

STUDIES OF ACUTE INTESTINAL OBSTRUCTION

I. DIFFERENT TYPES OF OBSTRUCTION PRODUCED UNDER LOCAL ANESTHESIA *

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Acute intestinal obstruction as presented in our schools and described in textbooks is often treated as a clinical entity in which there is one chain of symptoms and one type of treatment. The various etiologic factors are mentioned, but no variance of symptomatology or treatment to correspond with the diverse pathology is specified. The mortality rates are also usually classified under one general heading despite the dissimilar pathogenicity.

In a like manner, most of the experimental work of the last thirty years has disregarded the different underlying morbid conditions. The endeavor has generally been to find one specific lethal factor. Little notice has been taken of the extent or type of the lesion produced. This treatment of the subject must be fundamentally wrong. If not, how are we to explain the great differences in the physical and mental condition in acute obstruction cases seen clinically?

One patient, with an acute obstruction of six or eight *hours'* duration, appears to be in profound collapse. His face is pale and the expression anxious. The eyes are sunken, the features pinched, and the skin is covered with a cold clammy sweat. The pulse is very rapid and feeble, the temperature is subnormal. The tongue is dry and parched, and the thirst is incessant. Vomiting is profuse and foul smelling, and is preceded by abdominal pain. The blood pressure has fallen to 60 or 70.

Another patient, with an obstruction of three *days'* duration, seems to be in fairly good condition. The temperature, pulse and respiration are practically normal. The patient may complain bitterly of pain and frequent vomiting, but he presents none of the collapse symptoms shown by the former case. The blood pressure is normal or only slightly lowered.

In addition to this marked physical and mental contrast, these cases, when examined in the surgery or at necropsy, reveal vast differences in the underlying pathologic conditions. The former patient has an acute strangulation; the latter a simple obstruction of the bowel lumen.

In reviewing a series of clinical cases, we noted that the severity of the symptoms and the pathology of the tissues involved usually ran

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parallel, and we believe, therefore, that, clinically, acute obstruction should be divided into two classes: 1. Acute strangulation, those in which there is an interference with the venous, arterial and lymphatic circulation in the bowel wall and mesentery as well as complete obstruction of the intestine lumen. Under this heading can be grouped volvulus, strangulated hernia, intussusception, etc. Clinically, they present pictures similar to the first case described above. This group totals about 80 per cent. of obstruction cases. 2. Acute simple obstruction, those in which there is a complete blockage of the bowel lumen only, with practically no circulatory involvement. The obstruction here may be produced by gallstones, enteroliths, foreign bodies, adhesions or bands. The clinical picture corresponds to the second case described. This group comprises approximately 20 per cent. of the total.

These two classes have a different mortality rate; the process progresses more rapidly to a fatal outcome in one type than in the other, and it seems logical to conclude, therefore, that the cause of death must vary in the two types. As a natural corollary to this, the treatment should be altered accordingly.

The purpose of the following experiments was to ascertain whether this classification would hold true on experimentally produced obstruction, and also to determine whether the lethal factors varied in the different types.

A review of the work on experimental obstruction reveals that few investigators had observed such a distinction although it had been long recognized clinically. Furthermore, no worker has been able to obtain a true postoperative picture of either type. In these investigations, practically all of which were made on dogs, symptoms of ileus comparable to those seen in human beings were not observed. A critical examination of their methods discloses the fact that all operations were performed under ether or ether-morphin anesthesia. These drugs are known to cause a general central depression and an atonic state of the intestinal musculature for from twenty-four to forty-eight hours. It is during this time that all obstruction cases show their most characteristic objective signs. In many strangulation cases, the subjects die within the first eight to forty hours. It seems evident, therefore, that the anesthesia masks the picture.

The first problem was to devise a technic by which we could produce experimentally an obstruction that would leave the animal operated on as nearly normal as possible. All drugs acting on the intestine or with prolonged effect on the central nervous system had to be eliminated. After considerable experimental work, it was found that excellent results could be obtained with local anesthesia by subcutaneous injection of procain and epinephrin, along the expected line of incision one half hour before operation. During the operation, a large amount of the injected

solution seeps out of the tissues into the field of operation and is wiped away. The small fraction remaining in the tissues is very slowly absorbed owing to the vasoconstrictor action of epinephrin. It is rapidly oxidized in the body tissues, and therefore produces slight if any central effect. Within an hour after the injection, there is thus no complicating factor that would not be found in human obstruction cases except the small incision through the linea alba. Dogs, when operated on by this method, present a symptom complex comparable in detail, within the limits of any animal experimentation, to those exhibited by man.

