

ACUTE INTESTINAL OBSTRUCTION

A COMPARATIVE STUDY OF 511 CASES, WITH SPECIAL REFERENCE TO THE
LOWERED MORTALITY ACHIEVED BY MODERN METHODS OF THERAPY

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IN 1929, C. Jeff Miller¹ published from two New Orleans hospitals a series of 343 cases of acute intestinal obstruction with a mortality of 60.9 per cent., thereby demonstrating again a fact with which all writers on the subject are in entire accord, that the death rate in this disease is frequently very much higher than it is sometimes assumed to be. This discrepancy, as the author points out, is not hard to explain; indeed, it is inevitable, if cases of acute, complete obstruction, which is always potentially fatal, are not differentiated from cases of partial, incomplete obstruction, in which the pathology is, as a rule, inherently much less serious.

Doctor Miller's instructive paper has undoubtedly exerted a profound effect upon the general management of intestinal obstruction. It has been widely abstracted and quoted, as it deserved to be, and it is our personal opinion that here in New Orleans, whence the report emanated, it has had a most salutary effect in forcing upon the surgeons who handle the condition, particularly on the emergency services of the public hospital, a vivid realization of the true facts of this very deadly disease.

It was with the idea of contrasting the facts of a later period with the facts presented by Doctor Miller for an earlier period that we began this study, the basis for which is 340 cases of acute mechanical ileus treated at Charity Hospital in New Orleans from 1930 through 1932. Through the courtesy of Doctor Miller we have had access to his original material, and for comparison with the later three-year period we have chosen from his study the five-year period ending in 1927, during which 171 cases were treated at the same institution. This gives us two evidently parallel series of which a fair comparison can be made.

Both series include only cases of acute, complete obstruction which were submitted to surgical treatment. No attempt has been made to analyze medical cases, for obvious reasons. The patients who recovered without operation undoubtedly had obstructions which were not complete. Those who died simply furnished additional corroboration of the fact that in intestinal obstruction without surgery there can be no salvation, though perhaps, since Wangensteen has popularized Robertson Ward's method of decompression, that statement no longer holds without qualification.

¹Miller, C. J.: Study of Three Hundred Forty-three Surgical Cases of Intestinal Obstruction. *ANNALS OF SURGERY*, vol. 89, p. 91, 1929.

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The fact that 340 cases were treated over the three-year period in our own study, against only 171 cases over the five-year period of the earlier study, does not indicate, as it might seem, any marked increase in the incidence of the disease. The increase, for all practical purposes, may be set down as proportionate to the increase in the hospital population, and that increase, in turn, can be traced partly to the increase in the population of the community which the hospital serves and even more to the increase in the number of persons it is called upon to serve in these days of financial depression. Many of these patients, it must be granted, are of the social level which formerly did not seek its medical attention in public institutions, though that circumstance has little effect, we believe, upon the statistics which we are presenting; private patients, as every published series shows, are all too frequently guilty of the same reckless disregard of "inaugural symptoms" as the most ignorant of indigent patients could exhibit.

It may be taken for granted that the run of cases in the same institution is likely, year in and year out, to be about the same, and in a disease of this sort there seems no reason for assuming that the condition is any more serious in one year than in another. Furthermore, while the difficulties, let alone the invidiousness, of such a comparison are evident, it is fair to point out that the patients in both series were operated upon by surgeons of approximately the same level of skill and dexterity. The 1923-1927 group was handled by five surgeons, the 1930-1932 group by eight, but all of them were graduates of the same institution, and all of them, so far as the inescapable personal equation permits such a generalization, had been subjected to the same influences and had had the same amount of experience in their internships and in their surgical residencies.

Finally, as would be expected, the age incidence is practically the same in both series, the male incidence, as in most reported series, is slightly higher than the female, and the racial incidence is about in proportion in both series to the white and Negro hospital admissions.

We have purposely emphasized the fairness of comparing these two series by pointing out their fundamental similarities because only in these circumstances are they alike. The end-results are entirely different, the mortality of the later series being less than half as high as the mortality of the earlier series. Etiologically, as Table I shows, the differences are slight, about the same proportion of each type of case appearing in each series. That means, then, that the proportion of high and low obstructions is practically the same in both series, and that the incidence of high obstruction, which is always more serious, other things being equal, than low obstruction, cannot be invoked to explain the difference in the mortality rate. We are driven, therefore, to some other explanation or to some other explanations of the fact that in the early series of 171 cases covering the period from 1923 through 1927 the death rate was 70.7 per cent., more than twice as high as the death rate of 31.7 per cent. for the 340 cases covering the period from 1930 through 1932.

