

Postoperative Morbidity and Mortality in Intestinal Obstruction: Comparative Study of 100 Consecutive Cases from each of the Past Three Decades *

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THE striking improvement in morbidity and mortality statistics in the field of intestinal obstruction is presumed due to the high degree of refinement in the adjuncts to surgical treatment. We had wondered whether intestinal obstruction would reveal an ever-changing situation in regard to the modern methods and were stimulated to investigate what has actually been happening in our own institution in the past three decades. We were aware that others had had somewhat similar ideas and we turned first to the pertinent literature to scrutinize their conclusions.

Background Information

The death rate following surgical management for intestinal obstruction has decreased sharply from the strikingly high figure of 65 per cent reported in 1929, from the Charity Hospital in New Orleans by Miller, to a figure somewhere in the neighborhood of 10 per cent or less at this time. Wangenstein's classic monograph on intestinal obstruction first appeared 17 years ago, and he has found that the mortality rate has dropped some 43 per cent during the ensuing period to 1955. Wangenstein quoted the United States vital statistics as

revealing the death rate from hernia with obstruction of the intestine to be 10.5 deaths per 100,000 population in 1929 and 1936. However, by 1950, that rate had been reduced to 5.8 deaths per 100,000 population.

Smith, Perry and Yonehiro reported on 1,252 cases of mechanical intestinal obstruction occurring during the period, 1942 to 1953. They discovered an over-all mortality rate of 14.5 per cent and were of the definite opinion that the major factors to influence the survival rate in an adverse manner were gangrene, perforation, and severe distention of the intestine, and extreme youth or extreme old age.

In 1956, Tendler and Cartwright presented a review of the treatment of acute intestinal obstruction during periods which were similar to those in which we were interested. These authors noted that during their first period, which was 1923 to 1932, an occasional patient had received saline solution by the subcutaneous or even the intravenous route. Transfusion of blood was rare, and even less frequent was the application of a nasal tube in the attempt to decompress the stomach. During this first period the mortality rate was found to be 51 per cent. Their second period extended from 1933 to 1946, and here there was considerably more appreciation of the value of the plain roentgenogram (scout film) of the abdomen. Furthermore a siphonage type of suction was applied to the

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TABLE 1. *Site of the 100 Lesions in Each Group Causing Intestinal Obstruction*

	1929	1939-1940	1949-1950
Small intestine			
Duodenum	1	5	4
Jejunum	16	9	12
Ileum	41	36	46
Not specified	17	13	9
Duodenojejunal junction	1		
Ileocecal region	1		
Total	77	63	71
Large intestine			
Cecum	3	6	2
Ascending colon	4	2	
Hepatic flexure			2
Transverse colon	6	4	2
Splenic flexure	1	1	1
Descending colon		3	2
Sigmoid	5	12	17
Rectosigmoid	2	8	2
Rectum	2	1	1
Total	23	37	29

nasal tube for drainage, and there was a certain appreciation of the value of electrolyte replacement with more liberal use of transfusions of blood. Apparently the effect of these improvements was being realized as the mortality rate for that series had dropped to 26 per cent. In their third group, which covered the period from 1947 to 1953, the striking improvement in anesthesia, the much more widespread adoption of blood transfusion, the tremendous strides in antibiotic treatment and still better understanding of the requirements of fluid balance were obvious. The mortality rate for the third group was 8.5 per cent.

The trend during the most recent decade has been revealed in a multitude of articles and significant among these are the studies by Bollinger and Fowler in 1953, and Becker in 1955. All authorities have agreed that the reduction in mortality following surgical treatment of intestinal obstruction was progressive, and the general tone of the reports reflected rather uniform optimism.

The Present Study

Materials and Methods: The records in 100 consecutive cases of mechanical obstruction of the small and large intestine encountered at the Mayo Clinic in each of three periods 1929, 1939 and 1940, and 1949 and 1950 were studied. Confining the number to 100 in each group made it far more convenient to tabulate and record our results. All of the patients had been treated surgically, and the diagnosis of intestinal obstruction was proved at the time of operation. All degrees of obstruction were noted from acute to subacute and even a rather chronic form. Excluded from the study were all cases of mesenteric vascular occlusion. Likewise, the so-called neurogenic obstruction, or paralytic ileus, was eliminated from consideration, as were partial strictures of the intestine without definite distention of the proximal portion of the bowel at the time of surgical exploration.