METHODS AND TECHNIC

Dogs were used exclusively in the experimental work. Observations for normal data were made on all dogs for several days previous to operation. All experiments were performed under local anesthesia by careful aseptic methods. About from 40 to 60 c.c. of procain, 0.25 to 0.50 per cent. and epinephrin 1:10,000 was injected about one half hour before operation. No toxic symptoms were ever manifested. The animals were strapped on a well padded operating table and were made as comfortable as possible. The surgical procedure was accomplished quickly, seldom consuming more than fifteen minutes, and with little or no trauma. All obstructions were produced by tying the intestine with a heavy cord or small rubber catheter or by clamping with aluminum clamps. Blood pressure was taken under local anesthesia on the femoral artery to avoid the complications with the vagus and sympathetic trunks which occur when the common carotid is used. A standard mercury manometer was used and tracings were recorded on a drum kymograph.

Group 1.—Acute simple obstruction: To demonstrate the typical symptoms of a dog with acute simple obstruction produced under local anesthesia. In this series of twenty-one animals, simple ligation was performed at the duodenojejunal junction on nine animals, the lower jejunal on seven and the upper ileac on five. The symptoms presented at these different tie levels are practically identical. The following protocol of a dog under continuous observation presents the typical picture:

Adult male, black and white mongrel, weight 16 pounds (7.2 kg.), operated on, Jan. 10, 1923; time of operation fifteen minutes, off table at 5:15 p. m.

January 10, 4:00 p. m.: Temperature 102.2 F., pulse 90, respiration 18, blood pressure 150 (systolic).

4:30: Operation; dog active, appears normal in every respect.

5:30: Vomits large amounts of bile stained partly digested food.

6:15: Has been very restless, gets up and lies down frequently and whines.

6:30: Drinks considerable water.

6:45: Drinks again, restless, whines some.

6:50: Retches ten times and vomits 50 c.c. of bile stained alkaline liquid containing some bile content. Yelping precedes this retching.

6:55: Retches severely and vomits.

7:05: Drinks small amount of water several times.
 7:20: Restless, head down, appears nauseated.
 7:35: Restless, retches, no vomitus.
 7:40: Respiration 20, pulse 100, temperature 102.4 F., blood pressure 155.
 7:55: Whines loud and long, drinks.
 8:00: Resting, occasional subdued whine.
 8:15: Dog up, whines loudly, vomits profusely three times; vomitus alkaline watery fluid, some mucus.
 8:18: Drinks again, is hypersensitive and apprehensive, lies down.
 8:25: Up whining, appears slightly exhausted.
 8:55: Has been resting rather quietly.
 9:00: Up, drinks, in a minute whining. Vomits three times, lies down.
 9:23: Up, whines, retches; no vomitus.
 9:30: Drinks small amounts several times.
 9:35: Up howling, retches, vomits repeatedly.
 9:40: Resting quietly. Temperature 102.8 F., pulse 95, respiration 20, blood pressure 155 (systolic).
 9:55: Howls, retches and vomits profusely.
 10:00: Resting.
 10:10: Up, vomits several times small amounts with some mucus.
 10:20: Resting.

From 11:00 p. m. the dog was placed in a cage and was not observed until 7:00 a. m.

January 11, 7:00 a. m.: Dog looks somewhat haggard but is not toxic. Temperature 103.1 F., pulse 95, respiration 18, blood pressure 145.

From 7:00 a. m. to 1:00 p. m., the dog drank often; vomits much less frequent but greater amounts.

4:00 p. m.: Temperature 102.6 F., pulse 90, respiration 18, blood pressure 145. The animal seems in no pain and does not vomit unless he drinks water.

January 12, 2:00 p. m.: Dog appears to be in very good condition. Temperature 102.8 F., pulse 100, respiration 22, blood pressure 145 (systolic). The total vomitus today is 180 c.c. more than the fluid intake. Vomitus is yellowish brown watery liquid, alkaline in reaction and has a slightly foul odor.

January 13, 4:00 p. m.: Temperature 103.0 F., pulse 100, respiration 22, blood pressure 140, vomitus 80 c.c. The animal appears weaker, weight 14.1 pounds (6.4 kg.). Apparently in no pain and has vomited only a few times today.

