GUNSHOT WOUNDS OF THE ABDOMEN

A REVIEW OF TWENTY-TWO CASES

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Twenty-two patients suffering from gunshot wounds of the abdomen, who later received the benefit of surgical intervention, were admitted to the Denver General Hospital during the period, 1928 to 1933. The mortality rate in this series was 68 per cent., which corresponds with similar statistics as reported in the literature from other general hospitals throughout the United States. Loria[8] reports 122 cases observed at the New Orleans Charity Hospital, with eighty deaths; Mason,[10] of Birmingham, records thirty-three deaths in fifty-eight cases; while Condict,[2] of New York City, had nine deaths in twenty cases. These statistics when compared with those reported by Crawford,[4] in 1910, indicate that the mortality rate for similar injuries has not been appreciably improved in the last two decades. The extremely slow progress that has been made in the treatment of these injuries is further emphasized by an historical review.

In civil life, bullet wounds of the abdomen first became prevalent through the custom of pistol dueling. At that time surgery was indicated only when the abdominal contents had eviscerated. Later, during the War of the Rebellion, the mortality rate for penetrating wounds of the abdomen was found to be approximately 90 per cent., because surgical intervention was instituted only when the hæmorrhage was too profuse to be controlled by bandages. In such circumstances, the procedure consisted simply in enlarging the abdominal wound and ligating the bleeding vessel. It was not until the Spanish-American War that an effort was made to completely repair the intra-abdominal damage, and then only five cases were given the benefit of operative interference. During this period the mortality rate was variously estimated at 80 to 90 per cent. However, by 1910, surgical repair was generally accepted as the proper mode of treatment, and, as a result, the mortality was immediately reduced to approximately 60 per cent., a figure at which it now stands.

The three predominant factors determining the gravity of gunshot wounds of the abdomen are: (1) the degree of visceral damage; (2) the amount of hæmorrhage; and (3) the time elapsed fom the injury to the completion of its surgical repair. With this idea in mind, a chart is presented of all cases of gunshot wounds of the abdomen receiving the benefits of an operative procedure, which were admitted to the Denver General Hospital during the past five years.

The first factor, namely, the mischief caused by the bullet's course through

the abdominal cavity, must of necessity remain outside the realm of surgical control, and for this reason certain injuries will always command a high mortality rate. For instance, a wound of the hollow viscera is more dangerous than is a like injury to a solid organ, and a tear in the liver or spleen is not as hazardous as is one of the pancreas, while a perforation of the stomach and small intestine is less serious than a similar injury to the large bowel. Further, the more numerous the perforations, the more difficult is their isolation and suture, and the greater is the resulting risk.

CHART I

Gunshot Wounds of the Abdomen

Case Number	Time from Injury to Operation in Minutes	Operating Time in Minutes	Total Time in Minutes	Pathology	Hemorrhage	Recovered	Died	Transfusion	Time from Injury to Transfusion in Hours
34059	115	55	170	Perforations of Colon	----	X		0	0
34710	190	97	287	Perforations of Colon	--		X	0	0
36639	120	58	178	Perforation of Stomach & Pancreas	--	X		0	0
38095	150	60	210	Perforation of Colon	?		X	0	0
38664	90	48	138	Perforations of Jejunum	?	X		0	0
40039	110	50	160	Perforation of Ileum & Colon	---		X	0	0
44787	207	64	271	Section of Ureter	----		X	0	0
46081	115	45	160	Perforations of Ileum	?		X	0	0
46700	420	40-	460-	Perforations of Ileum	----		X	0	0
60496	102	58	160	Perforations of Ileum	?	X		0	0
61454	68	63	131	Perforation of Stomach	----		X	0	0
61703	94	56	150	Perforation of Liver & Stomach	--	X		0	0
62461	260	50	310	Perforation of Liver	?		X	X	16
64697	258	125	383	Perforations of Ileum	---		X	X	6
72912	510	30	540	Perforation of Liver & Kidney	--		X	X	20
73304	187	57	244	Perforation of Liver & Stomach	---	X		X	10
76082	80	70	150	Perforations of Ileum	?		X	X	24
76975	195	65	260	Perforations of Ileum	--		X	0	0
79868	164	143	307	Perforations of Ileum	----		X	0	0
81132	85	50	135	Perforation of Stomach	---	X		X	5
85171	140	65	205	Perforations of Ileum	?		X	0	0
85173	195	95	290	Perforation of Colon	--		X	0	0
				Summary					
Average	113	55	168			32%			7 1/2
Average	191	70	279				68%		18 1/2

The second factor, that of hæmorrhage, is partially under surgical control, and according to many authorities[1, 3, 5, 6, 7, 9, 11] is frequently disregarded because of a general inappreciation of its significance. Mason, of Birmingham, suggested, after a study of many case records, that the shock present in these injuries was the direct result of the hæmorrhage. If this statement is accepted, then it furnishes additional evidence in favor of the value of early surgical intervention. Six of the cases reported in this paper received one or more transfusions, but due to delay they were often given too late to be of any real value. The average time in this series, from the injury to the transfusion, was fourteen hours.

