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PENETRATING WOUNDS OF THE ABDOMEN *

REPORTING SIXTY-THREE CASES

RECEIVED FROM PISTOL, RIFLE AND SHOTGUN MISSILES

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PENETRATING wounds of the abdomen, even without injury to its contents, are quite dangerous. Except in unusual injuries of the abdominal contents the time elapsing between receipt of the injury and operation is probably the greatest single factor in the recovery of all patients whose injury is not so great as in itself to cause death, as is the case in so many shotgun wounds received at short range. The amount of hæmorrhage and leakage of colon contents, with its secondary peritonitis, are the two great factors which are directly influenced by time.

In treating infections subsequent to perforations of the viscera, the length of time from soiling to operation is of paramount importance. In many of these cases perforation of the colon with escape of fæces has occurred, yet patients will recover if operated upon within two or three hours after receipt of injury. Perforations of the stomach and small intestines, even though received four to six hours before operation, are not very dangerous even when evident localized peritonitis is present. Some of these are closed without drainage, as in perforating duodenal ulcers.

In all cases certain routine treatments should be carried out; these include intravenous glucose and hypodermoclysis of saline, application of heat, prohibiting everything by mouth, antitetanic and perfringens serums, liberal use of morphine for "splinting" the abdomen, and general good nursing. The use of enemas before or after operation in injuries of the lower ileum or colon should not be allowed. The bowels will move, and more safely, without assistance.

This paper is based upon the study of sixty-three cases of perforations of the abdomen admitted to the Park View Hospital and Bass Memorial Hospital to the service of Doctors Boice and Willis, and treated by one or both during the past seventeen years. Many of these were operated upon around midnight. The patients ranged in age from six to sixty-five years, and fifty-four of them were between ten and thirty years of age inclusive. Therefore, the young and robust adult is the usual case treated. There were fifty-five males and eight females. Ten were white and fifty-three were colored. The period of time elapsing between receipt of the injury and admission to the

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hospital was approximately obtained in fifty-one cases, nineteen being received in two hours; twenty-one, between two and five hours; seven, from five to ten hours; four, from ten to fifteen hours; one, thirty hours, and one, four days (abscess due to perforation unsuspected). The loss of time between admission to the hospital and the operation is also a factor in our opinion. Thirty-one of the patients were operated upon within one hour (shortest, five minutes), over one hour and within two hours, twelve; two hours to five hours, six; six to ten hours, two; and one was allowed to remain in the hospital seven days to wall off his abscess. This was the patient that was sent in on the fourth day. Two patients were so moribund that they were not operated upon. In six, the time of the arrival of the patient was not recorded.

The distance and mode of transportation to hospital is important. A few of the cases were from the city; the great majority from a few miles to seventy, the greater number coming from seventeen to forty miles. They were conveyed by automobile, some sitting up and others reclining on the back seat.

We classified this series according to the amount of hæmorrhage, as Mason,¹ of Birmingham, reported a much higher mortality in the large-hæmorrhage group, and we agree with his findings.

	Large Hæmor- rhage	Died	Per Cent.	Total Per Cent.
Pistol shot.....	24	11	46	
Shotgun.....	6	6	100	56.66
	Small Hæmor- rhage	Died	Per Cent.	Total Per Cent.
Pistol shot.....	24	3	12.5	
Shotgun.....	4	0	0	10.71

This complication is more apt to occur in the shotgun wounds inflicted at close range.

We further classified these by the number of perforations of the solid and hollow viscera, considering the point of perforation and its exit as two separate perforations in the hollow viscera, and as one in the solid. Seventeen had one to two perforations; thirteen had three, four and five perforations; twelve had six to ten perforations; ten had over ten perforations, and six were classified as numerous or shotgun wounds. Three abdominal shotgun wounded survived without operations; therefore we are unable to specify the number of perforations. In two, a bullet passed through the abdomen without perforation of organ. One of these had a perforation of right renal vein and died of secondary hæmorrhage twelve hours after operation.

