

A STUDY OF ONE THOUSAND OPERATIONS FOR  
ACUTE INTESTINAL OBSTRUCTION AND  
GANGRENOUS HERNIA.<sup>1</sup>

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STATISTICAL studies of the results of important operations must be sufficiently extensive and include only such cases as have been subjected to operation done under conditions closely resembling the practices of the present period. There are no statistics on intestinal obstruction that fulfil these indications, and this study represents the writer's endeavors to supply the deficiency.

The use of statistics is often dangerously misleading, and they are capable of such misconstruction that by many their value is greatly doubted. If we are to use statistics at all, their compilation should be conducted with care and discretion. Familiarity with literary research leads the writer to believe that he may ask for some consideration of his efforts, as this analysis has been carefully conducted and represents, perhaps, a maturer experience than is usually given to such work.

The material for this study is derived from publications of cases operated on between 1888-1898. The past decade has been marked by the evolution of many and important features in the technique of intestinal surgery. Many methods have been introduced, and while their sphere of usefulness—or lack of it—has in many instances been clearly defined, some of the most efficient innovations may still be said to be on trial.

In all questions relating to the surgery of the intestinal

<sup>1</sup> Read before the New York Surgical Society, May 9, 1900.

tract, the line must be sharply drawn between acute and chronic conditions. In these tables no cases have been admitted in which a new growth or extra-intestinal inflammatory process was a factor contributory or direct. Very few of the cases included present any doubt as to the category they belong in; but the acuteness of the manifestations has been the standard rather than the length of time.

No attempt has been made to include all cases in the literature. The standard set was to obtain a sufficient number (1000) occurring in the given period of time. With the exception of about seventy-five cases, kindly furnished by Dr. Boleslaw Lapowski from the Russian literature and by Dr. Eugene Caravia from the Italian, all the cases were read in detail by the writer. The greatest pains have been taken to obtain accurate estimation of the duration of obstruction prior to operation, this being with very few exceptions (for the most part herniæ) clearly indicated in every case.

The subject of gangrenous hernia is not usually treated under the same heading as intestinal obstruction. If, however, these observations have any particular value, it is chiefly in the comparison of the advantages possessed by the various methods of intestinal reunion and repair, and, in order to obtain so broad a comprehension of the subject as possible, it has seemed judicious to consider the two varieties of obstruction on the same basis. The cases of hernia are not cases of strangulated hernia, but of *gangrenous* hernia, demanding direct interference with the viscus. With the exception of a very few cases of minor procedures, such as suture and invagination of the intestinal wall, the treatment consisted in resection or making an artificial anus, and this series alone contains items of much practical importance and interest.

In attempting a study of conditions reported by observers of widely varying training, experience, and methods, care must be exercised to stick to facts, and not to rely unduly on data largely dependent on the personal equation. The most important and desirable information that we would wish from such a study of intestinal obstruction is on the line of diagnostic

aids; but such data cannot be furnished from statistical observations of such complex elements, and it has seemed wisest to confine the inquiry to safer if less valuable questions.

*Classification of Cases.*—Hernia, 354; intussusception, 187; bands, 186; volvulus, 121; Meckel's diverticulum, 42; gall-stones, 40; openings, 34; foreign bodies, 16; miscellaneous, 20. Total, 1000.

The classification is based on clinical manifestations, that is, on the conditions as they present themselves at the operation, and, for the purposes of simplicity, they have been ranged into quite general groups.

It is necessary to note that the high percentage of intussusception is, perhaps, somewhat artificial, as this variety of obstruction was the subject of a special study by the writer some years ago, when all the available cases were carefully searched for. The proportion of obstructions by volvulus seems too large, certainly for practice in New York City; but, on the other hand, the references to it in Russian and German literature are very frequent.

The term "bands" has been employed here quite broadly, and includes adhesions as well as kinks, twists, etc., due to adhesions. It has seemed wisest to preserve the identity of the Meckel's diverticulum, although, clinically, it is a "band." This classification, owing to the large number of cases collected, is probably as satisfactory an arrangement as can be devised, though it is conceded that any one system necessarily has drawbacks. Mr. Treves<sup>82</sup> says, in reference to the relative frequency of the various forms of obstruction, "Precise information upon this point is not very easy to obtain. Statistics based upon post-mortem records must obviously be incomplete, as only a proportion of the examples of intestinal obstruction are (*sic*) fatal. Hospital records deal for the most part with the severer forms of the trouble; although it must be acknowledged that such examples of intestinal obstruction as are not serious or severe are few in number. Tables based upon the published records of individual cases are the least suited of all for the present purpose. Such records are largely

concerned with instances of successful treatment on the one hand, and with pathological surprises and anatomical curiosities on the other.”

#### PART I. INTESTINAL OBSTRUCTION.

(646 cases; died, 312; mortality, 47 per cent.<sup>1</sup>)

*General Considerations.—Age.* As will be seen by the accompanying table (Table I), the first decade contains by far the greatest number of cases, or 28 per cent. Of children of one year or less the percentage is 14 per cent,—this being the period when the greatest number of cases of intussusception occur. For the remaining decades the relative percentages show no marked difference, ranging from 15 per cent., between twenty and thirty years, to 9 per cent. between sixty and seventy years. It must always be borne in mind that this study is based entirely on *acute* conditions, because, otherwise, we might think that the maturer periods should show a greater difference, owing to the formation of malignant stenoses. Certain ages have an individual predisposition to obstruction, *e.g.*, infancy and early life—intussusception; while gall-stones and volvulus chiefly affect the elderly. Foreign bodies occur chiefly in young children, one-half of the total recorded falling in the first decade.

The mortality of the various decades does not, on the whole, show marked variations. It ranges from 23 per cent. in the fourth decade to the fifth with 56 per cent. It is relatively low in the earliest and latest periods.

