

## GUNSHOT WOUNDS OF THE ABDOMEN

FREDERIC W. TAYLOR, M.D.

INDIANAPOLIS, IND.

FROM THE DEPARTMENT OF SURGERY, INDIANAPOLIS CITY HOSPITAL, INDIANAPOLIS, IND.

IT WOULD SEEM that no useful purpose could be served by adding another discussion to the deluge of papers which have appeared recently on the subject of abdominal wounds. This seems particularly true since the present report deals primarily with such wounds in civilian experience rather than military service. There are, however, several important features in comparison with Service experience that should be emphasized.

A few years ago the writer reported the results of 101 consecutive gunshot wounds of the abdomen treated at the Indianapolis City Hospital.<sup>1</sup> This included the eight-year period 1930 to 1938. The changes that have been incorporated in general surgical care since that time are justification enough for continuing the study for another eight years into the era of plasma, sulfonamides, and penicillin. It should be recalled that late in the period 1930-1938 sulfonamides were just making their entrance into surgery, the general use of plasma was not to appear for several years, blood banks were unknown and blood was obtained from relatives who were often unwilling.

A continuing study such as this has the advantage that the type of patient, the institution, and the general capabilities of its personnel remain much the same; therefore, a change in medical care can be better evaluated than comparing the results in two dissimilar institutions or communities.

In the previous study (1930-1938) certain conclusions were drawn and recommendations made. These along with the pertinent findings of others in this pre-war period are as follows:

1. Our general mortality of 59.8 per cent for all cases operated upon for perforation of the abdominal cavity seemed excessively high. This, however, was quite in keeping with other large and unselected series. The general mortality throughout the country stood at a challenging 60 per cent. (McGowan,<sup>2</sup> 59.3 per cent; Oberhelman and LeCount,<sup>3</sup> 61.4 per cent; Prey and Foster,<sup>4</sup> 72.7 per cent.)

2. As might be expected, multiple visceral injuries caused a very definite increase in mortality. Thus, when both solid and hollow visceral injury occurred, 88.2 per cent of the patients died.

3. It was pointed out that well over half of our deaths occurred within the first postoperative 24 hours (58.5 per cent), and 45.3 per cent took place during the first 12 hours. But 28.3 per cent were considered to have died of peritonitis or its sequelae.

4. The conclusion seemed obvious that the majority of deaths following perforating gunshot wounds of the abdominal cavity were the result of shock—shock either from excessive blood loss, operative shock, or shock from extensive fecal contamination of the abdominal cavity.

5. The answer to this was intravenous blood in large amounts. How well this was carried out and with what result may be seen from the present report.

During the eight-year period from 1938 to 1946 there were 84 admissions to the Indianapolis City Hospital for gunshot wounds of the abdomen. This was a slight though not significant decrease over the 101 such admissions seen during the previous eight years. There seemed to be no lack of gun-play among the citizens on the home front although this was considerably less accurate than formerly noted. Of the 84 admissions, 15 were found not to have perforations of the abdominal cavity. These nonpenetrating cases need not enter into our discussion since, aside from some rather large retroperitoneal hemorrhages, they presented none of the problems of the perforated viscus. All survived.

There remained 69 cases of abdominal cavity perforation. Of these 25 died, a mortality of 36.2 per cent as compared with the mortality rate in the previous series of 52 per cent.

A further breakdown of the mortality is given in Table I. Here, it will be noted that the mortality was quite reasonable where a single viscus was