In this series twelve had one organ involved; twenty-five had two; nine had three; eight had four; two had five; five were not operated upon. These included every organ of the abdomen except the suprarenal gland and spleen. One involved the ureter; three the urinary bladder; two the gall-bladder or ducts; many the liver and stomach; many had both colon and small intestines

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at the same time, and a few had one or the other. The pancreas was involved three times. One had three ruptures of an exploded stomach, one of which was about thirteen centimetres in length in the anterior wall (shotgun case). It is not so much the organ involved, excepting the pancreas, but it is the extent of the injury that counts. Pancreatic wounds are more fatal; acute pancreatitis is apt to follow and retroperitoneal hæmorrhage is usually large. Duodenal injuries are particularly difficult to handle because of hæmorrhage obscuring the field of injury and the necessity of mobilizing the duodenum and retroperitoneal infection.

Classification According to Weapon

	Case	Operated	Not Operated	Died	Mortality Per Cent.
Pistol shot	47	46	1	15	32
Rifle	2	2	0	0	0
Shotgun	14	10	4	7	50
Totals	63	58	5	22	35

One each of the pistol and shotgun groups were so moribund they were not operated upon; the former died in eighteen hours and the latter in six hours. Three of the non-operative shotgun cases survived.

Classification of Deaths as to Time of Occurrence Following Operation

	Died on Table	Within 48 Hours	After 48 Hours
Pistol shot	3	6	5
Shotgun	1	5	0

There was only one post-operative obstruction that was operated upon and he survived with an enterostomy. There were other post-operative obstruction cases, both partial and complete, among those that died. Some were recognized, but their condition was so critical that it would not permit interference. Four were enterostomized at time of operation for fear of obstruction, and we think this a very valuable procedure, especially where there are perforations below an anastomosis or too few perforations to justify resection but enough to greatly impair bowel movement.

Only three patients were transfused, but we agree with Mason² that this should be done more often.

The blood-pressure was recorded in twenty-four persons. Of those recorded, five were below eighty millimetres of mercury and nineteen over 100; many of the most desperate cases were not read.

Practically every patient received hypodermoclysis on the operating table, the amount varying from 300 to 3,300 cubic centimetres, and it was kept up after putting them to bed, varying from twenty-four hours to seven days, giving 100 to 200 cubic centimetres an hour. Herndon's intravenous-drip method with 5 per cent. glucose works very nicely in these cases.

Five patients received more than one pistol-shot wound. One developed pneumonia and empyæma; sixteen had a mild peritonitis at the time of

operation; ten had complicating chest wounds, most of these severe, and many died; four had bone fractures, and in twenty-five the bullet or shot lodged in the back. The pulse rate varied from 68 to 170 at beginning of operation, and the great majority were over 100. The upper abdomen was involved in thirty-five; both the lower and upper in three; the lower in twenty-five. Upper abdominal wounds are considered more serious, due to more vital organs and larger blood-vessels. In twelve it was necessary to do an anastomosis of the bowel; in one it was necessary to do two anastomoses, as the bowel was exploded and torn across without actual injury by missiles. This patient was a shotgun case with a large perforation of anterior wall of descending colon with wads and shot in left perirenal space; he survived. He had a temporary fecal fistula. Twelve patients were deliberately not drained, and of these eight lived.

Those that survived operation stayed in the hospital from twelve to fifty-seven days. Practically all received antitetanic serum, and a great many had

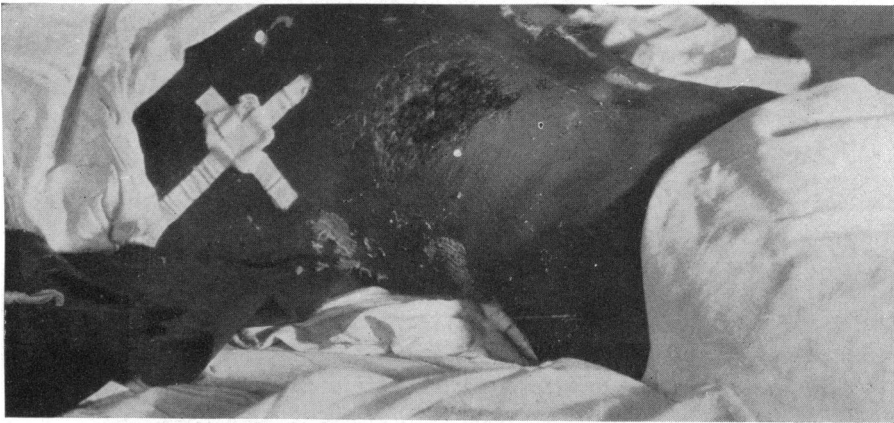


FIG. 1.—External injury from multiple gunshot charge at short range.

