In conclusion I wish to acknowledge my indebtedness to the medical committee of the Brompton Hospital for permission to make use of the clinical and post-mortem notes of the cases upon which this paper is based.

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**PERFORATED GastrIC UlCER: A Collective Report on a Series of 247 Cases of Perforated Gastric Ulcer treated in Edinburgh between 1896 and 1913.** Compiled from Data furnished by F. M. Caird, J. M. Cotterill, C. W. Cathcart, James Hodsdon, David Wallace, Alexis Thomson, H. J. Stiles, Alexander Miles, J. W. Dowden, A. A. Scot-Skirving, George L. Chiene, W. J. Stuart, J. W. Struthers, H. Wade, E. Scott Carmichael, D. P. D. Wilkie, L. C. Peel Ritchie, Denis Cotterill, and Lewis Beesly.

A little over a year ago we published in the *Journal* (November 1913) a collective report on a series of 200 cases of perforated duodenal ulcer which had been treated in Edinburgh between 1896 and 1912.

It was felt that that inquiry might be usefully supplemented by a similar analysis of the records of the cases of perforated gastric ulcer treated by the surgeons of the Edinburgh school. This investigation has since been carried out, and the results are embodied in the present report. As the material for these investigations was derived from the same sources, and for all practical purposes was dealt with by the same surgeons, the data obtained may be considered reliable for purposes of comparison.

The period embraced in the present study includes the years 1896 to 1913, one year more than in the previous inquiry.

During the 17 years the total number of cases of perforated gastric ulcer dealt with was 247.

**Annual Incidence.**—In our report on perforated duodenal ulcer attention was drawn to the remarkable increase in the number of cases that had come under observation in recent years. It will be seen from Table I that this applies within limits to perforated gastric ulcer.
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Table I.

| Year | Number each year | Year | Number each year | Year | Number each year |
|------|-----------------|------|-----------------|------|-----------------|
| 1896 | 3               | 1902 | 8               | 1908 | 16              |
| 1897 | 5               | 1903 | 8               | 1909 | 19              |
| 1898 | 2               | 1904 | 18              | 1910 | 22              |
| 1899 | 4               | 1905 | 21              | 1911 | 16              |
| 1900 | 6               | 1906 | 15              | 1912 | 21              |
| 1901 | 18              | 1907 | 24              | 1913 | 21              |

In the first three years of the period (1896-1898) there were 10 cases—an average roughly of 3 each year; during the following 5 years (1899-1903) there were 44 cases (average 9); during the next 5 years (1904-1908) 94 cases were treated (average 19); and in the last 5 years (1909-1913) 99 cases (average 20).

Table II.

| Period          | Gastric perforation | Duodenal perforation |
|-----------------|---------------------|----------------------|
| 1896-1898       | 10 cases            | 12 cases             |
| 1899-1903       | 44 cases            | 43 cases             |
| 1904-1908       | 94 cases            | 145 cases            |
| 1909-1913       | 99 cases            |                      |

The increase within the last quinquennial period is not so marked in the gastric as in the duodenal series (Table II.); a glance at Table I. shows that for the last 10 years the annual number has been remarkably constant. This confirms the opinion expressed in our previous report, that the great increase in the number of perforated duodenal ulcers recorded from 1908 onwards was not due to more accurate discrimination between gastric and duodenal perforations. It is to be borne in mind that the recognition of ulcer of the duodenum as a clinical entity is of comparatively recent date, and that many of the previous cases were probably classified as peritonitis of undiscovered origin.

Table III. shows the mortality in each of the periods.