TABLE I  
MORTALITY COMPARISON

	1930-1938		1938-1946	
	Cases	% Mortality	Cases	% Mortality
Patients having perforation of abdominal cavity.....	87	52	69	36.2
Perforation small intestine (including stomach).....	11	45	8	0
Perforation colon (including rectum).....	12	33	6	3.3
Perforation solid viscus (pancreas, liver, spleen, kidney).....	10	70	19	5.3
Perforation both colon and small intestine.....	13	61	13	61
Perforation colon and/or small intestine and solid viscus.....	17	84	20	70

involved. Thus, there were no deaths in the eight cases in which the small intestine or stomach alone were perforated. It should not be construed that the anatomic damage was less severe, for such was not the case. Practically all these patients had multiple perforations and one as many as 12 perforations of the small bowel. However, it does mean that the lesion was localized to one given area and organ. This apparently makes for a much better prognosis even though some multiple visceral lesions seem less in extent and with less peritoneal contamination than those of the single viscus. It is also noted that the mortality for wounds involving both hollow and solid viscera was 70 per cent. An extremely high figure is common in all such cases reported.

The improvement from a general mortality of 52 per cent in 1930-1938 to 36.2 per cent for 1938-1946 is quite significant. To what may this be attributed?

First of all, the type of patient treated throughout both periods has remained the same. Four out of five were young adults who have been on the debit side of the municipal ledger all their lives and will continue so.

Fortunate it is for them that no one balances the books or that those to whom their care is delegated do not have to pass on their economic value to the community.

Second, the personnel and the institution have remained relatively constant. There has been a better understanding on the part of the doctors as to the physiologic factors involved in such cases, but the operative procedure has shown little variation.

Third, between the 1930-1938 series and the 1938-1946 series a revolutionary step has been made in the preoperative and postoperative care of the patient—the general use of plasma, sulfanilamide, and penicillin.

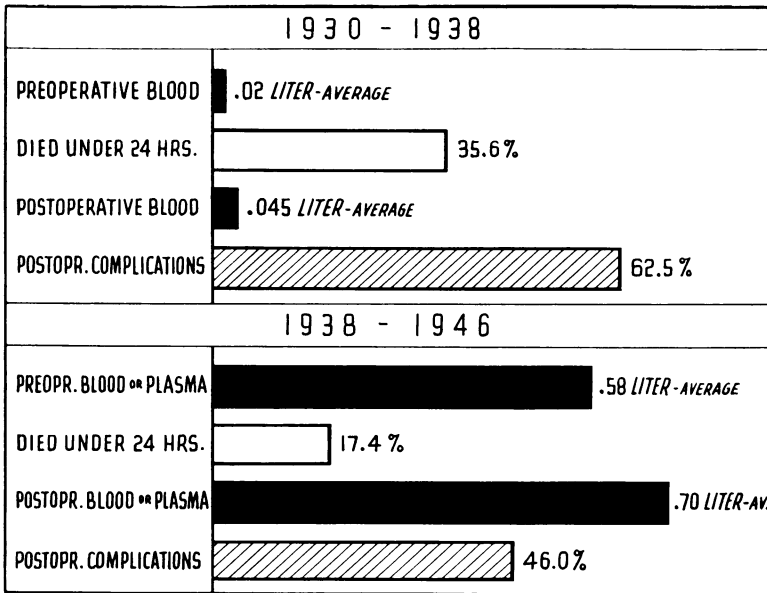


CHART I

PLASMA

Referring to Chart I it will be noted that a negligible amount of blood was given to the first series of patients in the form of transfusions. This all-important phase of therapy speaks for itself when it is noted that 35.6 per cent of these patients died during the first 24 hours after hospitalization. Such deaths can only be attributed to shock—shock from blood loss, extensive peritoneal contamination, or from the operative procedure. A sizable decrease in these 24-hour deaths is noted in 1938-1946 series (17.4 per cent). This improvement is attributed entirely to the increased use of blood and plasma. The amount used averaged .58 liters preoperatively and .7 liters postoperatively, and is small compared with the military use of three and four liters of plasma in similar instances. Undoubtedly some of our civil deaths were the result of insufficient blood or plasma.

## SULFONAMIDES AND PENICILLIN

It has been the hope of everyone dealing with the contaminated peritoneum that the sulfonamides or penicillin would be the long-sought panacea. Such has not been the writer's experience. There is nothing in the present cases to suggest any alteration in the intra-abdominal infection brought about by these drugs. Penicillin or the sulfonamides were never life-savers so far as the peritoneal cavity was concerned. Mortality rates remained identical whether or not they were used.