January 14, 10:10 a. m.: The dog was given a barium sulphate meal. Fluoroscopic examination reveals that the bowel above the tie is still very active. Frequent peristaltic waves are seen starting in the stomach and rapidly running down to the tie at the lower end of the duodenum. The duodenum which is now considerably dilated gradually fills and violent peristalsis continues for several minutes. These waves are followed by a period of quiescence. After a few minutes, a contraction and shortening of the entire duodenum, beginning about a half inch above the tie and quickly extending upward, forces all of the barium sulphate back into the stomach. The duodenum then remains empty for several minutes, after which the above mentioned cycle is again repeated.

4:00 p. m.: Temperature 103 F., pulse 100, respiration 22, blood pressure 140 (systolic). The barium sulphate meal has been regurgitated as well as about 40 c.c. of bile stained fluid.

January 14, 1:00 p. m.: No vomiting today. The tie has evidently cut through and the bowel reunited. Eats ravenously and drinks a great deal. Temperature 102.6 F., pulse 95, respiration 20, blood pressure 145 (systolic).

January 15: No vomitus. Dog has had normal stool. Recovery complete and uneventful.

Of this series, five dogs died of peritonitis following perforation at the base of the tie. In the remaining sixteen dogs, the tie cut through in from three to six days as shown by discontinuance of vomiting and passage of stool, or evidenced by fluoroscopic examination. The only objective symptom displaying any particular variation was the degree of whining that was manifest. This is purely an individual characteristic of the different types used.

TABLE 1.—*Daily Observations on Temperature, Pulse, Respirations and Blood Pressure on Dogs with Simple Obstruction with Recovery*

Dog	Weight, Pounds	Days	Average Daily			Blood Pressure (Systolic)
			Temperature	Pulse	Respiration	
2	43	1	102.4	90	18	150
		2	102.4	110	20	145
		3	102.8	104	20	140
		4	102.8	100	20	155
4	37.1	1	101.8	94	18	152
		2	102.6	100	20	145
		3	102.8	106	18	142
5	11	1	103.4	95	20	148
		2	108.8	110	20	144
		3	104.2	108	20	135
9	30	1	101.6	86	18	156
		2	102.8	88	18	140
		3	102.2	94	20	138
		4	102.3	90	16	144
10	29	1	102.2	84	16	138
		2	102.8	98	18	135
		3	103.6	106	20	138
11	15	1	102.4	86	20	160
		2	102.4	96	22	154
		3	102.6	100	20	148
		4	103.2	104	20	...
15	35	1	102.7	90	16	126
		2	101.9	100	18	120
		3	103.6	104	20	130
16	31	1	102.8	88	20	144
		2	102.9	110	24	148
		3	103.1	106	22	135

This characteristic protocol and the data presented in Table 1 demonstrate that dogs with acute simple obstruction never show any symptoms of collapse although they are noticeably distressed by the violent abdominal pain and profuse vomiting. The pulse and respirations are but slightly increased; the temperature is usually normal, and the blood pressure exhibits but slight variation even after from forty-eight to ninety-six hours. The slight increase in temperature and pulse rate is probably due to the small localized peritonitis which occurs at the point of the tie and the tissue absorption from the abdominal incision, a condition often observed in control animals with an uncomplicated abdominal incision.

The seven unselected cases of acute simple obstruction due to adhesive bands, presented in Table 2, were seen by us at Emanuel Hospital during 1921. All diagnoses were verified at operation. Six patients recovered. One died following resection and end to end anastomosis and a complicating peritonitis.

TABLE 2.—*Human Series of Acute Simple Obstruction Produced by Adhesion Bands**

Patient	Age, Years	Days	On Day of Entrance			Blood Pressure		Results
			Temperature	Pulse	Respiration	Systolic	Diastolic	
Mrs. B. E.	28	1	97	80	18	116	82	Recovered
Mrs. E. D. B. .	43	7	99.3	90	20	140	92	Died after 9 days
Mrs. F. J.	57	3	99.8	70	18	Recovered
Mrs. A. F.	38	3	102.4	120	22	120	90	Recovered
Mrs. F. F.	43	3	100.2	94	18	160	90	Recovered
Mrs. S. C. B. .	71	3½	99.5	86	22	Recovered
Mr. L.	56	8	98.6	78	18	150	70	Recovered

* All but one patient made uneventful recoveries after severance of the tissue band.