<sup>1</sup> Fractions are not employed in these computations.

TABLE I.  
DIVISION OF CASES ACCORDING TO AGE.

	Under 1 Year.	1-10.	10-20.	20-30.	30-40.	40-50.	50-60.	60-70.	70-80.	80-90.	90-100.
Number of cases . . . . .	81	73	55	87	70	73	58	50	21	4	1
Per cent., total number of cases . . . . .	14	14	10	15	12	14	10	9	4	..	..
“ males . . . . .	70	73	67	76	65	47	38	56	65	..	..
“ mortality . . . . .	47	50	49	47	23	56	33	54	38	..	..
“ bands . . . . .	..	4	38	40	43	33	31	28	14	50	..
“ intussusception . . . . .	100	40	23	16	11	4	5	8	5	..	..
“ volvulus . . . . .	..	8	12	11	25	26	31	28	38	..	..
“ Meckel's diverticulum . . . . .	..	5	3	16	5	1	5	..	..	25	..
“ openings . . . . .	..	6	11	10	5	9	1	6	5	..	..
“ gall-stone . . . . .	..	..	..	..	1	8	13	26	33	25	..
“ foreign bodies . . . . .	..	18	2	2	1	4	1	2	5	..	..

TABLE II.  
DIVISION OF CASES ACCORDING TO SEX.

	Males.	Females.	Mortality, Males.	Mortality, Females.
Total . . . . .	472	410	53 per cent.	37 per cent.
Per cent. of obstruction cases . . . . .	65	35	54	33
“ of hernia cases . . . . .	34	66	28	40
“ of intussusception . . . . .	72	28	45	56
“ of bands . . . . .	58	42	40	30
“ of volvulus . . . . .	64	36	65	39
“ of Meckel's diverticulum . . . . .	78	22	65	33
“ of openings . . . . .	52	48	63	35
“ of gall-stones . . . . .	24	66	33	53
“ of foreign bodies . . . . .	43	57	..	..

*Sex.*—Table II. The sex (including here the herniæ) was recorded in 882 cases,—472 males, 410 females. There is an interesting disparity in the statistics of intestinal obstruction (males, 65 per cent.) and of the hernia cases (males, 34 per cent.). Why the masculine element is so marked in the intestinal obstruction series is not at all obvious. It would seem as if inflammatory conditions of the female pelvic organs should give rise to a certain number of adhesions

capable of provoking obstruction. One element determining the larger masculine proportion is the ratio of intussusception, approximating 5:2. Why more male children should have intussusception is not obvious. The writer has once before suggested a tight phimosis as a possible etiological factor from the straining at urination it may provoke.

The reasons for the greater frequency of hernia cases among women will be referred to again. Other pronounced disparities are found in the frequency of Meckel's diverticulum,—male, 78 per cent.; female, 22 per cent. The division of the sexes on gall-stones is quite in accordance with ordinary clinical observations,—males, 34 per cent.; females, 66 per cent.

*Mortality of the Two Sexes.*—Of the total (hernia and obstruction), one is immediately impressed by the lower female mortality, 37 per cent., as against male, 53 per cent. An analysis of the two groups yields some explanation. In the obstruction cases, the female mortality sinks still lower, 33 per cent.; while the male is 54 per cent. When we compare the conditions in hernia, we find a mortality of males, 28 per cent.; females, 40 per cent. This latter proportion can be explained by the greater frequency of femoral hernia among women, the damage being in this variety usually greater, and presenting greater technical obstacles in treatment.

The writer has no similar explanation to offer for the more favorable results of operations for intestinal obstruction in the female sex. Certain elements are commonly accepted as factors determining a greater tolerance to disease and operations in the female sex,—better and more regular habits, much less poisoning by alcohol, tobacco, and venereal diseases, greater tolerance to loss of blood and more rapid restoration of lost blood, and greater amenability to treatment.

*Mortality.*—Tables III to VI show the mortality. According to Table III, the variety of obstruction; Table IV, the duration of obstruction; Table V, in resection and primary enterorrhaphy; Table VI, in artificial anus.

Further comments on these results will be found in the appropriate portions of the text.



TABLE IV.  
RESULTS BY DAYS.

The figures on the left hand of each column represent cures ; those on the right, in italic type, deaths.

DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	3 weeks.	4 weeks.	Not stated.	
Bands	3	2	12	4	19	5	23	11	11	6	11	7	4	5	8	5	4	
Intussusception	23	12	22	12	13	20	5	11	4	12	1	3	4	5	4	3	0	0
Volvulus	3	3	8	6	7	10	9	7	8	3	7	4	3	2	7	1	0	2
Meckel's diverticulum	1	0	2	2	2	2	6	4	4	0	3	1	3	0	2	1	0	2
Gall-stones	1	1	1	2	3	3	2	4	3	3	1	0	5	1	0	0	0	0
Openings	1	0	0	3	5	3	3	0	1	2	1	5	1	0	0	2	0	0
Foreign bodies	0	0	0	0	1	2	1	3	1	0	1	0	0	1	0	0	0	0
Miscellaneous	1	0	3	1	0	1	1	0	1	0	1	0	0	1	0	0	0	0
Hernia	12	0	45	14	45	23	30	17	24	10	12	13	7	2	14	10	1	5
Total	45	18	94	43	94	68	78	55	60	58	28	45	24	22	27	32	8	10
Grand total mortality, per cent.	29	31	42	42	49	60	49	54	67	44	36	53	65	45	41	30	4	48
Mortality for intestinal obstruction alone, per cent.	35	38	47	44	56	63	54	63	61	47	47	53	61	45	33	34	4	54



TABLE V.  
RESULTS OF RESECTION AND PRIMARY ENTERORRHAPHY IN INTESTINAL OBSTRUCTION.