Table III.

| Period          | Total | Average per year | Recovered | Fatal | Mortality |
|-----------------|-------|------------------|-----------|-------|-----------|
| I. 1896-1898 (3 years) | 10    | circa 3          | 3         | 7     | 70 per cent. |
| II. 1899-1903 (5 ) | 44    | " 9             | 17        | 27    | 61 "       |
| III. 1904-1908 (5 ) | 94    | " 19            | 58        | 36    | 38 "       |
| IV. 1909-1913 (5 ) | 99    | " 20            | 64        | 35    | 35 "       |

Method of Investigation.—The material for this inquiry was obtained in the same manner as in that of last year. A schedule (p. 457) was drawn up, and was filled in by the individual operators, after which the data were analysed and tabulated by the Committee.*

* The Committee consisted of Messrs. J. W. Struthers and D. P. D. Wilkie and the Editors.
### Schedule. Inquiry re Perforated Gastrointestinal Ulcer

| Date of operation. | Clinical Features of Perforation. | Operation. | Result. |
|--------------------|-----------------------------------|------------|---------|
| Name or initials.  | Pain at onset. | Time since perforation. | Recovery. |
| Sex.               | Severity. | Anaesthetic 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 general health and indigestion. |
| History of indigestion. | Subsequent modifications of pain. | Amount of. | |
| (Detail symptoms.) | Vomiting— | Food matter. | |
|                   | Time. | Perforation— | |
|                   | Severity. | Site of. | |
|                   | Material. | Size of. | |
|                   | Tenderness— | Evidence of other ulcers. | |
|                   | Site of maximum. | Adhesions. | |
|                   | Rigidity— | Method of dealing with perforation. | Any subsequent treatment necessary. |
|                   | Site of maximum. | Suture alone. | Medical— |
|                   | Liver Dulness— | Suture with omental graft. | Surgical. |
|                   | Present. | Excision of ulcer. | |
|                   | Diminished. | Pyloroplasty. | |
|                   | Lost. | Was gastro-enterostomy done? | Fatal. |
|                   | | Why? | Time of death after operation. |
|                   | | Means of cleansing peritoneum. | Cause of death. |
|                   | Tympainitis. | Drainage— | P.-M. Report. |
|                   | | Site. | Operator’s Remarks. |
|                   | Shock— | Duration. | |
|                   | Intensity. | Healing of wound. | |
|                   | Reaction period— | Post-operative complications. | |
|                   | Time of onset. | Any other important facts regarding operation or convalescence. | |
|                   | Duration. | | |
|                   | General condition of patient before operation— | | |
|                   | Hopeful. | | |
|                   | Grave. | | |
|                   | Moribund. | | |
|                   | Diagnosis when first seen by own Doctor. | | |
|                   | Diagnosis immediately before operation. | | |
|                   | | | |

| Was Ulcer diagnosed before present illness? |
|--------------------------------------------|
| Was there Hæmatemesis? |
| Was there Melæna? |
| Signs premonitory of perforation. |
| Possible factors determining perforation. |
| Relation to last meal. |
| Any other important facts antecedent to perforation. |
| Food or medicine taken after perforation. |
| Was morphia given after perforation? |
| | | |
Sex and Age Incidence.—Of the 247 gastric cases, 77 were males and 170 females, a ratio of 2:2 females to 1 male. This shows a much higher incidence of perforation among males than most statistics. In the series of 200 duodenal cases, 179 were males and 21 females, a ratio of 8:5 males to 1 female.

Table IV.

| Age Group         | Number of Cases |
|-------------------|-----------------|
| <20 years         | 31              |
| 20-30 years       | 101             |
| 30-40 years       | 57              |
| 40-50 years       | 29              |
| 50-60 years       | 18              |
| 60-70 years       | 10              |
| >70 years         | 1               |

It will be seen from Table IV., which shows the age incidence, that the main incidence of the affection was in patients below the age of 40, and that a large proportion of the cases occurred between the ages of 20 and 30. The number of cases occurring in persons past middle life, however, shows that this condition is not to be neglected in the differential diagnosis of acute abdominal catastrophes at any period of life. The records show that perforation occurs in males at a later age than in females, the average age of the males being about 37, and of females about 25. The youngest patient treated was a boy of 12½; the oldest a man of 71. The duodenal cases showed a somewhat later incidence, being fairly evenly distributed between the ages of 20 and 50.

Occupations of Patients.—As was noted in the duodenal series, the occupation of the patient did not seem to have any bearing on the question of perforation. A considerable proportion of the female patients were of the domestic servant and shop-girl class; the male patients followed many and varied occupations.