The subjoined case history demonstrates the striking similarity between clinical and experimental obstruction under local anesthesia.

REPORT OF CASE

History.—Mrs. E. D. B., aged 43, a Christian scientist, stated that the onset of her present illness began one week before entrance by a sudden attack of extremely severe colicky pain localized in the umbilical plane. The pain appeared to come in waves, increasing in severity until a climax was reached followed by a period of quiescence. She soon became nauseated and later began to vomit. Vomiting continued about every thirty minutes, with differing degrees of severity, for the next six days. The evening of entrance the condition had become more severe. At first, the vomitus was food recently eaten, followed by bile tinged liquid. On the second and third days, it was foul smelling. About three hours after the onset, the patient had had bowel movement, but there had been none since then. The temperature had been normal throughout the course. She had had no chills but complained of some cold sweating. From the first, she had been extremely bloated.

The appendix and right ovary had been removed twenty years before. The menstrual history was negative except for three questionable miscarriages. For the last year, she had complained of pain and gas distress after meals.

Physical Examination.—The patient was a normal, well nourished individual. The pathologic condition was confined to the abdomen, which was markedly distended and tympanitic. There was little or no rigidity, but it was tender, particularly over the lower duodenum area, where a palpable mass could be outlined. Auscultation revealed violent borborygmus above the umbilical line.

Laboratory Findings.—Leukocyte count rose from 10,750 at 5 p. m. to 21,200 at 9 p. m., just before operation; differential: polymorphonuclears, 67 per cent.; small mononuclears, 12 per cent.; large mononuclears, 16 per cent.; transitionals, 3 per cent.; eosinophils, 2 per cent. Examination of the urine revealed: specific gravity 1.035; albumin, plus. The blood pressure was 140 systolic, 92 diastolic.

Pathologic Findings.—An adhesion band completely obstructed the lower ileum with recent perforation at the base of the band. There was dilatation above the obstruction, but little or no circulatory involvement.

The foregoing clinical case clearly reveals, as do the experimental ones, that, in simple obstruction, there is but slight deviation from the normal in temperature, pulse, respiration or blood pressure. Furthermore, the symptoms are very similar, and if the obstruction is removed by cutting through or by surgical intervention, most of these patients recover. The low mortality rate is also undoubtedly due, in part at least, to the replacement of body fluids and salts by the introduction of large quantities of physiologic sodium chlorid solution and glucose after operation. The case cited in detail above, in which operation was refused until the eighth day, shows clearly that toxemia if present in these cases, plays but a very small rôle. Of course, if the integrity of the bowel is destroyed by perforation, we are dealing with a complication of a very different nature.

Group 2.—Acute strangulation: To illustrate the symptomatology in dogs with experimentally produced acute strangulation of varying lengths of small intestine. This series includes twelve dogs. As the results are uniform, only one typical protocol will be given in detail. A more comprehensive report on this series will appear later.

Dog 28, healthy Spitz female, weight 17 pounds (7.7 kg.); 9 a. m. normal; temperature 102.2 F., pulse 84, respiration 18, blood pressure 150 (systolic); operated on at 10:20 a. m., off table at 10:35 a. m.

10:20: A complete venous and lymphatic obstruction of a large segment of bowel was produced by twisting and tying off the intestine and mesentery with a small rubber catheter. The tie was not made sufficiently tight to shut off the arterial flow immediately but caused a marked venous occlusion at once.

10:35: Off table, walks around room, appears perfectly normal.

10:47: Vomits 30 c.c. of whitish stomach content, acid to litmus. Whines repeatedly and appears very nervous. Drinks small amount of water.

11:10: After whining and retching, vomits 40 c.c. of alkaline slightly bloody and bile stained fluid.

11:12: Retches and vomits a few cubic centimeters of very thick slimy mucus. Whines repeatedly.

11:19: After severe howling and retching, vomits 20 c.c. of blood stained alkaline fluid. This fluid has evidently come from the obstruction level.

11:26: Howls and retches, but raises no vomitus.

11:38: Howls loudly and vomits 20 c.c. of the usual thick frothy mucus. This fluid has the appearance of egg albumin although it does not give a reaction for albumin. It is negative for bile and shows but a slight trace of proteolytic and lipolytic enzymes.