The third, or time factor, is definitely under our control, but is often neglected. We know that the mortality rate in a ruptured peptic ulcer increases in inverse ratio to the time elapsed after the accident. We also know that the course of a bullet is frequently most fanciful, and because many of these patients are in a most excellent condition upon our first examina-

tion, we delay surgical intervention until such symptoms have arisen, which by their very presence, indicate the patient's condition to be hazardous. Cases Nos. 61703 and 61454 furnish excellent examples of the splendid condition in which a patient may appear with a gunshot wound of the abdomen.

Case No. 61703 is that of a seamstress, aged fifty-two, who was shot by her husband during a drunken quarrel. The bullet entered the left upper quadrant of the abdomen and lodged in the musculature of the back near the ninth dorsal vertebra. Upon entrance to the hospital, approximately thirty minutes after her injury, she was in practically no shock, with a pulse rate of 78 and a temperature of 99.4° F. The abdomen showed a small puncture wound just below the left costal margin in the mid-clavicular line. There was no distention present, and only a slight splinting of the muscles near the wound, with moderate dullness in the left lumbar gutter. The patient had not vomited and was having no pain. An immediate operation was performed, and the bullet was found to have transversed the left lobe of the liver, and penetrated both walls of the stomach.

The second case, No. 61454, demonstrating this same phase, is that of a man, aged twenty-eight, who had been on a drinking bout at a friend's home, and because he expectorated upon the rugs, he was shot through the abdomen at close range. When he entered the hospital, which was forty-five minutes following the accident, he was not in appreciable shock, was very talkative, and on examination showed a penetrating wound in the epigastrium, and dullness in both lumbar gutters. At the subsequent operation, which was performed immediately, the bullet had passed through both stomach walls, with its point of exit to the right of the vertebral column.

The time elapsed before the operation is performed is of vital importance, as is clearly shown in this series. (See chart.) The average time for this period in those cases that lived, was one hour and fifty-three minutes, while for the cases that died, there was more than one full hour longer of delay, or an average pre-operative time of three hours and eleven minutes. This factor is generally understood, but the danger of even the slightest delay is not fully appreciated. These patients represent real surgical emergencies, and must be respected as such if we desire to improve the excessive present-day mortality rate. Further, the same procrastination must be absent from our surgical procedure. The quickest, easiest, most logical, and surest method of repair will give the most satisfactory result.

This fact is demonstrated most forcibly by an analysis of the operating time in each case. The average operating time for the cases terminating fatally was one hour and ten minutes; four cases only, consuming less than one hour, and in four instances the procedure required over one hour and thirty minutes. The average time consumed by the surgery in the cases that survived was fifty-five minutes, and none required over one hour. For the two individuals that lived one week and two weeks, the surgical procedure occupied fifty minutes and one hour and ten minutes respectively. It is also interesting to note that every case necessitating resection of the intestine died. It is frequently suggested that in dealing with perforations in the small intestine, it is easier, simpler and therefore quicker to resect that segment of gut, than it is to suture the wounds separately. This is occasionally true, but only rarely, particularly if a lock stitch is used for the repair

of the larger perforations. This suture has the advantage of giving a most satisfactory closure and requiring a minimum amount of time for its execution. Of course, the time consumed for the surgical repair depends largely upon the extent of the intra-abdominal damage, but with a more general appreciation of the necessity for expeditious surgery, every possible means of surgical knowledge will then be utilized to serve this purpose.

It is certainly most pertinent that in this entire series not one of the patients who recovered had a surgical procedure requiring more than one hour's time to complete. Too much emphasis cannot be placed upon the single factor that a supreme effort must be made to complete the surgical repair within this time.

To this end this paper is dedicated; that we may have a more definite and systematic mode of care, which will alleviate delay and thereby bring to a more happy conclusion many of the cases of gunshot wounds of the abdomen. To delay is to destroy, and unless we are absolutely familiar with the most rapid method of attack and repair, many of our cases must necessarily be doomed to failure.