TABLE 2. *Etiologic Factors in 100 Lesions in Each Group Causing Intestinal Obstruction*

	1929	1939-1940	1949-1950
Small intestine			
Bands and adhesions	58	35	31
Carcinoma			
Primary	6	1	5
Metastatic	5	11	16
Hernia			
Diaphragmatic	2	1	4
Ventral	2	1	
Paraduodenal		1	1
Inguinal		2	3
Femoral			1
Meckel's diverticulum	2	5	1
Intussusception	2	1	2
Volvulus			5
Gallstone (ileum)		2	
Mesenteric cysts		2	
Prolapse ileum through stab wound		1	
Malrotation			1
Endometriosis			1
Total	77	63	71
Large intestine			
Carcinoma			
Primary	14	29	12
Metastatic		2	
Bands and adhesions	5	1	10
Intussusception		1	1
Volvulus	1	2	2
Congenital atresia of anus	1		1
Megacolon	1		
Diverticulitis	1	2	3
Total	23	37	29

Results

Age and Sex: In regard to the age incidence, the peak was discovered to be from the fourth through the sixth decades in each of the three periods. In fact, more than 60 per cent of all patients were in this particular age group. The ratio of males to females was almost 1:1, except for the 1929 group, when more females were encountered.

Location of the Obstructing Mechanism: The location of the obstruction was similar in each of the three periods studied. The obstruction of the small intestine was encountered approximately twice as frequently as that of the large intestine, and

the obstructing mechanism in the small intestine was located predominantly in the ileum, while the lesions of the large intestine were somewhat more widely scattered. It appeared that most often the obstructing lesion in the colon was located low in the sigmoid (Table 1).

Etiology: In the small intestine post-operative adhesive bands were by far the most common cause of the obstruction, and this held true for each of the three groups. In fact, nearly half of the lesions of the small bowel were found to be adhesive or band phenomena as shown in Table 2. It came as somewhat of a surprise to note the role that adhesive bands played in ob-

TABLE 3. *Postoperative Complications: A Comparative Study of Cases from the Past Three Decades*

Complication	1929	1939-1940	1949-1950
Peritonitis	7	3	1
Bronchopneumonia	7	5	
Irreversible P.O. shock	5	5	
Fecal fistula	3	2	1
Infection of wound	3	2	4
Dehiscence of wound	1	1	
Pulmonary embolus			1
Gastrocutaneous fistula			1
Pleurisy with effusion	1		
Decubitus ulcer	1		
Heart failure	1		
Parotitis	1		1
Paralytic ileus	2	1	
Phlebitis		1	
Embolus (peripheral)	1		
Intestinal obstruction		1	
Total	33	21	9

struction of the colon as we had expected this to be only minor. As we had anticipated, malignant tumors were the most common cause of obstruction of the large intestine (Table 2).

Strangulation: We had been particularly alert to the possibility of the "strangulation" type of obstruction as compared with "simple" (nonstrangulation) obstruction and analyzed the series from this standpoint. It was somewhat of a surprise to note the relatively small number of patients exhibiting definite strangulation in each of the three periods. There were only two such patients in the first group, four in the second and five in the third.

Average Duration of Hospitalization: After due consideration, it was thought only fair to include the entire hospitalization both preoperatively and postoperatively in the total figures. In spite of all modern adjuncts we found that there was little difference in the total number of days that the patients were hospitalized for their obstruction during each of the three periods studied. The mean total days of hospitalization were 25, 31 and 24 days respectively.

Morbidity: A significant decrease in the number of operative complications occurred during each of the past two decades. We found that the over-all morbidity rate for the 1929 group was 33 per cent. This dropped to 21 per cent for the second decade and on down to 9 per cent for the third. The chief problems encountered in cases of this type have remained peritonitis, bronchopneumonia and operative shock. Other much less common complications are listed in Table 3. It is evident that the adjuncts to surgical care are reflected directly in those figures.