	Total.	Died.	Mortality, per cent.
Intussusception .....	32	26	81
Bands .....	17	8	47
Volvulus .....	16	13	81
Meckel's diverticulum.....	5	4	80
Gall-stones .....	2	2	100
Openings .....	2	2	100
Foreign bodies.....	..	..	..
Miscellaneous .....	..	..	..
	74	55	74

The frequency with which resection and enterorrhaphy could be or had to be performed in the various forms of obstruction is interesting as showing but slight fluctuations.

Intussusception, resection performed in 17 per cent. of cases.

Volvulus, resection performed in 13 per cent of cases.

Meckel's diverticulum, resection performed in 12 per cent. of cases.

Openings, resection performed in 11 per cent. of cases.

Bands, resection performed in 9 per cent. of cases.

Gall-stones, resection performed in 5 per cent of cases.

TABLE VI.  
RESULTS OF ARTIFICIAL ANUS IN INTESTINAL OBSTRUCTION.

VARIETY OF OBSTRUCTION.	WITH RESECTION.			WITHOUT RESECTION.			ALL CASES.			Percentage of Cases requiring an Artificial Anus.
	Cases.	Died.	Mortality.	Cases.	Died.	Mortality.	Cases.	Died.	Mortality.	
Intussusception .....	5	5	..	19	14	..	24	19	79	13
Bands.....	4	4	..	18	17	..	22	21	95	12
Volvulus .....	5	4	..	15	12	..	20	16	80	16
Meckel's diverticulum.....	1	1	..	3	2	..	4	3	75	9
Gall-stones.....	..	..	..	..	..	..	..	..	..	..
Openings.....	1	1	..	4	4	..	5	5	100	26
Foreign bodies.....	..	..	..	9	2	..	9	2	22	56
Miscellaneous .....	..	..	..	5	3	..	5	3	60	25
Total .....	16	15	94	73	54	74	89	69	77	12

TABLE VII.

INTUSSUSCEPTION, ONE HUNDRED AND EIGHTY-SEVEN CASES; MORTALITY AND CONDITION BY DAYS.

Days.	Died.	Cured.	Total.	Mortality, per cent.	Reduction.	Artificial Anus.	Resection.	Various.	Per cent. Reducible.
1 .....	13	22	35	37	33	.....	2 6 per cent.	..	94
2 .....	14	22	36	39	30	3 8 per cent.	3 8 "	..	83
3 .....	20	13	33	61	20	4 12 "	9 27 "	1	61
4 .....	10	5	15	67	6	3 20 "	5 33 "	..	40
5 .....	11	4	15	73	7	5 33 "	2 13 "	2	47
6 .....	3	1	4	75	2	.....	1 25 "	..	50
7 .....	5	4	9	..	5	1 per cent.	3 33 "	..	..
8 .....	3	4	7	..	4	2 "	1 "	..	..
10 .....	3	..	3	..	..	2 "	1 "	..	..
11 .....	..	1	1	..	1	.....	.....	..	..
12 .....	1	1	2	..	1	1 per cent.	.....	..	..
14 .....	1	..	1	..	1	.....	.....	..	..
3d week. ...	1	4	5	..	3	2 per cent.	.....	1	..
4th week. ...	..	3	3	..	1	.....	1 per cent.	1	..
Not stated. .	10	8	18	..	12	1 per cent.	4 "	5	..
Total ...	95	92	187	51	126	24 per cent.	32 per cent.		

ANALYSIS OF THE VARIOUS FORMS OF INTESTINAL OBSTRUCTION.

Age.	Cases.	Died.	Mortality, per cent.
Intussusception .....	187	94	50.
Infants, 1 year or under .....	81	38	42
Children, 1 to 10 years. ....	49	24	49
All others. ....	50	27	54

Males, 72 per cent. ; females, 28 per cent.

SITE OF THE INVAGINATION.

	Died.	Cured.	Mortality, per cent.
Enteric. ....	23	15	60
Ileocaecal .....	50	46	52
Ileocolic .....	14	70	67
Colon. ....	14	14	50

CONDITION OF THE INVAGINATION.

	Cases.	Died.	Mortality, per cent.
Reducible. ....	126	45	36
Irreducible. ....	14	9	64
Gangrenous. ....	23	22	95
Irreducible <sup>1</sup> or gangrenous. ....	24	18	75

<sup>1</sup> Data insufficient to classify these cases any more accurately.

## PROCEDURES EMPLOYED.

	Cases.	Died.	Mortality, per cent.
Reduced .....	126	46	36
Resection .....	32	26	81
Artificial anus.....	5	5	..
Resection and artificial anus.....	19	14	79
Various.....	5	4	80
Total .....	187	95	51

The writer's views of the secret of success in operating for intussusception have been recently expressed as follows: <sup>18</sup>

"I would lay particular emphasis on the fact that these cases are all acute, because the conditions of a chronic intussusception differ greatly from the acute, as regards indications for treatment and the results of such treatment. These acute cases are of three grades; that is, in addition to the ordinary term of acute, the condition may also be expressed as hyperacute or subacute, according to the intensity of the symptoms.

"In operating for intussusception, we find three degrees of change in the intussusceptum, each one varying very distinctly, in symptoms, in morbid anatomy, in the indications for treatment, and the results from the condition *per se*, and from the operative procedures in order. That is, we find on operating, that the intussusception is either reducible, irreducible, or gangrenous. And whether we find one or the other of these conditions *depends almost entirely on the duration of obstruction*. This fact I must emphasize, that in early interventions we get a reducible intussusception with a good prognosis; in *delayed* intervention, a more serious state of affairs, with bad prognosis *per se*, and requiring operations attended with greater shock and risk to life. Combined forms may exist,—that is, an intussusception may be reducible,—and yet be in a condition of gangrene or on the verge of becoming so. The irreducible intussusception may be entirely innocuous, except with regard to its mechanical impediment, or it may also be plainly gangrenous or it may present doubtful elements in regard to existing or threatened gangrene. It is, of course, obvious that the distinction between the several varieties must be clearly appreciated.