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TABLE I

Etiological Factors

Cause of Obstruction	Number of Cases		Percentage	
	1923-1927	1930-1932	1923-1927	1930-1932
Herniæ.....	53	157	31.0	46.2
Adhesions and bands.....	46	91	26.9	26.7
Intussusception.....	20	18	11.6	5.3
Volvulus.....	18	29	10.5	8.5
Malignancy.....	9	4	5.2	1.2
Peritonitis.....	6	16	3.5	4.7
Foreign-body occlusion.....		10		2.9
Diverticulitis.....	2	2	1.2	0.6
Congenital occlusion.....		1		0.3
Diagnosis undetermined.....	17	12	9.9	3.5

One explanation immediately presents itself. Generally speaking, and of course with reservations, the duration of any acute intra-abdominal disease affords the first clue to its mortality, and that generalization holds here. The figures for both groups of cases prove the truth of Van Beuren's aphorism, that the longer a patient with intestinal obstruction lives before operation, the sooner he dies after it. In the Miller series of cases (in the 155 cases in which the time was stated), the average duration of illness prior to admission was 42.7 hours, whereas in our own series it fell to thirty-five hours. Looking at it from another standpoint, in the Miller series 49 per cent. of the patients had been ill more than ninety-six hours when they sought relief, against only 27.6 per cent. in our own series. In partial explanation of the duration of the illness, at least in some cases in both series, it should be interpolated that the New Orleans Charity Hospital serves not only New Orleans, but some four-fifths of Louisiana also, and that, even though the distances within the state are not excessive, patients must sometimes travel for hours to reach the institution.

Why the average duration of illness prior to admission has been reduced, or why the number of patients whose illness was of long duration is so much smaller in the later series, we cannot explain. Perhaps, thanks to public propaganda concerning the risk of ignoring intra-abdominal pain and the dangers of home treatment for it, the public is actually becoming more intelligent. Perhaps the medical profession is becoming more alert in both the suspicion and the diagnosis of acute abdominal disease, more "obstruction-minded," as Wangenstein puts it. Whatever the reason, the fact remains that the duration of the obstruction prior to hospitalization is decidedly less in the series we are reporting than it was in Miller's series, and in that fact lies the first explanation of the materially reduced mortality in the later group of cases.

Varying etiological factors, as we have already intimated and as Table II shows, play no special part in the lower death-rate in our own series. In malignancy, as Miller pointed out in his report, many indigent patients who had undergone colostomy remained in the hospital after their surgical

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recovery until they were carried off by the natural processes of their disease, because they had literally nowhere else to go. That situation holds in our own series also, but to a lesser degree, for a more active social service department, in combination with an increased demand for bed space for patients for whom something can be done, has seen to it that many such patients in the later group were returned to the care of their communities or were provided for elsewhere, and the hospital death-rate is proportionately lower. The very striking reduction in the mortality of strangulated hernia, from 77.3 per cent. to 22.3 per cent., is apparently to be explained on the basis of earlier treatment. In many of the cases in both series the patients were men advanced in years, in whom cardiorenal complications undoubtedly played a part in such fatalities as occurred, or were obese women, in whom umbilical hernia is always a serious event.

TABLE II
Mortality in Relation to Etiological Factors

Cause of Obstruction	Mortality 1923-1927	Mortality 1930-1932
Herniæ	77.3	22.3
Adhesions and bands.....	65.2	35.1
Intussusception.....	55.0	27.7
Volvulus.....	72.2	51.7
Malignancy.....	77.7	50.0
Peritonitis.....	66.6	50.0
Foreign-body occlusion.....		40.0
Diverticulitis.....	50.0	
Congenital occlusion.....		100.0
Diagnosis undetermined.....	82.4	50.0

The surgical procedures undertaken we have not studied in any great detail. For one thing, it is manifestly unfair to condemn any operation without a more accurate knowledge of conditions than can be gained by a perusal of the history after the event. For another, even surgeons of the same experience and training differ in their opinion of the worth of certain procedures under certain circumstances, as well as in their technical ability to perform them. One or two facts, however, are outstanding. In the later series enterostomy was performed proportionately less frequently than in the early series because, since the patients were seen promptly, it was less often necessary. Furthermore, when it was used, it was not the procedure of desperation, the last resort, that it so often was in the earlier series. It was the procedure of deliberation which it should be, and from which, when it is so employed, good results can be expected, not the *ante-mortem* act which it always is when it is employed after paralysis has affected most of the bowel wall.