Clinical Features.

History of Indigestion previous to Perforation.—The difficulty of obtaining from a patient suffering from perforation an accurate history regarding the early symptoms of an illness which has probably lasted for many years is readily understood, but the available records make it abundantly clear that in the vast majority of cases the patient suffered from indigestion of a severe type for long periods before perforation occurred. Only in 11 cases is it definitely stated that no such history was forthcoming. In a large number the presence of ulcer had been definitely diagnosed by the
usual symptoms, and the patients had been treated more or less systematically for this condition. Hæmatemesis was much more common in women than in men.

**Table V.**

*Previous History of Indigestion or Ulcer.*

| Gastric Perforations | None | Slight | Well-marked | Insufficient data |
|----------------------|------|--------|-------------|------------------|
| 247                  | 11   | 53     | 146         | 37               |

| Duodenal Perforations | None | Slight | Well-marked | Insufficient data |
|-----------------------|------|--------|-------------|------------------|
| 200                   | 17   | 55     | 90          | 38               |

From Table V, it will be observed that gastric ulcers which go on to perforation are more frequently associated with severe dyspepsia than are duodenal ulcers, and that an entire absence of antecedent indigestion is commoner in duodenal cases.

*Premonitory Signs of Perforation and Factors determining its Occurrence.*—As was the case in the duodenal series, no information could be elicited in the records of gastric perforations to indicate that the occurrence of perforation is heralded by any characteristic symptoms. In several cases the indigestion had been distinctly worse than usual for some days before; but no stress can be laid upon this point, as similar exacerbations had frequently been experienced apart from perforation. Nor did we find anything convincing in the statements made by the patients regarding the determining cause of perforation. In several cases the acute pain came on suddenly while a severe muscular effort was being made—e.g. a nurse lifting a patient, a woman stretching to hang clothes on a rope, a man making a heavy lift at his work, and so on. It is conceivable that a severe muscular effort might determine the actual rupture of an ulcer the base of which had become greatly attenuated, but this would merely amount to the hastening of what would have occurred in time by purely pathological processes. In one case, in which a band of omentum was adherent to the stomach over the ulcer, and in which the perforation took the form of a longitudinal tear, there was reason to believe that the lesion was produced by the patient stretching to reach a high object. This point might have a medico-legal bearing in connection with claims for compensation. Two patients had just taken an unusually heavy meal; one was straining at micturition. One woman alleged that she had been assaulted, and her assailants were for a time under arrest. Fortunately, she recovered; and as the charge was departed from, the question of the relationship between the trauma and perforation did not require to be decided.
The entrance of food into the stomach does not appear to have any determining influence on perforation. It is true that in several cases the patient had just completed an unusually hearty meal; but in a considerable proportion of the cases in which the point is noted the perforation occurred within 2 hours of a meal, and in others it was 6, 7, or even 10 hours since food had been taken. Nor is there any evidence that the condition of the stomach as regards food has any influence on the mortality.

**Signs and Symptoms following Perforation.**—As was noted in the duodenal cases, in practically every case the initial symptom was agony in the epigastrium coming on with great suddenness and severity. The nature, mode of onset, and site of the pain are so characteristic and constant as to constitute important diagnostic features of perforation of an ulcer as distinguished from acute appendicitis and the various forms of abdominal colic.

**Site of Pain.**—In the great majority of cases the pain was situated in the epigastrium and, as a rule, towards the left of the middle line. This is in contrast with the duodenal cases, in which it was clearly brought out that the pain was usually felt towards the right of the middle line. In several cases the patient complained of generalised abdominal pain; in a few it was vaguely referred to the lower part of the abdomen, and in 6 cases it was chiefly complained of in the right iliac fossa. In comparatively few cases is any record made regarding radiation of the pain; in 4 it shot through to the back between the shoulder-blades, in 3 to the left scapula, in 3 down the left side, in 1 to the left upper arm, and in 1 to the right axilla.