“The main feature of expected success in relieving intussusception depends: First, on the intussusceptum being found in a reducible condition and free from septic changes, and, second, that such a favorable condition can ordinarily only be met by a very early interference, that is, the prognosis depends absolutely on the promptness of relief. Under such circumstances, other things being equal, in competent hands, a comparatively good result is to be expected. But so soon as we encounter the second degree of severity,—the irreducible intussusception,—speaking in the strictest sense as of a purely mechanical phenomenon entirely free from septic conditions, the mortality is at once more than doubled. When we encounter the third variety, gangrene of the intussusceptum, we are confronted with a state so severe as to be almost beyond the hope of relief by human methods. For we are dealing with a profound toxæmia, which, if not checked, is necessarily fatal, and so affects the resisting power of the patient that even a trivial interference cannot be borne. And yet, in order to entertain the slightest hope of saving the patient, the operative measures undertaken must be drastic. A double indication exists,—the relief of the obstruction and the relief or elimination of the gangrenous element. To accomplish the one, without as thoroughly handling the other, is futile and absolutely bad judgment. To make an artificial anus in gangrene of the gut may relieve the obstruction, but brings no betterment of the prognosis, which still remains absolutely hopeless. Free extirpation of the intestine is called for, an operation which, in these desperate cases, is practically always fatal.

“The results of operations for these various degrees of intussusception bear out the above statements with remarkable accuracy. The mortality of reduction alone is only 36 per cent. In thirty-four cases in which an artificial anus was established the mortality was 83 per cent., and of thirty-two resections the mortality was 81 per cent. Only one case of resection of gangrenous intestine was saved. These results are perhaps most clearly defined when we study the conditions attending operations on any given day. (See Table VII.) For instance,

on the first day there were thirty-five operations and thirteen deaths, a mortality of 37 per cent. Even on the first day the bowel may be found so damaged that reduction alone is insufficient, as there were two resections performed, and a study in detail of the histories gives the impression that more such operations should have been performed. The percentage of reducible cases was 94 per cent.

“ On the second day there were thirty-six operations with fourteen deaths, a mortality of 39 per cent. On this day six operations other than reduction were found necessary, namely, artificial anus, three; resection, three, bringing down the percentage of reduction to 83 per cent., while the mortality rate is on the increase. On the third day, of thirty-three cases, twenty died, a mortality of 61 per cent.

“ These tabulations afford most striking proof of the disastrous consequences of delay. For now (third day) only twenty cases could be reduced (61 per cent.), and it was necessary to perform an operation for artificial anus four times and to do resection nine times. Here we strike a level between the percentage of reducible cases and the percentage of mortality. On the fourth day, of fifteen cases, ten died, a mortality of 67 per cent. The chief reason for this increased mortality is at once apparent, for on this day only six cases (40 per cent.) were reducible, the others requiring an artificial anus or resection. There is no need of any further elaboration to demonstrate the rightfulness of the plea that in order to obtain success operations must be performed early enough to find the intussusception reducible,—that good results depend entirely on reducibility.

“ The fifth and sixth days show respectively a mortality of 73 per cent. and 75 per cent.”

It is hardly feasible to go into any prolonged consideration of the treatment of intussusception by enemata (of fluids). That this method is a valuable aid and should be the first choice under certain conditions, the writer firmly believes. He, however, is inclined to the belief, on the principle of “ the greatest good to the greatest number,” that it is almost a mis-

fortune that there should be such a means of relief, as, owing to its ill-judged use, it costs many lives by delay and illusions as to its effects. His views on the subject have not changed since 1897.<sup>2</sup>

When the abdomen is opened, if the intestine presents no evidence of impaired vitality, the intussusception may be reduced chiefly by working the sheath back rather than pulling on its neck.

If the intussusception is irreducible, but presents no septic changes, an atypical resection may be performed, that is, excision of the inner layer, by making a longitudinal incision below the neck, after having secured the point of junction between the two layers by a row of sutures at the neck, amputation of the inner layer just below the neck, suturing the cut edges, extraction of the amputated portion either through the original incision or from below, if accessible. If gangrenous, the whole intussusception must be formally resected, and the ends may either be united on the general principles of intestinal repair, or, if the patient's condition forbids further manipulation, and the portion of the intestine is not too near the stomach, they may be preserved as an artificial anus, repair being completed, as is most expedient.

The indications for establishing an artificial anus are extremely limited in intussusception, the operation being absolutely contraindicated with a gangrenous condition of the gut, as it only relieves the obstruction and not the sepsis, which, if unchecked, will as inevitably kill the patient as the element of obstruction. It is therefore only of occasional use in irreducible intussusception; and here it must generally be inferior in value to the atypical resection, especially as, in this variety, the patient's condition will more often allow of the time necessary for this comparatively simple operation.

#### BANDS.

One hundred and eighty-six cases; died, 76; mortality, 41 per cent. Per cent. males, 58. Site of obstruction, small intestine, 81; large intestine, 6.

Procedures employed: Removal of obstructing cause, 127; mortality, 26 per cent.

Resection, 17; mortality, 52 per cent.

Resection and artificial anus, 4; mortality, 100 per cent.

Artificial anus, 18; mortality, 94 per cent.

Various, 4; mortality, 50 per cent.