11:50: Drinks again.

12:00 m.: Animal is now beginning to show definite collapse symptoms. The eyes are retracted, pupils dilated, ears and tail drooping, nose dry, thirst incessant and the extremities cold. The respirations are loud and rapid, the pulse is greatly augmented and of small volume. The gait is unsteady and animal leans heavily against the side of the cage. The entire attitude is one of extreme dejection.

12:00 m. to 1:00 p. m.: Frequent drinking and vomiting during this hour. The dog is rapidly becoming more dazed and whines less frequently. Collapse is more pronounced.

1:10: Whining at short intervals, drinks frequently. Temperature 101.5 F., pulse 135, respiration 38, blood pressure 80 (systolic). This doubling of the

pulse and respiratory rates, subnormal temperature and extreme fall in blood pressure indicates an already advanced case of shock.

1:40: Retches profusely, then vomits 140 c.c. clear slimy mucus.

1:45: Drinks considerable and whines. Very weak. Gait staggering, falls when attempt is made to lie down.

1:56: Gets up with effort, cries, vomits 25 c.c. mucus. Drinks again.

1:59: Lies down, retches but raises no vomitus.

2:03: Whines, gets up, drinks and lies down again.

2:28: Gets up, howls, retches and vomits 50 c.c. of clear mucus.

2:45: Dog resting, breathing very heavily. Whines frequently.

2:55: Temperature 100.8 F., pulse 140, respiration 40, blood pressure 70.

3:02: Whines, drinks, retches violently and vomits 50 c.c.

3:17: Resting quietly, suddenly up, whining, drinks and then yelps.

3:40: Retches twelve times, and finally raises 20 c.c. of slimy mucus.

3:55: Yelps frequently and drinks; exhaustion more marked.

4:11: Retches fourteen times, vomits a few cubic centimeters.

4:25: Drinks small amount, whines, retches but raises no vomitus.

4:47: Drinks again, two minutes later retches twenty-two times and then vomits 60 c.c. Temperature, 100.2 F.; pulse, 240; respiration, 44; blood pressure, 60. The pulse has shown a profound increase and is of small volume. The respiration has trebled its rate, and the rectal temperature is subnormal. The blood pressure is very low.

5:30: There has been a vomitus of 175 c.c. more and 125 c.c. of water has been consumed since the last period. Whining is less frequent and greatly subdued.

8:00: Consumed 140 c.c. of water; about 160 c.c. of vomitus since 5:30. Temperature, 99.2 F.; pulse, 300; respiration, 63; blood pressure, 62. The animal was hardly able to stand and was insensitive to most pain. The belly was opened without a local anesthetic and the belly cavity and bowel examined. The gangrenous loop was immensely distended and black. There was no evidence of perforation. The segment was perforated with a needle, and a stream of bloody fluid ejected in a fine stream for 3 feet. No evidence of pain throughout this procedure.

8:45: Dog up, drinks, and then falls down.

9:00: Resting in cage. Retches suddenly and vomits a few cubic centimeters.

9:15: Prone in cage. Temperature, 102; Pulse, 300; respiration, 76; blood pressure, 40.

10:00: Moribund; necropsy.

All dogs in the series died in from seven to twenty-four hours. In all cases, the blood pressure exhibited a conspicuous fall within six hours after the strangulation was produced. Within two hours, there was always at least a doubling of the pulse rate. A consistent increase in respiratory rate and usually a fall in temperature were noted within the first from eight to ten hours.

These experiments represent strangulation of from 15 to 35 inches (37.5 to 87.5 cm.) of small intestine, the ligature being tied in such a manner as to cause immediate and complete venous stasis. These two factors, namely, the length of the segment and the completeness of venous obstruction, are extremely important, as they determine directly the degree and rapidity of onset of shock. In cases in which the segments are long and there is complete venous occlusion, shock appears early and is profound. When short loops are employed, it comes on slowly and is seldom very marked. There are naturally all gradations between

these two extremes. It is thus evident that, in acute strangulation, the lethal factors vary in all cases. The extent of shock is directly proportionate to the length of intestine involved and the degree of venous obstruction.