**Vomiting.**—Vomiting is a much more common symptom in perforation of the stomach than in duodenal perforation. In the gastric series 96 vomited soon after perforation, and in only 24 was it definitely recorded that no vomiting occurred. As in duodenal cases, prolonged or repeated vomiting is of grave significance, especially when the vomited matter is coffee-ground.

**Examination of Abdomen—Site of Maximum Tenderness.**—In the great majority of cases the maximum tenderness was over the epigastric and left hypochondriac regions, and this was found to correspond fairly accurately with the site of the perforation. There were exceptional cases, however, because in 10 the tenderness was most marked to the right of the middle line, in 4 it was below the level of the umbilicus, and in 11 it was definitely in the right iliac fossa. In only one case was supra-
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pubic tenderness specially noted, in another there was tenderness in both flanks, and in one it is stated that there was no tenderness.

Site of Maximum Muscular Resistance.—In the majority of cases, by the time the patient came under observation, general muscular rigidity was present, but in a considerable number of cases the upper part of the abdomen was tighter than the lower part and the left rectus was more firmly contracted than the right. In 5 cases the rigidity was most pronounced in the appendicular region.

Modification of Liver Dulness.—In 48 cases it was recorded that the area of liver dulness was normal, in 58 it was diminished, and in 69 it was lost. Diminution or loss of liver dulness was recognised, therefore, in 127 of the 175 cases in which this point was noted.

Table VI.

| Modification of Liver Dulness. | Normal | Diminished | Lost | No Note |
|-------------------------------|--------|------------|------|---------|
| **Gastric Perforations.**     | 247    | 48         | 58   | 69      | 72     |
| **Duodenal Perforations.**    | 200    | 58         | 46   | 43      | 53     |

Table VI. shows that some modification of the liver dulness is more frequent in gastric than in duodenal perforations.

Reaction Period.—In a considerable proportion of cases note is made of a definite period of reaction coming on within from 2 to 5 hours of the perforation, and lasting for some hours. During this time the more acute symptoms abate, and the patient both looks and feels better. The importance of recognising this phase of the illness lies in the fact that the improvement may suggest that the original diagnosis was wrong, or may deter the surgeon from urging the necessity for immediate operation. As the recurrence of the acute symptoms usually indicates the onset of peritonitis, valuable time may thus be lost and the chances of the patient be seriously prejudiced.

Operation.

Anaesthetic.—Chloroform was the anaesthetic employed throughout in about two-thirds of the cases; in most of the remaining third ether was given after anaesthesia had been induced by chloroform, and in some ether alone was used. So far as the records show, the anaesthetic employed has no influence on the
issue. In 2 cases the operation was performed under local anaesthesia.

Nature of Fluid in Abdomen.—As a rule the fluid in the abdominal cavity consisted of turbid peritoneal exudate, and the quantity present did not appear to bear any constant relation to the duration of the condition; in some quite recent cases a large quantity was found both at the seat of the perforation and in the pouch of Douglas. In those cases in which a considerable time had elapsed since the perforation occurred, the fluid was usually thicker, and in cases of still longer standing it was sero-purulent or purulent. Those cases in which there was an excessive quantity of fluid were usually attended with a considerable degree of shock, and generally proved fatal. In 6 cases bile was present in the exudate, and all of these proved fatal. As might be expected, the duodenal series contained a larger proportion of cases in which bile was present in the exudate, and these cases also showed a high mortality.

Stomach contents were frequently noted as having been found in the exudate, sometimes only in that immediately adjacent to the perforation, sometimes in the pouch of Douglas. The substances recognisable included curdled milk, fragments of fish and meat, peas, potatoes, grains of raw rice (which the patient had been in the habit of eating), castor-oil, and whisky. It is a remarkable circumstance that the great majority of these cases recovered. Free gas was noted as present in the general peritoneal cavity in about 50 cases, but its presence did not appear to be of any definite significance.

Distribution of Fluid.—The fluid did not tend to accumulate except under the liver and in the pouch of Douglas. In 5 cases there was fluid in the lesser sac, and of these 3 were fatal.