It is worthy of note that there is a record of obstruction by more than one band in thirty-three cases, and the proportion is probably much greater. This failure to find or to search for more than one cause of obstruction accounts for some of the particularly bad results of operations for obstruction by bands; in no less than twenty-four out of the seventy-six deaths, recovery could not possibly have taken place owing to the inefficient or insufficient mode of operating, *e.g.*, a second obstruction, or several more obstructions besides the one definitely relieved, was found, post mortem, nine times. The obstructing cause was *first* found at the autopsy five times. There was failure in six cases to realize the damaged condition, although the obstruction was found attended with gangrene of the gut. In no less than four cases an artificial anus was made *below* the site of obstruction. These results are all obtained from post-mortem reports; when it is remembered that for most of the cases such complete information was unobtainable, it is fair to presume that there was a number of additional preventable deaths,—that many diagnoses of peritonitis, exhaustion, etc., really mean that the operation was neither sufficiently thorough as regards search for the obstruction, nor sufficiently radical in its treatment. For it must be ever reiterated that operations for intestinal obstruction have a twofold purpose,—relief of the obstruction and relief of the septic changes brought about by the obstruction, and that relief of the one without similar treatment of the other is absolutely useless.

*The Nature of the Bands.*—The most frequent cause appears to be dependent on inflammatory remains of appendical trouble, and from the female pelvic organs. Omental and epiploic adhesions were also frequent. Two of the operations

were for the adhesion of laparotomies performed three months and two years previously. While the subject for simplicity's sake is treated under the heading of bands, it must be borne in mind that many of these are in the form of diffuse velamentous adhesions, causing obstruction by kinking and knotting of the intestines, as well as by direct diminution of the caliber of the intestine and strangulation of its blood supply.

The study of this particular variety of obstruction shows again that the making of an artificial anus is usually a hit or miss procedure; that in order to obtain success it must be attended with certain fortunate conditions, whose existence the operator is generally unable to foresee or ascertain. Eighteen cases with one recovery is certainly a striking commentary of the unreliability of this treatment. The one recovery is an example of a piece of good luck rather than of a logically planned operation.<sup>31</sup> A man with fæcal vomiting, operation on the third day, the abdomen was opened, the presence of adhesions made out, but death seeming imminent, the operation was abandoned. The next day the wound was reopened, and an artificial anus was made in the small intestine. This opening was closed some hours later by suture; these gave way the next day, and a fæcal fistula developed; but the next day there was a fæcal movement per rectum. The fistula closed spontaneously in six weeks.

The resections yielded better results, eight successes of seventeen operations. The time when the operation was performed is undoubtedly a factor; the successes averaging three and four-tenths days of obstruction, the fatalities, eight and five-tenths. One resection on the second day was successful, although 135 centimetres were resected.

Of the various methods of resection, it may be noted that there was one success with Maunsell's method. Four unfinished resections, that is, exsection of the damaged gut, but leaving the ends as an artificial anus, repair to be made at a later and more propitious moment, were all fatal. The operation is, however, an eminently judicious one, and the results,



if discouraging, prove that the operators foresaw the 'inutility of completing the operation.

The Murphy button had three successes and two fatalities. One resection by end-to-end suture terminated fatally by the giving way of the sutures on the sixth day. In another resection, the autopsy showed areas of gangrene at the site of anastomosis and elsewhere.

There were four instances of side-tracking or entero-anastomosis. One ileocolic with Abbe's rings, death by shock; another with Senn's plates successful. One by sutures performed on the eighth day died of shock at the close of operation; in the remaining case a perforation of the bowel, exclusion of the loop by making an anastomosis above and below, was successful. For certain types of obstruction unattended with any damage to the vitality of the intestine, this operation, in the presence of very extensive and firm adhesions, is probably the ideal; but it must not be performed on doubtful cases, except with extraperitoneal isolation of the suspicious portion of gut by Hahn's method, until the fate of the intestine is determined.

#### VOLVULUS.

One hundred and twenty-one cases; died, 66; mortality, 54 per cent.; males, 67; females, 40.

*Site.*—Sigmoid, 58; died, 27; mortality, 46 per cent. Colon, 15; died, 7; mortality, 50 per cent.; average, 47 per cent. Small, 36; died, 25; mortality, 70 per cent.

Procedures employed: Untwisting, 79; died, 31; mortality, 29 per cent.

Resection, 16; died, 13; mortality, 81 per cent.

Resection and artificial anus, 5; died, 4; mortality, 80 per cent.

Artificial anus, 15; died, 12; mortality, 80 per cent.

The average age was forty-five.

Four of these operations were second operations for the same condition. Two by Roux were operated on six years previously. Eliot<sup>3</sup> reports a case of Foote's of a boy who was

operated on three times for this condition. There were also two deaths after operation from recurrence of the volvulus; the condition being verified by autopsy. There is no reason given the peculiar conditions predisposing to volvulus, atony, long mesentery, etc., why such recurrences should not occur quite frequently. Many operators have practised and recommended prophylactic measures; and a note relative to "anchoring" is found in eleven cases, either by fixing the affected loop to the abdominal wall, by taking a reef in the mesentery, or by a procedure, which Villar<sup>20</sup> claims as original, called "transverse colopexy." Obalinski in 1891 resected forty-seven centimetres of colon to avoid recurrence; in another case, fifty-six centimetres of sigmoid; both cases are classed as fatal, although one of them occurred four weeks after operation of pneumonia.

This form of obstruction when attended with damage to the gut gives rise to some of the most extensive lesions, as can be readily appreciated from the mechanics of the obstruction. Of thirteen resections, in which the length of gut excised is noted, the average was 124 centimetres,—the longest being 365 centimetres cæcum and ileum; another, 250 centimetres ileum, both fatal.

The importance of the duration of the obstruction on the prognosis is shared in this variety of obstruction by the relative degree of obstruction depending on the degree of completeness of the twist. There may, however, be complete obstruction, with only a slight degree of torsion due to the bending produced by the weight of the descending mass, with little or no disturbance of the integrity of the gut. The degree of torsion is usually not clearly described in the published cases; it is also not always clearly appreciable clinically.