antiperfringens. Fifty had ether anæsthesia. Two had ether and spinal anæsthesia; four had spinal anæsthesia alone; two of these died. We do not believe spinal anæsthesia is a safe anæsthetic in these cases. One had local anæsthetic; one did not require any anæsthetic as the opening was so great in the anterior abdominal wall that his insensitive organs could readily be repaired. Two were moribund; and three deliberately not operated upon, believing this was the best treatment. These three are the real basis for reporting this series, and their histories are as follows:

CASE I.—Negro youth, aged sixteen years, admitted to hospital June 27, 1928, stating he had been shot four hours before. He was shot thirty feet from muzzle with No. 4 bird shot, and vomited blood. On examination there were eight shot holes scattered over the abdominal region. Pulse, 75; temperature, normal. He was given antitetanic serum, nothing by mouth, and hypodermoclysis. On the fifth day he was allowed liquid diet and discharged well on the tenth day. Röntgen-ray films were made before his discharge, showing some shot had apparently penetrated the abdomen.

CASE II.—Negro, aged twenty-three years, entered the hospital one hour after being

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shot by 12-gauge gun, No. 6 bird shot, muzzle about nine feet distant and about four feet above him. The load entered the lower border at the right costal margin in nipple line. There were numerous shot holes (Fig. 1), some coalescing, over an area eleven centimetres in diameter. He was not shocked; he had eaten nothing that night. He was not operated upon; was given morphine, $\frac{1}{6}$ grain, every four hours; glucose, 100 grams intravenously on alternate days and nothing by mouth for eight days. Anterior and lateral Röntgen-ray films made about the eighth day showed numerous scattered shot in the right half of the abdomen (Fig. 2) reaching from the costal margin to the symphysis and back in the lumbar region. Colon pus was discharged through shot holes

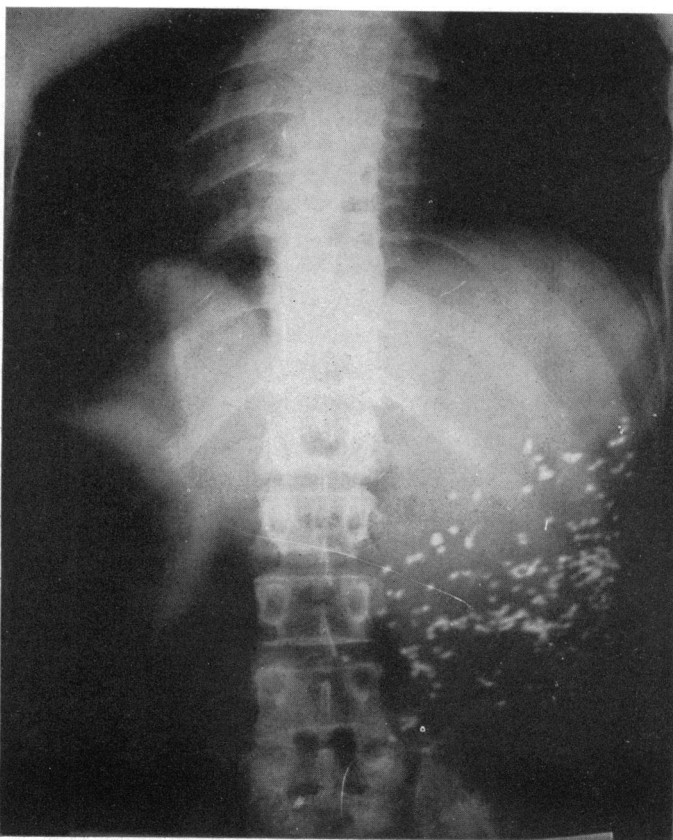


FIG. 2.—Skiagraph of abdomen of patient shown in Fig. 1, demonstrating the scattered intra-abdominal wounds.

for nearly three weeks. The patient was discharged well on the twenty-ninth day, returning at intervals for several dressings.