Site of Perforation.—The site of the perforation was recorded in 235 of the cases. The distribution of the lesions is indicated in Table VII.

Table VII.

| Perforations | Near lesser curvature (207) | Near greater curvature (2) | Near lesser curvature |
|--------------|---------------------------|---------------------------|---------------------|
| in anterior  | In pyloric portion 116     | In middle portion 54      | In cardiac portion 37|
| wall (209)   |                           |                           |                     |
| in posterior |                           | In pyloric portion 12     |                       |
| wall (19)    |                           | In middle portion 2       | In cardiac portion 5 |
|              |                           |                           |                     |
| Perforations on hour-glass constriction of stomach
It will thus be seen that the most common site of perforation is on the anterior wall of the pyloric portion of the stomach near to the lesser curvature. Perforations on the posterior wall, which are comparatively rare, are most frequently towards the pyloric end. The occurrence of perforation in 7 cases of hour-glass constriction is interesting. Perforation on the posterior wall did not show a relatively higher mortality than those on the anterior wall, nor did the segment of the stomach implicated seem to influence the mortality.

The great majority of the perforations varied in size between a pin-head and the calibre of a lead pencil. Several were large enough to admit the tip of the index finger, and one or two were larger. As was noted in the duodenal series, the larger perforations were on the whole more fatal than the smaller ones. The ulcers varied greatly in size, some being as large as a half-crown piece, and so far as the records bore they were practically all of the chronic indurated type with thickened and shelving edges.

Presence of other Ulcers.—In less than 2 per cent. was more than one ulcer observed. In one case two perforations were found in the stomach, and in another a perforation had also occurred in the duodenum, the resulting exudate being confined by adhesions to the head of the pancreas.

Presence of Adhesions.—The replies to the inquiry regarding the presence of adhesions did not discriminate sufficiently between recent adhesions resulting from the irritation of the peritoneum following the perforation, and organised adhesions associated with the pre-existing ulcer, to admit of any conclusion being arrived at as to their frequency or importance. In several cases old-standing omental adhesions had walled off the exudate and led to the formation of a localised perigastric abscess.

Method of Dealing with Perforation.—Table VIII. indicates the various methods adopted for dealing with the condition found at operation and the results.

| Method                                | Cases | Recovered | Fatal |
|---------------------------------------|-------|-----------|-------|
| Suture alone                          | 146   | 90        | 56    |
| Suture with omental graft             | 41    | 20        | 21    |
| Excision of ulcer                     | 14    | 7         | 7     |
| Pyloroplasty                          | 5     | 4         | 1     |
| Gastroplasty                          | 1     | 1         | ...   |
| Partial gastrectomy                   | 1     | 1         | ...   |
| Gastrostomy                           | 1     | 1         | ...   |
| Not closed—Drained                    | 3     | 1         | 2     |
| Gastro-enterostomy after closure of perforation | 29 | 21 | 8 |
In one case in which the walls of the ulcer were so thick that the edges could not be invaginated by sutures, a rubber tube was introduced through the perforation and the stomach wall folded over it after the method of Witzel; the patient made an excellent recovery and the fistula gradually closed. The relatively high mortality in the group in which the line of sutures was supplemented by an omental graft cannot be attributed to the method adopted.

*Cleansing of Peritoneal Cavity.*—The method adopted to cleanse the peritoneal cavity is reported in 203 cases. The whole abdominal cavity, including the pouch of Douglas, was irrigated with warm saline solution in 143 cases, of which 85 recovered and 58 died. The soiled areas were swabbed out with gauze in 41 cases, with a mortality of 10. In 19 cases, for one reason or another, no special steps were taken to cleanse the cavity, and of these 14 recovered and 5 died. It would be fallacious from these figures alone to argue in favour of one or other of the methods. Many of the cases were operated upon before the advantages of the Fowler position and rectal infusions of saline solutions were fully appreciated in the treatment of peritoneal infections, and when irrigation and drainage were the accepted procedures. The cases in which swabbing alone was relied upon were comparatively recent and had the benefit of the more modern measures.