The distention is often so enormous, especially when the sigmoid is involved, that on opening the abdomen, it becomes absolutely imperative to evacuate the distended coil before further manifestations are attempted. This was done twenty-seven times. Even after successful reduction, it is the author's firm belief that provision must be made for the immediate

evacuation of the bowel, either by passing the rectal tube while the abdomen is still open, as was done successfully in several cases, or by incision of the gut. To allow the intestine to remain in a condition of paralysis from over-distention, and absorption of the putrid contents to continue, is to fail to realize the urgency of the situation. Great care should be exercised in closing this incision; and it is, perhaps, wisest to anchor it temporarily in the wound, lest extravasation should take place from post-operative paralytic distention.

The results of artificial anus are not much more encouraging than in other conditions,—three successes out of fifteen cases. In two instances the opening was so placed as to give no relief; in one it was made in the jejunum, and in the other there was extravasation backward into the abdomen. Most of the cases in which an autopsy was performed showed gangrene of the bowel and the obvious inefficiency of this form of treatment.

The volvulus was first found at the post-mortem in four cases.

Of the details of resection there is little to add to what has previously been alluded to, and no one method was marked by any particular success. It is in such operations that excision of the ileocæcal coil is frequently necessary. The best method seems to consist in closure of the colon by suture and lateral implantation of the small intestine. This procedure has also been advantageously employed by Eiselsberg<sup>7</sup> in an extensive resection of the small intestine, with only a few centimetres remaining at its distal end.

The diagnosis of the condition before operation was probably made with greater frequency than in other forms of obstruction, with the exception of intussusception. It is usually easy to recognize the condition, especially when the large intestine, especially the sigmoid, is involved. The distention, though often extreme, is not uniform, and the coils involved may often be marked out quite accurately. There is usually less vomiting, sometimes none, and usually occurring late in the chain of symptoms. The history usually records a sudden

onset, also the fact that it is generally seen in middle or advanced life; with such data a diagnosis can frequently be made.

In this condition, when the small intestine is involved, the mortality is high, 70 per cent., as contrasted with 46 per cent. of the large intestine. This difference may be partially accounted for by its greater physiological importance, the greater acuteness and manifestations of shock. It is also probable that the mobility of this portion of the bowel allows of a greater tightness of the twist, and, in addition, the vitality of the intestinal walls is probably less.

There is only one record of successful resection of the small intestine for volvulus, 127 centimetres on the second day of obstruction (Riedel<sup>28</sup>).

#### MECKEL'S DIVERTICULUM.

Forty-two cases; died, 23; mortality, 62 per cent. Males, 31; females, 8.

Procedures necessary: Division or excision of diverticulum, 30; died, 17; mortality, 57 per cent.

Resection, 5; died, 4; mortality, 80 per cent.

Resection and artificial anus, 1; died, 1.

Artificial anus, 3; died, 2; mortality, 67 per cent.

In one case an entero-anastomosis was made, the gangrenous gut being treated extraperitoneally: a very good procedure. The result, however, was fatal. In two cases the operation was not completed, the cause being found post-mortem.

The part of the bowel involved by the constriction was in all cases the small intestine, usually the lower end of the ileum.

The point of attachment is generally only vaguely alluded to; it seems to have been in the order of frequency to the abdominal wall, the umbilicus, and the mesentery.

Its point of origin varied from fourteen to thirty-six inches above the ileocæcal valve; for the most part at about twenty-four inches.

It may be noted that the subjects were usually young adults, and that the male sex is much more frequently so

affected. It is not evident why the mortality should be so high, as the damage to the intestine is not more frequent than in other varieties.

Oderfeld<sup>12</sup> has suggested that the presence of some congenital malformation, such as club-foot, harelip, cleft palate, webbed fingers, etc., should lead one to think of the possibility of another malformation, such as a Meckel's diverticulum, as a cause for obstruction.

In the only successful case<sup>4</sup> of artificial anus, the cause was only found at a second operation, the closure of the artificial anus having produced a recurrence of symptoms. There were several other instructive instances of failure to find the cause of obstruction; failure to divide the other end of the diverticulum still causing obstruction;<sup>5</sup> untwisting of what passed for a volvulus, the diverticulum being found post-mortem.<sup>21</sup>

#### GALL-STONE.

Forty cases; died, 21; mortality, 57 per cent. Males, 9; females, 27.

*Age.*—The youngest, thirty-five; only seven cases under fifty, and eight aged seventy or more.

*Site.*—The obstruction was only once found below the ileocæcal valve; once the stone was impacted in the valve. In twenty-one cases the history distinctly states the site of its arrest as the ileum, twice in the jejunum, and once at the junction of the jejunum and ileum.

There was a clear history of the passage of gall-stones, or of definite symptoms pointing to the presence of stones in eighteen cases; in five cases it is distinctly stated that there never had been anything to lead to suspicion of cholelithiasis.

In one instance the impacted stone could be felt through the abdominal wall.

The largest stone<sup>11</sup> weighed three and one-half ounces; the patient made a good recovery. Other large stones weighed respectively, two and one-quarter, two, one and one-quarter ounces, and one ounce, and the lightest, 170 grains.

Procedures necessary: Two resections were performed,

both fatal. In two cases the suture of the incision was perforated (post-operative paralysis), both fatal; though in one good judgment was exercised in treating the loop extraperitoneally.<sup>33</sup> In two instances the stone was simply pushed through into the small intestine. When incising the gut for extraction of the stone, it is wisest not to make the incision directly over it, as the intestinal wall may be injured by the pressure at that point and endanger the integrity of the suture.

Less damage to the bowel is produced by this form of obstruction than from constriction from without. The condition is easily discoverable at operation, especially if the nature of the obstruction is suspected beforehand, as can well be surmised in an elderly female with a previous history of jaundice or other symptoms of gall-stones. The symptoms are often quite mild, the obstruction being sometimes only partial for a certain period. The operative measures required are simple, and do not usually take much time. The patients, however, are generally unfavorable subjects for operation, owing to age and attendant complications.