The foregoing experimental group is comparable only to the most severe human cases of volvulus and extensive internal strangulation. The majority of cases seen clinically are inguinal and femoral hernia, with but a few inches of strangulated intestine and only partial venous obstruction. Furthermore, the patients are usually seen within a few hours from onset, and early surgical intervention occurs before alarming symptoms can develop. For these reasons, we were unable to obtain a sufficiently large series of clinical cases similar to our experimental type. A review of the case reports in the literature will convince one of the striking similarity between symptomatology of the experimental cases and that of the human cases.

Following is a protocol presenting the symptomatology of a dog with simple obstruction, under morphin and local anesthesia (procain), demonstrating the effect of morphin on the objective signs.

Male mongrel, weight 17 pounds (7.7 kg.), operated on Jan. 10, 1923, at 3:30 p. m., with morphin, 1 grain.

A simple obstruction was produced by ligating the duodenum with a heavy cord. A rather large window of cellulose was sewed into the abdominal wall after the removal of part of the recti. The bowel could be observed directly at any time on the table.

4:00: Sleeping quietly.

4:30: Peristalsis can now be elicited on pinching the bowel, but there are no cramp spasms or violent waves evident.

5:00: Resting quietly.

6:40: Very shallow peristaltic waves can be seen for the first time passing over about 8 cm. of intestine above the tie. Dog whines while this occurs.

7:00: Whines occasionally.

7:30: More or less repeated peristalsis, rather rapid, can now be seen running over the visible segment of bowel. The waves stop a centimeter or two above the obstruction. Occasional whimper during activity of the waves.

8:30: Almost continuous peristalsis, quite vigorous, is present over the visible segment. The waves follow each other at intervals of about from two to four seconds. Repeated antiperistalsis can now be seen beginning above the obstruction and passing over the entire segment. These waves are not preceded by the true inhibitory phase but appear more as a massive contraction originating just above the obstruction.

8:40: Dog awake. Tries to get up.

9:00: Bowel is more active.

9:10: Dog whines, struggles to get up; segment above tie is in spasm.

9:30 to 11:00: Occasional whines. Dog has not vomited while under observation.

11:00 p. m. to 9:00 a. m.: Placed in cage and not observed. Peristalsis now present above and below tie. Animal in good condition; killed for tissue examination.

These observations clearly demonstrate that morphin inhibits peristalsis for a period of from three to six hours and thus prevents the appearance of the usual symptom complex. If it is used in conjunction with ether, the effects are still more prolonged.

COMMENT

So far as we were able to ascertain, no previous work of this nature has ever been attempted under local anesthesia. The method has its difficulties, requires patience and necessitates minimum manipulation. However, these very factors render the experimental states as nearly as possible like those that occur under normal conditions. Further, we have been able to reproduce, in these experimental animals, symptom complexes which simulate and parallel the clinical entities. It seems logical, therefore, that the results and deductions in a large measure should be applicable to human cases.

The division of acute intestinal obstruction into acute simple obstruction and acute strangulation appears to be amply proved by this experimental work. In the former, we are dealing with obstruction of the lumen of the intestine without circulatory involvement of much consequence. In the latter, there is segmental obstruction plus extensive vascular derangement.

The rapid fall in blood pressure, the great increase in pulse and respiratory rates, the subnormal temperature and the certain speedy death in acute strangulation when compared with the normal temperature, pulse, respiration and blood pressure in acute simple obstruction indicate that the underlying lethal factors must be different in each type.

In acute strangulation, we are dealing primarily with a shock complex, in which toxemia, dehydration and chlorid loss play but little part. In simple obstruction, shock is not present, and toxemia per se is but a slight factor, if present at all, death instead being due to perforation and peritonitis or, in uncomplicated cases, to inanition, dehydration and chlorid deficiency. These differences in pathology and mortality demand special operative and postsurgical treatment for each type.

CONCLUSIONS

1. Intestinal obstruction as produced experimentally under local anesthesia in dogs closely resembles the human symptom complexes.
2. Experimental acute intestinal obstruction can be classed under two general headings, (1) acute simple obstruction and (2) acute strangulation.
3. The pathology of these two groups is distinctly separable and the lethal factors are different.

4. The symptom complexes of the two types are also very different. Acute simple obstruction shows relatively slight variations in temperature, pulse, respiration and blood pressure; while acute strangulation causes profound changes in these physiologic indicators.

5. Uncomplicated blood pressure observations on dogs following bowel obstruction, can be secured from the femoral artery under local anesthesia.

6. Ether and morphin must be eliminated in experimental studies of the acute symptomatology of intestinal obstruction.

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