It is interesting to compare these figures with those of the duodenal series.

| Table IX.                          | Irrigation.             | Swabbing.             | No Cleansing.          |
|-----------------------------------|-------------------------|-----------------------|------------------------|
| *Gastric perforations*            | 143                     | 19                    |                         |
| Recovered                        | 85                      | Recovered             | 14                     |
| Fatal                             | 58                      | Fatal                 | 5                      |
| *Duodenal perforations*           | 102                     | 48                    |                         |
| Recovered                        | 54                      | Recovered             | 3                      |
| Fatal                             | 48                      | Fatal                 | 3                      |

From this table it would appear that swabbing alone was more efficacious in duodenal than in gastric perforations, while irrigation gave rather better results in the gastric cases.

*Drainage.*—In the great majority of cases a tube was introduced into the pouch of Douglas through a suprapubic wound, and was retained for several days. Drainage through the upper wound was employed in most of the earlier cases, but appears to have have been gradually abandoned. In a number of cases where there were special indications, extra drains were introduced into the flanks and into the subphrenic space.
Post-Operative Complications.

As was found in the duodenal series, the most frequent complications after operation were affections of the respiratory system. Of these there were 31 (Table X.).

Table X.

| Condition                  | Cases | Recovered | Fatal |
|----------------------------|-------|-----------|-------|
| Bronchitis                 | 6     | 5         | 1     |
| Pleurisy                   | 7     | 5         | 2     |
| Empyema                    | 5     | 3         | 2     |
| Pneumonia                  | 11    | 5         | 6     |
| Abscess of the lung        | 1     | ...       | 1     |
| Pulmonary embolus          | 1     | ...       | 1     |
| Total                      | 31    | 18        | 13    |

The other complications met with, apart from those relating to the healing of the wound, are included in Table XI.

Table XI.

| Condition                  | Cases | Recovered | Fatal |
|----------------------------|-------|-----------|-------|
| Subphrenic abscess         | 10    | 4         | 6     |
| Gastric fistula            | 2     | 1         | 1     |
| Intestinal obstruction     | 3     | 1         | 2     |
| Volvulus (10 feet of intestine resected) | 1 | 1 | ... |
| Parotitis                  | 3     | 3         | ...   |
| Phlebitis, leg             | 3     | 3         | ...   |
| Delirium tremens           | 1     | ...       | 1     |
| Suppression of urine       | 1     | ...       | 1     |
| Total                      | 24    | 13        | 11    |

From this list it will be seen that post-operative complications are more common after gastric than after duodenal perforations. In the 200 duodenal cases there were only 17 showing pulmonary complications, as against 31 in the 247 gastric cases. Subphrenic abscess is also proportionately more common; 5 cases occurred in the duodenal series, and 10 in the gastric.

A number of the cases suffered from post-operative haematemesis varying in degree and duration.

Immediate Results.

In the series of 247 cases, 142 recovered and 105 died. Table XII. shows the mortality in each of the last three
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quinquennial periods, and the period of three years prior to 1899.

Table XII.

| Period    | Recoveries | Fatal | Total |
|-----------|------------|-------|-------|
| 1896-1898 (3 years) | 3          | 7     | 10    |
| 1899-1903 (5 years) | 17         | 27    | 44    |
| 1904-1908 (5 years) | 58         | 36    | 94    |
| 1909-1913 (5 years) | 64         | 35    | 99    |

It will thus be seen that within the last ten years the results have materially improved; in the first period the mortality was 70 per cent.; in the second 61·3 per cent.; in the third 38·2 per cent.; and in the fourth 35·3 per cent. This corresponds pretty closely with what was found in the duodenal series, in which the mortality fell from 58·3 per cent. in the first period to 48·8 per cent. in the second and 36·5 per cent. in the third.

Table XIII.

Period which Elapsed between Perforation of the Ulcer and Operation.