It is interesting to note that no operator succumbed to the temptation of making an artificial anus.

#### OPENINGS (AND DIAPHRAGMATIC HERNIA).

Thirty-four cases; died, 21; mortality, 62 per cent. Males, 21; females, 10.

Nature of opening. The diversity of language used to report these cases prevents a very satisfactory classification. Reduced to simple language there were, Fossa duodenojejunalis, 2; sigmoid fossa, 2; foramen Winslow, 2; mesenteric opening, 10; ileo-appendicular fossa, 1; "undetermined pocket," 1; pocket formed by vesico-umbilical urachus, 1; pocket from ligation of hernial sac, 2; sacculation in abdominal wall, 1; retrocæcal pouch, 1; "retroperitoneal" pouch, 1; fossa hypogastrica dextra, 1; opening between broad ligament and sacrum, 1; anterior vesical fossa, 1; properitoneal pouch at internal ring, 1.

In four of these cases the obstruction was first found post-mortem, viz.,—

(1) In the sigmoid pouch.

(2) In the sacculaton of the abdominal wall, resection, and artificial anus of ends which were found to be two feet *below* the obstruction.

(3) In an opening between the sacrum and broad ligament, removal of a band apparently holding the bowel in the pelvis.

(4) In mesenteric opening, removal of a twisted gangrenous Meckel's diverticulum, artificial anus was made twice with fatal results, as might well be expected. Resection with artificial anus of ends, one case, fatal; two resections, one of four feet of bowel, both fatal; one of them in consequence of imperfect technique.<sup>19</sup>

The intestine prolapsed into these openings was in all but two cases the small intestine. The cæcum was once partially prolapsed into the foramen of Winslow; once both small and large were found in an "intraperitoneal" opening through the mesentery. The opening was closed by suture five times, —ileo-appendicular fossa, 1; mesenteric opening, 3; properitoneal pouch at internal ring, 1.

#### DIAPHRAGMATIC HERNIA.

Six cases, all fatal. Males, 5; females, 1.

CASE I.<sup>25</sup>—Boy, eight years old; operation on sixth day of obstruction. Hernia of cæcum and colon so far as the splenic flexure; reduction by dilatation of opening; died in twelve hours; bowels moved before death.

CASE II.<sup>10</sup>—Man, twenty-nine years old; left pleural effusion and symptoms of intestinal obstruction. Diagnosis of diaphragmatic hernia made beforehand. Operation, resection of rib, opening of pleura; sudden death. Post-mortem, opening eight centimetres in diameter in the left half of diaphragm, through which was prolapsed greater part of stomach. Death due to pneumothorax; better to have sought access to it by the abdomen.

CASE III.<sup>20</sup>—Man, twenty-one years old; operation on sixth day of obstruction. Laparotomy, hernia of splenic flexure through diaphragm; extraction; death.

CASE IV.<sup>2</sup>—Male, forty years old; laparotomy for acute obstruction. Nothing found, nothing done. Post-mortem, hernia of the stomach, splenic flexure, and omentum through hole in the diaphragm.

CASE V.<sup>28</sup>—Woman, twenty-five years old; obstruction of six days' duration; marked uniform abdominal distention; resonant on percussion everywhere except for dulness in the flanks. The abdominal wall and the diaphragm, notwithstanding the tremendous tympanitis, still retain some respiratory movement, however, of the "superior costal type." Artificial anus made on the cæcum, marked temporary relief. Fæcal empyema; died in seventeen days. Post-mortem, diaphragmatic hernia of descending colon and sigmoid 110 centimetres, with perforation of the intestine into the pleura. Commenting on this case, the authors add, "The orifice was situated above the spleen, the usual situation of acquired herniæ; of 133 cases, Boursier found that in over 100 cases this orifice occupied the left half of the diaphragm centre and was entirely independent of the normal outlets for the œsophagus and aorta. The presence or absence of a sac could not be made out in this case."

CASE VI.<sup>30</sup>—Man, thirty-three years old; obstruction, sixteen days. Laparotomy, nothing discovered; artificial anus made in the cæcum; died the next day. Post-mortem, hernia of the splenic flexure through the diaphragm.

It will be noted that the portions of the alimentary tract which prolapsed in all these cases were those in direct anatomical proximity to the diaphragm; although they involved very remote portions as regards the continuity of the alimentary tract, that is, either the stomach or large intestine, but never the small intestine.

The chief questions of interest are the diagnosis of the condition both before and after the abdomen is opened, and the best and safest operative route. If a routine physical examination of the patient were always made, it is probable that the diagnosis would occasionally be made, and more frequently its possibility would be suggested. When the abdomen is opened and evisceration is performed without finding an obstruction, the possibility of a hernia of the stomach should certainly occur to the operator.



Some operators have recommended the abdominal route, others the transpleural route. The ante-operative diagnosis will be so seldom made, that we must presuppose the abdominal route will be chosen. The advisability of the transpleural route will then only arise if the hernia cannot be easily reduced from below; it will probably not be a matter of choice, as the pleura must be invaded if access from below is insufficient. To talk of opening the pleura from choice, the writer thinks, is futile, as the pneumothorax is a very grave complication.

The subject is an interesting one and deserves consideration, which cannot be given here. The reader is referred to the authors already quoted and the references contained in Mr. Treves's work.<sup>32</sup>

#### FOREIGN BODIES.

Sixteen cases; died, 4; mortality, 25 per cent. Age ranged from six to seventy-nine; half of the number being in children of ten or under.

*Site of Obstruction.*—Colon, 1; transverse colon, 2; ileo-cæcal valve, 2; lower ileum, 3; small intestine, 1.

Procedures employed: Artificial anus, 9; 2 died.

