. It should be stated, however, that in one case in which chloroform was used the patient died some days later with symptoms of acetonæmia.

Nature of Fluid in Abdomen.—In the vast majority of cases this consisted almost entirely of turbid peritoneal exudate. In only 6 cases was food matter found in the exudate. In 22 cases the fluid was definitely bilious in character, and of these, 14 were fatal. This high mortality, which in this series is not to be explained by the time factor, is probably due to the fact that the presence of quantities of bile in the exudate is associated with a large perforation with free leakage. In regard to the amount of fluid, it was found that little prognostic significance attached to it, except that in cases where the abdomen was described as "bursting with fluid" the issue was usually grave.
In practically every case it was noted that the fluid tended to accumulate in the right kidney pouch and in the pelvis, especially in the latter, and in a few cases it was confined to these two situations.

Site of Perforation.—This was located in the first part of the duodenum in practically every case; in only one case was the perforation found in the second part.

Of 120 cases in which the exact position of the perforation was described, it was situated on the anterior surface, within 1½ inches of the pylorus in 101, on the superior surface in 13, on the posterior surface in 4. In one case in which at operation a perforation at the upper part on the anterior surface was closed and in which the patient died, a second perforation on the posterior surface was found post-mortem. In this case a large horseshoe-shaped ulcer, encircling the upper part of the duodenum, had given way in two places.

In size the perforations varied from a minute hole to a tear large enough to admit the tip of the finger.

As might be expected, the prognosis is distinctly more grave with large perforations than with small.

The size and character of the ulcer varied within very wide limits, and whilst in a fair number it was small, and possibly of recent origin, in the majority of cases it was of some size and appeared to be of the chronic type.

Method of Dealing with Perforation.—Suture, alone or reinforced by an omental graft, was the method almost universally adopted. In 4 cases, however, excision of the ulcer combined with pyloroplasty was carried out. In 3 cases in which the perforation could not be closed, but the sub-hepatic space was drained, death followed continued leakage.

Gastro-enterostomy.—An immediate gastro-enterostomy was performed in 88 cases. In 39 of these it was obligatory, the closure of the perforation having narrowed the lumen of the duodenum to such a degree as to threaten its permeability for the passage of food. In the remaining 49 cases gastro-enterostomy was performed with a view to curing the ulcer because the patients' general condition after suture of the perforation was good. In the latter group there were 3 fatalities; in the former 22.

Cleansing of Peritoneal Cavity.—The abdomen was douched out with warm saline solution in 102 cases, and of these patients 54 recovered, 48 died. In 54 cases the exudate was merely swabbed out, and of these 45 recovered, 9 died. In 6 cases the exudate was left in situ with 3 recoveries and 3 deaths.
In regard to these figures it should be noted, however, that the cases in which lavage was employed were on the whole later and more severe in type than the others. On the other hand, the figures show that swabbing out is an effective method of dealing with the exudate.

_Drainage._—In the great majority of cases, a pelvic drain was employed for the first day or two following operation. Drainage through the upper wound was employed in many of the earlier cases, but latterly was almost entirely abandoned. A small drain for the abdominal wall was, however, used in some cases.

**Post-operative Complications.**

The most frequent complication met with after operation was some respiratory trouble, varying from a slight _bronchitis_ to a definite _pneumonia_ or _empyema_. Such respiratory complications were noted in 17 cases.

_Subphrenic abscess_ developed in 5 cases. The physical signs of this complication usually became evident during the second week following operation.

_Parotitis_ was met with in 3 cases. _Post-operative hæmatemesis_ was noted in 4 cases.

_A duodenal fistula_ developed in the 3 cases in which the perforation was not closed at the time of operation. All 3 cases died within a few days with rapid emaciation and asthenia, illustrating how imperative it is that the perforation be closed in one way or another at the operation.