A. In Cases which Recovered = 135.

| Hours | 3 | 3-6 | 6-9 | 9-12 | 12-15 | 15-18 | 18-21 | 21-24 | +24 |
|-------|---|-----|-----|------|-------|-------|-------|-------|-----|
| Cases | 6 | 38  | 21  | 24   | 9     | 8     | 4     | 4     | 17  |

B. In Fatal Cases = 98.

| Hours | 3 | 3-6 | 6-9 | 9-12 | 12-15 | 15-18 | 18-21 | 21-24 | +24 |
|-------|---|-----|-----|------|-------|-------|-------|-------|-----|
| Cases | 8 | 8   | 10  | 8    | 3     | 16    | 6     | 8     | 31  |

Table XIII. shows the number of hours which elapsed between the occurrence of perforation and operation, so far as this was noted in the schedules. It will be observed that out of the 135 cases which recovered, 89 (= 65·9 per cent.) were operated upon within 12 hours of perforation, while of these operated upon later only 46 (= 34·1 per cent.) recovered. A comparison with the duodenal series shows that 73·1 per cent. of the recoveries were operated upon within 12 hours, and only 26·9 per cent. later. Of the 98 fatal gastric cases only 34 (= 34·6 per cent.) were operated upon within 12 hours, while 66 (= 65·4 per cent.) were later. In the duodenal series 37·6 per cent. of the fatal cases were operated upon within 12 hours, and 62·4 per cent. later.
The importance of early operation is emphasised by Table XIV., which 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. In commenting on a similar table relating to perforated duodenal ulcers in our previous report, it was noted that year by year a larger proportion of the cases came to operation within 12 hours of perforation, and that coincidentally the mortality was becoming less.

The statistics in Table XIV. do not reveal such a decided improvement in the diagnosis of perforated gastric ulcer, as the number of the cases coming to operation within 12 hours has not proportionately increased within recent years. In spite of this, however, the results have gradually improved.

Subsequent History.—The usual difficulty experienced in tracing hospital patients, and in obtaining reliable information regarding their subsequent history, prevents us giving statistical evidence of the after-results in the whole series of cases under consideration.

Taking the cases in the group operated on between 1896-1898, we find that in one—the first case operated upon in the Royal Infirmary—the patient was readmitted six months later suffering

### Table XIV.

| Year | No. of Recoveries | No. of Recoveries Operated upon within 12 hours of Perforation | No. of Cases Operated upon within 12 hours of Perforation | Total Number of Cases | Total No. of Cases Operated upon within 12 hours of Perforation |
|------|-------------------|---------------------------------------------------------------|----------------------------------------------------------|-----------------------|---------------------------------------------------------------|
| 1896 | 1                 | 0                                                             | 2                                                        | 1                     | 3                                                             |
| 1897 | 1                 | 0                                                             | 4                                                        | 1                     | 5                                                             |
| 1898 | 1                 | 0                                                             | 1                                                        | 0                     | 2                                                             |
| 1899 | 1                 | 1                                                             | 3                                                        | 2                     | 4                                                             |
| 1900 | 1                 | 0                                                             | 5                                                        | 2                     | 6                                                             |
| 1901 | 5                 | 4                                                             | 13                                                       | 3                     | 18                                                            |
| 1902 | 5                 | 3                                                             | 3                                                        | 1                     | 8                                                             |
| 1903 | 5                 | 3                                                             | 3                                                        | 2                     | 8                                                             |
| 1904 | 9                 | 5                                                             | 9                                                        | 2                     | 18                                                            |
| 1905 | 12                | 3                                                             | 9                                                        | 9                     | 21                                                            |
| 1906 | 8                 | 6                                                             | 7                                                        | 3                     | 15                                                            |
| 1907 | 16                | 15                                                            | 8                                                        | 2                     | 24                                                            |
| 1908 | 13                | 10                                                            | 3                                                        | 0                     | 16                                                            |
| 1909 | 11                | 9                                                             | 8                                                        | 1                     | 19                                                            |
| 1910 | 12                | 9                                                             | 10                                                       | 4                     | 22                                                            |
| 1911 | 10                | 7                                                             | 6                                                        | 2                     | 16                                                            |
| 1912 | 16                | 9                                                             | 5                                                        | 1                     | 21                                                            |
| 1913 | 15                | 6                                                             | 6                                                        | 2                     | 21                                                            |
Perforated Gastric Ulcer

from a subphrenic abscess from which he died. On post-mortem examination it was found that in addition to the abscess between the liver and the diaphragm there was another collection of pus in relation to the spleen, and a right-sided empyema. Another case was known to be in good health some years after the operation and had had no further symptoms of indigestion.