Another point should also be enlarged upon. Comparing the series, case for case, and estimating the risk as fairly as a risk can be estimated on paper, it was evident always that the less surgery was done, the better the

result was likely to be. It was equally evident, too, that the more radical was the surgery, the more inevitable was the fatality. In Miller's series of 171 cases, radical operation (by which is meant resection with immediate anastomosis) was done twenty-eight times with twenty-six deaths. In our own series of 340 cases that procedure was carried out only fourteen times, with only seven deaths. A mortality of 50 per cent. is still a frightful mortality and by no means to be condoned, but it is quite evident that the far smaller proportion of cases treated by radical measures in the later series explains at least part of the reduction in the mortality generally, while the reduction of the mortality for that particular procedure from almost 93 per cent. to 50 per cent. proves that the cases in which it was done were certainly more carefully selected.

From that fact can be drawn another conclusion, that the conception of intestinal obstruction has changed in a striking way with the passage of even the few years that have elapsed between Miller's study and our own. Any disease the very name of which implies a blockage of or interruption to the fecal current must necessarily be a disease in which mechanical problems are very important problems, but we have come more and more to believe that such considerations are, after all, relatively minor ones as compared to the sequelæ which follow in their wake. Patients suffering from intestinal obstruction die from many terminal complications, it is true, but all of them die of those complications in association with one overwhelming pathological change, a perversion of the normal blood chemistry. That change, in the minds of the surgeons of this era, is the single consideration that overshadows all others in the management of intestinal obstruction, and the comprehension of its importance is a relatively new thing.

It is quite true that, as early as 1912, Hartwell and Hogue, in the course of their experimental work in high intestinal obstruction in dogs, pointed out the part played by a disturbed chloride balance, and that the host of investigators that succeeded them, among whom Haden and Orr are outstanding, continued their experimental studies, corroborating their results and adducing new facts, but the correlation between the clinic and the laboratory is notoriously slow, and the mere publication of experimental facts, even with their clinical application, by no means implies their general adoption. The importance of a disturbed blood chemistry in intestinal obstruction has been recognized for many years, but only very recently has that realization been generally translated into action, only quite recently have routine methods of correction been introduced. The sequence of events in intestinal obstruction, as Haden and Orr have pointed out, has always been mechanical obstruction, dehydration, starvation and toxæmia, but the importance of all the links in the chain has been a late realization, as is evident in the comparison of these two series of cases.

In the early group there was in many instances an attempt to rehabilitate the patient and to prepare him for surgery, but it was always a more or less half-hearted attempt. The chief idea was to get him to the operating

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room as rapidly as he could be transported thither. Infusions were frequently given, but they were usually given empirically, sometimes of glucose and insulin, sometimes of normal saline solution, practically never with reference to the actual conditions present.

In 1929, however, the clinical application of long and patient years of experimental work reached its climax in the publication of the formula of Hartman's buffer solution. That solution takes into account these facts: that the body tissues need all the normal body salts of which they have been deprived by the pathological process of intestinal obstruction; that while some patients are suffering from alkalosis, others, as McIver and Gamble, and Gatch have stressed repeatedly, are suffering from acidosis; and that provision must be made to combat either type of perverted blood chemistry. It was about this time, too, that Haden and Orr, whose work was quickly confirmed by other investigators, pointed out that those patients in whom the blood chlorides were seriously disturbed received no benefit whatsoever, except from the standpoint of fluid balance, from the administration in any fashion of normal salt solution, and that what they needed was the restoration of their lost chlorides in the form of hypertonic salt solution. In other words, during the period that intervened between Miller's study and our own, intestinal obstruction to the surgeon became less of a mechanical and more of a chemical problem, and surgery became only one step of the process that was designed to save the life of the individual suffering from it.