Extraction and suture of incision, 6; 2 died.

Pushing of obstruction (worms) through into lower bowel, 1.

One artificial anus closed spontaneously, others after procedures ranging from the simplest plastic to resection.

*Causes of Death.*—Persistent obstruction by scybalæ, from shock twice, and once apparently from making an artificial anus at too high a level in the small intestine.

The conditions presented by internal obstruction afford the greatest chances for relief by an artificial anus; it is here a proper method of treatment, giving results that compare very markedly with the usual series of disasters that attend its injudicious use.

#### MISCELLANEOUS.

Twenty cases, 7 deaths.

*Constriction of Intestines by the Vermiform Appendix,* 7 cases, 2 deaths. The site of constriction was five times the

ileum, once the cæcum, and once the rectum. In one case the operation was abandoned; the cause only being found post-mortem, in others the appendix was excised.

*Constriction of the Small Intestine by surrounding Mesentery*, 1 case, 0 died.

*Stricture of Small Intestine* (non-malignant), 3 cases. Artificial anus, 2; died, 1; entero-anastomosis, cured, 1.

*Laparotomy for Strangulated Hernia*, 5 cases; in two the cause becoming recognized, the operation was further completed by external herniotomy; 1 died from pre-existing peritonitis; in two the operation was completed from within (both cured); in the fifth case, laparotomy was performed for paralysis of gut following herniotomy, cure.

*Colotomy for Unknown Causes*, 3 cases; 2 died, 1 cured.

*Twist of Mesentery*, no obstruction, 1 case, cured.

## PART II. GANGRENOUS HERNIA.

Three hundred and fifty-four cases; died, 120; mortality, 34 per cent.

Males, 123; died, 34; mortality, 28 per cent.

Females, 209; died 82; mortality, 39 per cent.

Ratio of inguinal to femoral, 1 to 2.

Ratio of inguinal to femoral, males, 12 to 5.

Ratio of inguinal to femoral, females, 1 to 15.

Mortality, ratio of inguinal to femoral, 3 to 4 (26 to 37).

Mortality, ratio of inguinal to femoral, males, 3 to 4 (23 to 33).

Mortality, ratio of inguinal to femoral, females, 1 to 2 (10 to 19).

Site of hernia: right, 154; left, 83.

Mortality, right, 31 per cent.; left, 36 per cent.

*Relative frequency of various forms of hernia according to the conditions in which they are seen, strangulated (gangrenous) or non-strangulated.*

As a basis, the writer has added up various series (see Maydl)<sup>24</sup> of cases, with a total as follows:

In 61,561 males with hernia in the groin, 2362 are femoral, or as 1 is to 25.

In 12,061 women, 6012 are femoral, or as 1 is to 1.

Berger,<sup>9</sup> from 10,000 dispensary cases, estimates the relative frequency of hernia in men and women as, males 3 to females 1. Macready puts it as 5 to 1. This less marked contrast is probably the most accurate, and the difference may possibly be less, if it is borne in mind that women do not offer such ready means of tabulation by not presenting themselves so constantly for treatment. They are inclined to conceal their condition; it has less affinity with the "objective" genital apparatus than in the male; women are less incommoded by its presence in the discharge of the duties more peculiar to their sex, and they do not seek employments from which they would be barred by the presence of an unsupported hernia. Moreover, they can be more easily relieved by a truss that is not supplied by a skilled surgeon, such as are obtained in drug stores, etc.

Berger<sup>9</sup> estimates that 3.31 per cent. of herniæ are subject to accidents, not necessarily, but chiefly strangulation; for men the probability of such accidents is 2.46 per cent.; for women, 5.84 per cent.

Although the total of women afflicted with hernia is much less than in men, the "accidents" are observed in about the same frequency in both sexes. Berger attributes this fact quite rightly to the greater frequency of femoral hernia in women, this hernia being the most liable to "accidents." He estimates that a woman with an inguinal and a femoral hernia stands a chance of undergoing "accidents" to the extent of 11.8 per cent.; that is, the risk of the inguinal hernia is 2.16 per cent., and for the femoral hernia, 9.02 per cent.

The above may be taken to represent as fair a basis of estimates of the frequency and variety of herniæ in general. The writer's compilation of his cases of gangrenous herniæ shows a marked difference from this "normal" distribution, and he offers a parallel comparison of his estimates of the two varieties.

TABLE VIII.  
VARIETY OF HERNIA (BERGER).

	In General.	In Gangrenous Hernia.
Inguinal .....	84 per cent.	34 per cent.
Femoral .....	10 “	59 “
Umbilical .....	5 “	6 + “
Others .....	1 “	1 — “

## VARIETY IN SEX (AUTHOR'S COMPILATION).

	Male.	Female.	Male.	Female.
Inguinal .....	25	1	12	1
	to	to	to	to
Femoral .....	1	1	5	15
Ratio of hernia in general, men to women.....	3 to 1		1.2 (37.63)	

## INGUINAL HERNIA.

Total, 96; died, 25; mortality, 26 per cent.

Males, 72; died, 18; mortality, 23 per cent.

Females, 15; died, 15; mortality, 33 per cent.

Right side, 50; males, 42; females, 6.

Left side, 26; males, 18; females, 6.

It is evident that the mortality of inguinal hernia is less than in femoral. There does not seem to be any decided factor for this difference, as we are dealing in either case with the extreme degree of damage, that is, gangrene. The operative technique is somewhat more difficult in femoral hernia, especially for inexperienced operators; and this circumstance may perhaps account for part of the difference of 11 per cent. in favor of inguinal hernia. For inguinal hernia is not favored in the distribution of severe cases, as analysis showed that its proportion of more desperate conditions, not permitting of primary enterorrhaphy, was about 15 per cent. greater than in the femoral variety.

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(TO BE CONTINUED.)