Mortality Rates: The mortality rate decreased significantly in each of the last two decades. The over-all trend was from 27 per cent in the cases drawn from the first decade to 21 per cent in the second and finally to 4 per cent in the third. Data are presented in Table 4. It is evident at once that the most marked improvement of all occurred in the final decade when the decrease was in the magnitude of 17 percentage points. The most common causes of death in the first two periods were generalized peritonitis, bronchopneumonia and postoperative shock (Table 4). These com-

TABLE 4. *Causes of Death*

Causes	1929	1939-1940	1949-1950
Generalized peritonitis	10	7	1
Bronchopneumonia	6	4	
Postoperative shock	6	3	
Pulmonary embolus		1	2
Postoperative volvulus		1	
Gangrene of small intestine		1	
Indefinite causes	5	4	
Mesenteric thrombosis			1
Total	27	21	4

plications were not significant factors in the final period. As one might predict, the mortality rate in the cases of strangulated intestinal obstruction was understandably high. Both of the patients in the 1929 period who had strangulated hernia died while three of the four in the 1939 period died but only one of the five in the final period died.

Comment

It is evident from our study that in the last three decades a rather progressive decline in the morbidity and mortality rates has been the rule. The greatest improvement has taken place since 1940. This coincides well with the reports of other authors.

The age and sex of our patients, the location of the obstructing lesions and the etiologic factors responsible for the obstruction compare closely with those in other series. We have the distinct impression that the small number of hernias in our series which were found to produce significant obstruction compared to large numbers of such cases from other centers, particularly large city hospitals, represents only the difference in the types of practice involved. In other words, most of the patients with acute intestinal obstruction due to hernia were treated in home hospitals whereas most of the hernia repairs at the clinic are carried out on a prophylactic basis.

Irreversible postoperative shock was a significant, frequent complication during the first two periods. The records of all such patients were examined in an effort to determine whether enterocolitis might have been the responsible factor, especially in the light of present knowledge of micrococcic complications. However, we found no good evidence to bear out this suspicion and the injudicious use of antibiotics could not be a factor, since such agents were not available.

The continuing decrease in mortality rates during each of the decades has probably been due to the interplay of a large number of factors. Included among these must be: (1) earlier diagnosis and more prompt, adequate treatment; (2) correction of electrolyte and fluid imbalances; (3) decompression of the distended intestine by intestinal intubation and suction methods; (4) judicious employment of properly selected antibiotic agents; (5) improvements in anesthesia; (6) special attention to the treatment of associated conditions, such as cardiac failure, pneumonia, peritonitis, anemia and malnutrition; and (7) earlier surgical intervention in any possible case of strangulating intestinal obstruction and the so-called closed-loop obstruction.

It seemed important to consider the antibiotic agents alone. The opinion that the use of antibiotics has been paramount in

the management of intestinal obstruction and is responsible for the dramatic improvements in the present record is not uniformly accepted by any means. Wangensteen has stated that whereas a number of experimental observations attest to the protective and favorable influence of antibiotics on the course of the obstruction he has observed little evidence that the use of antibiotics has made an important contribution to management. However, he stated that treatment with antibiotics lessens the risk for patients with perforation of the intestine and gross soiling of the peritoneal cavity. Nemir failed to note any improvement when comparing results of treatment of intestinal obstruction prior to 1945 (the pre-penicillin era) with those after 1945. Although we have no accurate statistical figures to confirm our impression, when we note that most of the patients in our final group, 1949 and 1950, received antibiotics and that almost none of the earlier patients received them, we are forced to conclude that the use of these agents and the statistical improvement must be associated. This assumption is further strengthened by the marked reduction in the number of cases of postoperative peritonitis encountered in the final decade.

Summary and Conclusion

The morbidity and mortality rates in 100 consecutive cases of intestinal obstruction in which surgical treatment was employed during each of the periods 1929, 1939 and 1940, and 1949 and 1950 have been presented.

The small intestine was the most common site of obstruction during each of these decades, and bands or adhesions were the

most common cause of obstruction in that situation. The most common cause of obstruction of the colon was carcinoma involving the low part of the sigmoid.

Little difference was noted in the mean number of days of hospitalization for each of the three periods. However, the mortality rate decreased strikingly and the number of postoperative complications decreased significantly in the cases drawn from each of the final two decades. Most noteworthy of all was the marked reduction in postoperative peritonitis, bronchopneumonia and shock in the final group. Possible contributing factors for these changes are discussed.

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