The idea, then, in the later series of cases was not to get the patient to the operating table as fast as possible, but to get him there in the best condition possible. The importance of prompt mechanical correction of the intestinal pathology was realized no less than in the earlier series, but to that realization was added the comprehension that mechanical correction without, in addition, what we may term constitutional correction, could be of value only in a limited number of cases, in those rare instances in which the diagnosis is made so promptly and surgery is undertaken with so little delay that changes in the blood chemistry are slight or do not enter the picture at all.

Certain treatment was routine in all of the cases we are reporting. The relief of the shock that is always an accompaniment of intestinal obstruction in any but the very early stages was achieved by the elevation of the foot of the bed, the application of external heat, and the administration of morphine in large doses. Such measures, it is universally granted, are as helpful to the patient who is in shock from intestinal obstruction as to the patient whose shock is the result of accidental or surgical trauma.

Gastric lavage, just as in the early series, was routine, not only to keep the patient from developing an aspiration pneumonia or from drowning in his own secretions, particularly if a general anæsthetic were contemplated, but also to rid the stomach and the upper intestine of the accumulated contents which are increasingly toxic in proportion to the level at which the obstruction has occurred. In no case in either series was the Wangensteen

method of decompression used, but it will certainly, in the future, play an important part in pre-operative preparation, even if it does not—many of us are afraid to hope for too much—avoid surgery altogether in many instances.

Lost fluids were replaced either by hypodermoclysis or by infusion, usually the latter, Hartman's solution being used unless an excessive loss of chlorides demanded the administration of hypertonic salt solution. With modern technic and in a properly equipped laboratory, such as is available in any large hospital, blood-chemistry studies can be done without undue loss of time, and are sufficiently helpful in indicating the line of treatment necessary to justify the slight delay they involve, particularly since, as we have pointed out, the selection of the optimum time for surgery on the rehabilitated patient serves his interests far better than does immediate surgery without such rehabilitation.

The outstanding fact in these cases seemed to be the individualization of the patient. Every patient was carefully observed at frequent, regular intervals by the surgeon in charge of the case. His every reaction, his every response to treatment, was noted and evaluated, with the idea of bringing him to the operating table as promptly as his condition warranted, prepared for the further ordeal that is inevitable in the surgery necessary to afford relief. There is no doubt in our minds that the method of pre-operative preparation we have outlined, with its emphasis on the constitutional rather than the local changes produced by the mechanical blockage of the intestines, is perhaps the most important single therapeutic factor contributing to the reduction of the mortality in the three-year period we have studied.

Miller, in his study of 343 cases, arrived at the conclusion—on what seems, it must be granted, indisputable evidence—that the anæsthesia of choice is some form of general anæsthesia. No matter from what aspect the figures are considered, he points out, general anæsthesia seems to have the best of the bargain, and if it be granted, as we have already granted, that the cases which enter the hospital over any two given periods of time are likely to be of equal gravity, he seems to have proved his thesis. On the other hand, in the light of our own series, his conclusions are open to question.

The trends evidenced by an analysis of the two series of cases are exceedingly interesting. In Miller's series (Table III) local analgesia was used in 35.6 per cent. of the 171 cases, with a mortality of 98.3 per cent., against its use in 7.3 per cent. of our 340 cases, with a mortality of 76 per cent. In Miller's series spinal analgesia was used in 19.8 per cent. of the cases, with a mortality of 70.5 per cent., against its use in 70 per cent. of our cases, with a mortality of 22.2 per cent. In Miller's series general anæsthesia was used in 41.5 per cent. of the cases, with a mortality of 46.4 per cent., against its use in 22.6 per cent. of our cases, with a mortality of 42.8 per cent.

How is one to interpret these figures? The surgeons who handled the cases in the period covered by our study had, as we have pointed out, an ad-

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TABLE III

Mortality in Relation to Anæsthesia

Anæsthesia	Number of Cases		Proportion of Cases		Mortality	
	1923-1927	1930-1932	1923-1927	1930-1932	1923-1927	1930-1932
Local.....	61	25	35.6	7.3	98.3	76.0
Spinal.....	34	238	19.8	70.0	70.5	22.2
General.....	71	77	41.5	22.6	46.4	42.8

vantage over the surgeons who handled the cases in Miller's report in that they saw the patients earlier, but on that basis one would expect a consistent drop in the mortality for each anæsthetic, not a reversal of the mortality, which is what has really happened. Some other explanation clearly must be sought.