**Immediate Results.**

In the series of 200 cases it is found that 121 recovered and 79 died. Examining the figures for the three quinquennial periods over which these statistics extend it is seen that during the years 1897-1902 there were 12 cases with 5 recoveries and 7 deaths; during the period 1903-1907 there were 43 cases with 22 recoveries and 21 deaths; whilst during the final period 1907-1912 there were 145 cases with 94 recoveries and 51 deaths.

**Table IV.**

|                | 1897-1902 | 1903-1907 | 1908-1912 |
|----------------|-----------|-----------|-----------|
| Recoveries     | 5         | 22        | 94        |
| Fatal          | 7         | 21        | 51        |
| Total          | 12        | 43        | 145       |
Table V.
Period which Elapsed between Perforation of the Ulcer and Operation.

A. In Cases which Recovered = 119.

| Hours | 0-3 | 3.6 | 6.9 | 9-12 | 12-15 | 15-18 | 18-21 | 21-24 | +24 |
|-------|-----|-----|-----|------|-------|-------|-------|-------|-----|
|       | 10  | 30  | 31  | 16   | 8     | 6     | 4     | 4     | 10  |

B. In Fatal cases = 77.

| Hours | 0-3 | 3.6 | 6.9 | 9-12 | 12-15 | 15-18 | 18-21 | 21-24 | +24 |
|-------|-----|-----|-----|------|-------|-------|-------|-------|-----|
|       | 3   | 7   | 8   | 11   | 3     | 6     | 9     | 9     | 21  |

Table V. shows the number of hours which elapsed between the occurrence of perforation and operation. So far as our data permitted of this being determined, it will be seen that 87 of the 119 cases which recovered were operated upon within 12 hours of perforation, while of those operated upon later, only 32 recovered. That 10 of these patients recovered after more than 24 hours had elapsed before operation is partly explained by the fact that in several cases there was only a localised infection in the vicinity of the duodenum. Of the 77 fatal cases, only 29 were operated upon within 12 hours, and 48 after a longer interval.

The striking increase in the number of cases coming to operation and the improvement in results of late years can be explained largely, if not entirely, on the basis of improved diagnosis and earlier operations.

The figures emphasise in a striking manner the fact that the chief responsibility in these cases rests with the medical man who first sees the patient, and that on his diagnosis and prompt action the fate of the patient largely depends.

On the other hand, it must be recognised that there are a certain limited number of cases in which from the outset the issue is grave, and in which even early operation fails to save the patient.

Table VI. shows the number of operations performed in each year with the results, and the number of cases in which the operation was performed within 12 hours of perforation. It brings
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out the interesting fact that the condition is being recognised by
the practitioner at an earlier stage year by year, and that with
earlier diagnosis and operation the mortality is steadily dimin-
ishing. Thus in 1912, 29 of the 30 cases which recovered were
operated upon within 12 hours of perforation. Of the 11 fatal
cases only 4 were operated upon early.

TABLE VI.

| Year | Number of Recoveries | Number of Recoveries operated upon within 12 hours of Perforation | Number of Fatal Cases | Number of Fatal Cases operated upon within 12 hours of Perforation | Total Number of Cases | Total Number of cases operated upon within 12 hours of Perforation |
|------|----------------------|---------------------------------------------------------------|----------------------|-------------------------------------------------------------------|----------------------|---------------------------------------------------------------|
| 1896 | 1                    | 0                                                             | 1                    | 1                                                                   | 2                    | 1                                                             |
| 1897 | 0                    | 0                                                             | 1                    | 0                                                                   | 1                    | 0                                                             |
| 1898 | 1                    | 1                                                             | 0                    | 0                                                                   | 1                    | 1                                                             |
| 1899 | 0                    | 0                                                             | 0                    | 0                                                                   | 0                    | 0                                                             |
| 1900 | 1                    | 0                                                             | 3                    | 0                                                                   | 4                    | 0                                                             |
| 1901 | 1                    | 0                                                             | 2                    | 0                                                                   | 3                    | 0                                                             |
| 1902 | 0                    | 0                                                             | 1                    | 0                                                                   | 1                    | 0                                                             |
| 1903 | 2                    | 2                                                             | 4                    | 2                                                                   | 6                    | 4                                                             |
| 1904 | 2                    | 1                                                             | 3                    | 1                                                                   | 5                    | 2                                                             |
| 1905 | 9                    | 5                                                             | 6                    | 4                                                                   | 15                   | 9                                                             |
| 1906 | 2                    | 1                                                             | 1                    | 1                                                                   | 3                    | 2                                                             |
| 1907 | 7                    | 3                                                             | 7                    | 1                                                                   | 14                   | 4                                                             |
| 1908 | 10                   | 8                                                             | 8                    | 2                                                                   | 18                   | 10                                                            |
| 1909 | 14                   | 10                | 8                    | 3                                                                   | 22                   | 13                                                            |
| 1910 | 21                   | 13                | 11                   | 5                                                                   | 32                   | 18                                                            |
| 1911 | 18                   | 14                | 10                   | 5                                                                   | 28                   | 19                                                            |
| 1912 | 30                   | 29                | 11                   | 4                                                                   | 41                   | 33                                                            |