There was, however, a definite though not too significant decrease in the complications following surgery (Table I). For this reason, and this reason only, penicillin or sulfonamides should be used routinely. Their use as a life-saving measure for the primary lesion only fogs the issue and the surgeon is too apt to put faith in the mystic drug rather than in surgical principles and treatment of potential shock.

In this connection, it might be well to mention the local use of sulfonamide. In the 1938-1946 series, sulfonamide powder was used locally in 13 instances. No benefit was noted. The powder was poured on some supposed critical area, dusted over the exposed intestines or smeared with the fecal contamination over uninvolved loops of bowel. Certainly, such practices are surgically unsound and at best are merely a means of temporarily raising the sulfonamide in the blood to an unpredictable level.<sup>5, 11</sup>

## COMPARISON WITH SERVICE ABDOMINAL WOUNDS

From the standpoint of the actual lesion and the surgical problem, civil gunshot wounds and those in the Service are the same. There seems to be no significant difference in service mortality between small arms wounds and shell fragment wounds.<sup>6,7</sup> Likewise, there are few wounds from high explosives which are more mutilating than a shotgun charge at close range. There were ten such wounds in the last eight years, with five deaths.

The recent mortality records of Service wounds of the abdomen are considerably better than those seen in civil life. There are several obvious explanations for this fact. First of all, there has been insufficient time for the accumulation of any appreciable number of civil cases since the general use of plasma, penicillin, or sulfonamides. Practically all recent reports have been from the Services.

Second, there are a few Service cases who die before they are transported to the Forward Hospital. These deaths are, therefore, not included in any surgical analysis since they are not seen. On the other hand, all such cases are seen in the civil hospital and are included in the mortality analysis. In the field the lag-time between wounding and hospitalization is quite variable. In the survey by Imes<sup>7</sup> it averaged 11 hours. Ogilvie<sup>8</sup> reported that less than half of their cases were operated upon under 12 hours after injury. In the Indianapolis City Hospital cases the interval of injury to hospital averaged .7 of an hour. More than 20 per cent of the deaths occurred during the first 12 hours following injury. Admittedly, the treatment given during this time-inter-

val may not have been ideal from the standpoint of antishock therapy but nevertheless most of these patients would not be included in any military survey. They would have died before reaching the operating unit.

Third, no single Service hospital can follow all their cases to convalescence. A small number die or are lost to follow-up after evacuation from the unit originally reporting operative results.<sup>7,8</sup>

A few of the Service mortality rates which have been reported for penetrating wounds of the abdomen are as follows: Ogilvie, 43.4 per cent; Jarvis, *et al.*, 28.7 per cent; Bradford, *et al.*, 25.5 per cent; Imes, 20 per cent. A review by Sloan on 35 civil cases treated recently reports a mortality of 14.3 per cent.

There is no essential difference in the surgical treatment of civil or military abdominal gunshot wounds. It is a little disappointing that no improved routine has sprung from the large numbers of Service cases which have been reviewed. Plasma was always handy in large quantities and was used in ever increasing amounts. The same cannot be said of the civil institutions where plasma was often not too plentiful. The Service dictum to "exteriorize all wounds of the colon" was greatly overemphasized. There is no reason to exteriorize the simple puncture wound of the large bowel. It can be closed perfectly safely and is followed with a convalescence which is far more satisfactory to the patient. Of course, large rents, devitalization, and retroperitoneal wounds of the colon demand exteriorization.

It would be of interest to know what part overlooked perforations of the gastro-intestinal tract played in the mortality of Service cases. No such figures have been reported. If this incidence approaches that of civil cases, it may be estimated that one-third of the Service deaths were associated with lesions overlooked at the operating table. It is obvious that there will always be overlooked perforations since at times the condition of the patient may not warrant methodical search of all viscera. However, with the increasing use of plasma and control of the patient's shocked state, there should be ample opportunity for a more thorough search and less hurried repair.