The very high mortality in each group for local analgesia presents no difficulty. It is reasonable to assume that it was reserved for the very bad risk patients, some of whom were practically moribund when they were placed on the operating table, others of whom were submitted to surgery not with any hope of relief, but merely not to deprive them of their gambler's chance of life, even though all the odds were against success. Table IV, which shows the time of death in relation to the anæsthesia, supports that point of view.

TABLE IV

Time of Death in Relation to Anæsthesia

Time of Death	Local		General		Spinal	
	1923-1927	1930-1932	1923-1927	1930-1932	1923-1927	1930-1932
On table.....	4.9		1.4	7.7	5.8	2.5
1-12 hours.....	34.4	16.0	14.0	5.2	23.2	1.2
12-24 hours.....	21.3	16.0	8.4	11.7	11.6	2.9
24-48 hours.....	11.4	12.0	8.4	5.2	8.8	4.2
48-72 hours.....	8.1	12.0	2.8	2.6	5.8	2.1
After 72 hours.....	18.0	24.0	11.2	14.2	14.7	8.8

Our own interpretation of the proportion of spinal and general anæsthesia used in the two series, and of the mortality which accompanied each one, is this: In the earlier series spinal analgesia was used chiefly for bad risk patients, patients who were in better condition than those for whom local was used, but who were assumed to be unfitted to withstand a general anæsthetic, whereas in the later series the use of spinal analgesia became more and more routine, for good and bad risk patients alike. An analysis of the anæsthetic agents by years, we might add, supports that hypothesis. Moreover, it may fairly be concluded, though it must be admitted that the conclusion is supported by no statistical facts, that general anæsthesia, while it was used in the first series from an honest conviction that it was in the better interests of the patients, was frequently used in the second merely in deference to public opinion. Spinal analgesia, it must be remembered, is subject at intervals to a great deal of criticism, some of which it must be granted is entirely deserved. One of those periods coincided with the

period at which our study begins, and our inference is that the use of spinal analgesia would have been decidedly greater except for the fear of this criticism, and for the additional fear that some patients might succumb on the operating table, as all too many patients with this disease do, and that their deaths might be charged to the anæsthetic rather than to the pathological process. To withhold a type of anæsthesia which one feels is best for the patient for any such reason as this is, of course, fallacious reasoning, but the facts, it seems to us, warrant the deduction.

One final explanation of the reduced mortality in our series must be mentioned: the increasing use of the X-ray for the early diagnosis of intestinal obstruction. The method has been long known; German radiologists have employed it since 1911, and isolated reports have appeared in American medical literature for almost as long a time. But as in the application of chemical studies, so here, the publication of a method, however valuable it may be, and its adoption are two very different considerations. It was not until the late 'twenties that the X-ray was seriously advocated as a diagnostic aid in intestinal obstruction, and the result is that in Miller's series it was not used, as far as we can discover, in a single case, whereas in our own series it was used in 108, nearly a third of the total number. The typical step-ladder appearance of the fluid and gas levels in intestinal obstruction establishes the diagnosis absolutely, it is now recognized, and the use of this method in the cases we have studied undoubtedly played an important part in dictating the treatment, both preliminary and surgical.

SUMMARY AND CONCLUSIONS

The mortality of intestinal obstruction in Charity Hospital has been reduced more than half within a period of ten years by the use of the proper pre-operative preparation, chiefly directed toward the correction of perverted blood chemistry, by the restriction of surgical procedures to those directed only toward the relief of obstruction, by the increasing use of spinal analgesia for all patients, by the use of the X-ray as a diagnostic measure, and by the shortening of the interval between the onset of symptoms and admission to the hospital, an improvement which is clearly evident even though its occurrence cannot be explained.

The reduction of the mortality from 70.7 per cent. in the five-year period from 1923 through 1927 to 31.7 per cent. in the three-year period from 1930 through 1932 should be a matter of congratulation to the surgeons who treated the patients in the later series in the light of new discoveries and with a new conception of the disease. But a death-rate of 31.7 per cent. is still too high for any illness in which such a mortality is not absolutely inevitable, as it is not in intestinal obstruction, and it is to be hoped that the addition of Wangenstein's decompression method, both as an independent procedure and as an adjuvant to surgical measures, will still further reduce even this greatly improved mortality.