In the second group (1899-1903) 7 out of the 17 who recovered were reported well and free of gastric symptoms at periods varying from 2 to 12 years after operation. One man had joined the army and had been on foreign service for twelve years. Of the others no information was forthcoming, but none of them had returned for further treatment of gastric trouble.

In the third group (1904-1908) 58 recovered, and 36 of these were traced. One had good digestion a year later, but suffered occasionally from spasmodic pains in the stomach. One had an occasional feeling of dragging in the upper part of the abdomen. Three had slight indigestion 1, 4, and 7 years respectively after operation. One 7 years later suffered severely from dyspepsia. One was readmitted 2 months later with left-sided pleurisy and pneumonia. Two subsequently required to have gastro-enterostomy performed for narrowing of the pylorus. The remaining 27 had no further trouble with the stomach at periods varying from 8 months to 10 years. In 2 cases gastro-enterostomy was performed on the third day after the perforation had been closed, on account of persistent vomiting. The patients recovered, but 4 years afterwards one had occasionally some pain after food: the other had no further symptoms.

In the fourth group (1909-1913) 64 recovered. Of these 42 were in good health and had no further gastric symptoms for periods varying from some months to 5 years. Four suffered as much as ever from indigestion, one had occasional pain, one had pain and vomiting, and one had a second perforation about a year and a half later, from which he recovered. In two of the cases in which there were slight symptoms later, gastro-enterostomy had been performed.

In the complete series gastro-enterostomy was performed in 29 of the cases. In two cases it was done three days after the perforation had been closed, as there was persistent vomiting due to closure of the pylorus; in the remainder it was done as part of the initial operation, in the great majority because the closure of the perforation dangerously narrowed the outlet of the stomach. In one or two cases it was done as a precautionary or curative
measure. In three of the cases the presence of an hour-glass constriction necessitated an artificial outlet being formed from the cardiac pouch. Eight of the cases in which gastro-enterostomy was performed were fatal; in one the patient survived the operation but died three months later from tuberculous peritonitis; the remaining 21 recovered. In only three was there recorded any return of gastric symptoms. The others remained free of symptoms for periods varying from some months to 6 years. In a number of these, however, a sufficiently long period had not elapsed to determine that the cure was permanent.

Table III., which shows the mortality in each of the 5-year periods over which this inquiry extends, brings out the fact that there has been a gradually diminishing mortality—from 70 per cent. to 35 per cent. Various factors doubtless contribute to this satisfactory result—increased experience of the condition, better technique, and improvements in methods of after-treatment, e.g. the Fowler position, the use of saline infusions, etc.—but so far as the records before us show, the most potent factors are earlier diagnosis and more prompt operative interference.

In the great majority of the cases which rapidly proved fatal death resulted from generalised peritonitis. The post-operative complications referred to on p. 465 accounted for the fatal issue in a number of cases.

THE NUTRITIVE DISEASES OF INFANCY: A REVIEW.

By J. S. FOWLER.

The high mortality of the first year of life is due almost entirely to the group of diseases which are commonly described as "diarrhoea and vomiting," "marasmus," "improper feeding," and the like. Such cases form a very large proportion of the material of out-patient cliniques of children's hospitals and everyday practice, especially among the poorer class of the people. The management of these patients is often very difficult and the result of treatment disappointing, while from the scientific standpoint our knowledge of the pathology of the various conditions leaves a great deal to be desired. During the past half-dozen years these nutritive diseases have been studied from a new point of view by Professor Finkelstein of Berlin and his collaborators, and their work has received a great deal of attention in America, although in this country, except for passing references, it has not come into general notice. There are no doubt several reasons for this neglect. For one thing, owing to our milder climate, acute