With this idea in mind, the following tabulated suggestions are made as a means of obviating a few of the petty delays which are encountered in the treatment of these cases.

(1) In most cities, patients suffering injuries of this nature are cared for in the general hospitals, and usually are promptly transported to the emergency room. The interne then notifies the staff officer and awaits his arrival and subsequent examination before ordering the operating room to be prepared. When it is appreciated that even the loss of one-half to one hour is of paramount importance to their successful outcome, then only will the internes be encouraged to order the operating room immediately upon the arrival of the patient in the emergency ward.

(2) At the same time that the notification to the staff surgeon is given, the house interne should begin the necessary arrangements for a transfusion. This can seldom be accomplished under one hour's time, but if the preparations have been started early, the transfusion frequently can be given before the surgical procedure, and if not, immediately upon its completion. According to many authorities, those cases showing moderate to severe bleeding have a higher mortality rate than those with only slight hæmorrhage. The procedure of transfusion then becomes of prime importance to their proper surgical care.

(3) The degree of shock present, whether it is due to a loss of blood volume; the result of an increased permeability of the capillaries, dehydration, or hæmorrhage, must be treated immediately, and to this end an intravenous infusion should be started at once; the patient should be placed on shock blocks, and external heat applied. This phase of the surgical treatment is seldom neglected, and the desire of this paper is only to emphasize the value to be obtained by its immediate application.

(4) The size of the incision must be sufficiently ample to permit easy

visualization and exploration of the abdominal viscera. Fortunately, it no longer is an indication of good surgical technic to work through small, buttonhole like incisions, but even so, the tremendous advantages of a liberal wound are not fully appreciated. Nothing so facilitates an easy and rapid surgical procedure; and as a careful exploration is an absolute necessity in this type of injury, the incision must be generous enough to easily permit its performance. Further, it is an accepted fact that a large wound shows no greater tendency to hernia formation than does a small one, and as our desire is to repair the damage in the least possible length of time, then we must necessarily have an ample incision in order to accomplish this objective.

(5) Because hæmorrhage is always present, and an accumulation of blood will uniformly be encountered upon opening the abdomen, a satisfactory apparatus for suction should be at hand for immediate application upon entering the peritoneal cavity.

(6) In the event the bullet has penetrated the liver, the operative procedure is simply to control the subsequent hæmorrhage resulting from the laceration of this organ. Although there are numerous means suggested for suturing the liver, all are time-consuming, and it has been shown most clearly that tamponade alone will prove sufficient. As our desire is to accomplish the control of the hæmorrhage in the shortest possible time, then packing should be utilized for this purpose in every case where a solid organ has been injured. It has been suggested that a packed liver is prone to subsequently develop an abscess. This danger undoubtedly has been greatly exaggerated, because not only in this series but in the last fifteen years, at the Denver General Hospital, autopsy records fail to reveal the presence of a single liver abscess resulting from tamponade.

(7) Should the bullet have pierced both stomach walls traveling from before backward, it will regularly be noticed that the wound in the anterior wall is small, while that in the posterior is much larger. By enlarging the opening in the anterior wall by means of a linear incision in the direction of the long axis of the stomach, the posterior wound may be sutured through this incision with comparative ease. The readiness with which this may be consummated in comparison to suturing the tear in the posterior wall of the stomach by an approach through the mesocolon is most astounding.

(8) Large tears of the stomach or bowel frequently present difficulty in closure. In our experience we have repaired these wounds by means of a lock stitch in preference to the Lembert suture, because of its comparative ease and rapidity of execution, and not once have we regretted its employment. This is accomplished by placing two Allis forceps at each angle of the wound, one near the mesenteric border of the intestine, and the other directly opposite, then by means of a continuous lock stitch, the wound can be sutured both rapidly and snugly. In repairing the stomach, the direction of the suture line should be in its long axis, except when it might interfere with the lumen at the pylorus.

(9) Frequently when the intra-abdominal damage has been most severe, and its repair necessarily time-consuming, we can facilitate the incisional closure by utilizing the method of approximating all layers with heavy through-and-through silk sutures. This method of closure has been used frequently enough in our own experience, as well as that of others, to justify its practice in every case when a rapid closure is essential.

The above suggestions have been offered as a means by which we may obviate some of the more common delays encountered in the treatment of gunshot wounds of the abdomen. There is no implication intended that they represent the only impediments to a brisk and speedy recovery, but it is hoped that by pointing to the more obvious hindrances to an expeditious surgical care, further study will be stimulated; to the end that the employment of immediate, rapid surgery will subsequently reduce the embarrassing present-day mortality rate.

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