With the further realization of the importance of the patient's shock, or his potential shock, as the dominant feature in the care of these cases, it is expected that the general mortality for gunshot wounds of the abdomen will decrease considerably in civil institutions. There will always be a sizable mortality in this type of injury. The resultant mortality will be in direct proportion to the extent of intra-abdominal injury. The cases here reported run quite parallel in this respect to those of Imes, who noted that the type of missile, time-lag before operation, principal viscus involved, and extent of peritoneal contamination were of secondary importance.

#### SUMMARY

1. A comparison is drawn between gunshot wounds of the abdominal cavity treated at the Indianapolis City Hospital during the period 1930-1938 and during the subsequent eight years, 1938-1946.

2. The mortality during the recent series was 36.2 per cent as compared with 52 per cent in the former.

3. This improvement is attributed entirely to the realization that shock or potential shock is the principal factor to be considered in treatment. Plasma became available during the second period and was used as much as a somewhat limited supply would permit.

4. The sulfonamides and penicillin also came into general use during the second eight-year period. So far as could be determined, these drugs did not alter the course of the intra-abdominal lesion. Likewise, they did not alter the mortality.

5. The use of a sulfonamide or penicillin is advocated in all these cases but not because of what the drugs can do to the intra-abdominal lesion and its subsequent peritonitis. They are advocated for their ability to decrease the complications following operation. When an operator becomes too conscious of the virtues of sulfonamide or penicillin he tends to lose sight of surgical principles. It would be far better to realize that at the present time nearly half of these patients who are going to die, die presumably of shock during the first 24 hours. After that time a few more will die from overlooked bowel perforations.

6. Military and civil mortality statistics cannot be directly compared because military cases are to some extent selected. Medical care has been essentially the same in both groups.

#### REFERENCES

- <sup>1</sup> Taylor, F. W.: Gunshot Wounds of the Abdomen. *J. Indiana State M. A.*, **31**, 342, June, 1938.
- <sup>2</sup> McGowan, F. J.: Penetrating Wounds of the Abdomen. *ANNALS OF SURGERY*, **102**, 395, September, 1935.
- <sup>3</sup> Oberhelman, H. A., and LeCount, E. R.: Peace-time Bullet Wounds of the Abdomen. *Arch. of Surg.*, **32**, 373, March, 1936.
- <sup>4</sup> Prey, D., and Foster, J. M.: Gunshot Wounds of the Abdomen. *ANNALS OF SURGERY*, **99**, 265, February, 1934.
- <sup>5</sup> Taylor, F. W.: Misuse of Sulfonamide Compounds. *J. A. M. A.*, **118**, 959, March 21, 1942.
- <sup>6</sup> Jarvis, F. J., Byers, W. L., and Platt, E. V.: Experience in the Management of the Abdominal Wounds of Warfare. *Surg., Gynec. and Obst.*, **82**, 174, February, 1946.
- <sup>7</sup> Imes, P. R.: War Surgery of the Abdomen. *Surg., Gynec. and Obst.*, **81**, 608, December, 1945.
- <sup>8</sup> Ogilvie, W. H.: Abdominal Wounds in the Western Desert. *Surg., Gynec. and Obst.*, **78**, 225, March, 1944.
- <sup>9</sup> Bradford, B., Battle, L. H., and Pasachoff, S. S.: Abdominal Surgery in an Evacuation Hospital. *ANNALS OF SURGERY*, **123**, 32, January, 1946.
- <sup>10</sup> Sloan, H. E.: Perforating Abdominal Injuries. *Surg., Gynec. and Obst.*, **79**, 337, October, 1944.
- <sup>11</sup> Wilkinson, R. S., Hill, L. M., and Wright, L. T.: Gunshot Wounds of the Abdomen, *Surgery*, **19**, 415, March, 1946.