Subsequent History.—In examining the ultimate results in the
cases in which recovery took place, it was found convenient to
group the cases into the three periods mentioned at the beginning
of the report, i.e., those treated between 1896-1902, those between
1902-1906, and those between 1906-1912, because the treatment
carried out in the three periods varied in some respects, notably
as regards the practice of doing a primary gastro-enterostomy at
the operation for closure of the perforation.

Thus in the first series of 12 cases, gastro-enterostomy was not
done at all. Of the 5 patients who recovered, one died 3 months
later from pneumonia, and one was lost sight of. Two were in
perfect health when heard of 5 and 11 years after operation.
One came under observation again 11 years after operation,
for recurrence of dyspeptic symptoms, and required a gastro-
enterostomy for their relief.

In the second series, the practice of doing a primary gastro-
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enterostomy was coming into vogue, although not to any great extent, and accordingly we found eight cases of primary gastro-enterostomy in this series. Five of these recovered and four remained in good health, while the fifth was lost sight of. Of the remaining recoveries—17 in number—4 had been treated with pyloroplasty and were well when heard of 5 years or more after operation. Of 13 treated by suture alone, 5 were known to be in excellent health five to eleven years after operation, while 4 were known to suffer from dyspepsia with symptoms suggesting pyloric stenosis. Two of these consented to further operative treatment by gastro-enterostomy, while two were not operated on. The remaining four patients were lost sight of.

In the third series of cases, out of 94 recoveries, 75 were traced for varying periods, some for as long as five years, but many only for short periods of six to eighteen months or two years; 54 of the 75 were in good health, 42 after primary gastro-enterostomy, 2 after pyloroplasty, 10 after suture alone; 21 suffered from indigestion; 5 of these had had primary gastro-enterostomy, 2 had been treated by pyloroplasty, and 14 by suture alone. Five of these patients required a secondary gastro-enterostomy.

As will readily be understood, it was not possible to arrive at perfectly definite conclusions from these facts. The length of time which had elapsed since the majority of cases in the third series had been treated was not long enough nor was the material sufficient to enable a dogmatic statement to be made about the necessity for a primary gastro-enterostomy.

Adding the available material in the three series together, we found that out of 40 cases treated by suture alone, 19 suffered later from dyspepsia and 8 of these were treated by secondary gastro-enterostomy, while out of 52 cases treated by primary gastro-enterostomy 5 suffered later from dyspepsia. These figures certainly suggest that a primary gastro-enterostomy was of advantage in warding off subsequent digestive trouble. On the other hand, there was no evidence in the records to show that the omission of gastro-enterostomy was the cause of death in any of the fatal cases, or seriously interfered with the immediate recovery of the patients.

While, therefore, the evidence at our disposal tended to show that primary gastro-enterostomy was well tolerated and was probably useful in promoting complete and permanent recovery, we feel that more information is required before the indications for its performance in operating for perforated duodenal ulcer can be confidently stated.