CASE III.—Negress, aged fifteen years, was admitted to the hospital 1:30 A.M., September 19, 1931, for shotgun wounds abdomen, chest, left forearm and right thigh. Temperature was 98° F.; pulse, 84. The patient stated that she was sitting in her nightgown on the edge of her bed about 10:30 P.M. "tonight" when she was shot. The gun was 12-gauge and the muzzle was about twelve feet from her. The load passed through the window pane. She was sitting with her right side at about a forty-five-degree angle to the window. Practically three-fourths of the load was received in the right half of the abdomen; a few scattered shot in the chest, breasts, right thigh, and left forearm. (Figs. 3 and 4.) She was carried to the hospital, put to bed, the wounds

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dressed with hot packs of boric-acid solution; morphine, 1/6 grain, every four hours was ordered and nothing given by mouth. Hypodermoclysis, normal saline 100 to 200 cubic centimetres every hour started, and 1,500 units of antitetanic and ten cubic centimetres of anaërobic antitoxin given.

By the fifth day her temperature had gradually risen to 103.5° F., reaching normal on the thirteenth day. Her pulse rose to 120 per minute on the second day and remained at that rate with slight variation until the sixth day. Nothing was allowed by mouth until the eighth day. She was given 100 grams glucose intravenously in 1,000 cubic centimetres of distilled water on the third, fifth, seventh, eighth and ninth days. She left the hospital on the twenty-fifth day, apparently well. The abdomen was examined from day to day for peritonitis and abscess.



FIG. 3.—Widely scattered gunshot wounds of abdomen; external appearance.

CASE IV.—Negro man, aged fifty years, admitted to the hospital December 12, 1930, with a pistol-shot wound of the abdomen and was operated upon, but died on the table. During exploration of the abdomen two birdshot were found in the liver and one noted in the gall-bladder wall. He no doubt had other shot that were not found. Patient had been previously shot and recovered.

Particular attention is called to the inadvisability of operating upon shot-gun wounds when small birdshot have scattered throughout the abdomen, as it is hopeless and useless to try to locate all the perforations. These perforations are small and, as Bunch³ says, there is no discharge of mucosa through openings. His descriptions are so clear as to the types of wounds, I wish to quote from him as follows:

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Wounds made at a distance, after the pattern of the scattering shot has enlarged and the load is no longer massed, are those of the many individual shot. A small pistol ball may make many intestinal perforations, and a load of scattered shot striking the abdomen may cause numberless perforations. A single shot may pass through the abdomen without penetrating blood-vessel or intestine, but many shot cannot pass through the abdominal wall without injury to the underlying viscera. If the shot penetrating the gut is large, the hole made by it is large, and the everted mucosa pouts through the opening automatically, keeping the wound open and preventing the probability of spontaneous healing. A shot, if it passes longitudinally through the gut-wall, may slit it for an inch or more. If the shot penetrating the intestine is small, the opening made by it may be so small that the mucosa does not pout through the serosa. Such a wound appears as an



FIG. 4.—Skiagraph of abdomen of patient shown in Fig. 3, demonstrating the widely scattered multiple intra-abdominal condition.

elongated pink dot or dash on the gut-wall. The edges fall together in proper apposition and heal readily without surgical help if the gut be kept at rest. Owing to the number of missiles penetrating the abdomen and the vascularity of the viscera, internal hæmorrhage is apt to be free. There are multiple hæmatomas from the mesentery, making particularly difficult the recognition of gut injury.

We would particularly urge that these patients be put to bed with the head of the bed elevated at a 10 to 15° angle; nothing by mouth; morphine sufficient to keep them quiet; hypodermoclysis of saline or intravenous 5 per cent. glucose with proper sterilization and dressing of external abdominal

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wound. Tetanus and perfringens serums should be given and a watchful waiting policy followed. If these patients are operated upon, the surgeon will succeed only in milking the infection through the holes in the intestines, greatly shocking the patient, and these efforts will be rewarded by a general peritonitis and death. Bunch, of Columbia, S. C., reported operating upon one of these cases who was in very good condition, and, after closing numerous perforations, gave up the task, realizing that there were many more, and closed the abdomen, and the patient died two hours later.

We have been expecting some of these patients to have secondary abscesses or severe hæmorrhage, and no doubt they will occur and require operation.

The mortality in this series of sixty-three cases with twenty-two deaths is 35 per cent.

BIBLIOGRAPHY

- ¹ Mason, J. M.: ANNALS OF SURGERY, vol. lxxix, p. 382, 1924.
- ² Mason, J. M.: ANNALS OF SURGERY, vol. lxxviii, p. 364, 1923.
- ³ Bunch, G. H.: Southern Surg. Trans., vol. xli, p. 38, 1928.