

jejunum in 44, the ileum in 38, the colon in 4, and other portions of the intestine in 21. According to Morton and MacKenzie, in 345 cases of abdominal contusion the intestine was ruptured in 31 instances. Vulliet reports 171 cases of coeliotomy for lacerated and punctured wounds of the abdomen with intestinal involvement in 71. In 133 similar cases Adler noted intestinal injury in 32. In 144 like cases Lühe found that the intestine had escaped injury in 38, and there was no visceral lesion whatever in 24 instances.

Non-penetrating gunshot wounds of the intestine are essentially contused injuries of that structure. In cases of penetrating gunshot injury, the character of the intestinal wound assumes a different aspect. Still, even here one frequently meets with both contused and lacerated wounds, independent of those due to direct penetration, in places where, owing to the mobility of the intestine or perhaps because of a mere impingement upon it, the missile fails to cause direct penetration. It is proper to say, also, that the borders of a penetrating gunshot wound of the intestine often possess the characteristic features of ordinary lacerated and contused wounds, although, for obvious reasons, in a minor degree.

Penetrating gunshot wounds of the intestine are comparatively more frequent in civil than in military life, as in the latter the trunk is exposed as little as possible and the missiles fly high, while in the former the attack is often unexpected, and the recipient is therefore ill prepared to guard against it. Moreover, in civil encounters the range is shorter, hence the aim is better. It is interesting to note that the percentage of gunshot injuries of the abdomen reported as occurring during the late Civil War was astonishingly small (about 0.035), while that of head injuries was 0.15. The larger percentage of the latter is due to the greater exposure of this part of the body. No definite estimate can be made, prior to investigation, of the number, size, direction, or exact nature of the injuries of the intestine that may follow a penetrating gunshot wound of the abdomen.

SYMPTOMS.—Pain, tenderness, tympanites, and bloody stools, with or without the protrusion of the viscus and the escape of the intestinal contents, are common symptoms of intestinal wounds. They are greatly modified, however, with reference to their presence and their association with each other, by the nature of the wound itself.

Pain and Tenderness.—Pain is not a reliable symptom. Soon after the occurrence of an injury, there may be little, or indeed none, even when perforations are present. Commonly, however, pain and tenderness are among the first of the abdominal symptoms. Located primarily at the seat of the wound, the pain is dull or lancinating in quality, the former being more characteristic of contused wounds. As a rule it increases rapidly, becomes burning in character, and is accompanied by exquisite tenderness of the abdomen, retraction of the thighs, and obstinate constipation. It is increased by any muscular exertion, even the act of breathing. Sometimes there are griping pains with a desire to go to stool. Retention of urine may occur, due to the shock, to the peritonitis, or to the treatment employed.

Emphysema.—This sign is not associated very frequently with penetrating wounds of the abdomen, but when present is usually due to the escape of intestinal gases into the connective tissues situated between the intestine and the abdominal walls; hence it is associated especially with injuries of those portions of the intestinal tract that are not entirely surrounded by peritoneum. It may be limited to the immediate neighborhood of the injury, or may become general by spreading gradually into the surrounding tissue. It may also be due entirely or in part to a complicating wound of pulmonary tissue. Emphysema has been considered by some writers to be a certain sign of intestinal perforation, when associated with a suspected penetrating abdominal wound. Its diagnostic value is much lessened, however, by the fact that it has been frequently observed in connection with non-penetrating wounds of the abdominal wall, one such

instance having fallen within the observation of the writer. If septic processes occur in the course of a penetrating wound of the abdomen, emphysema may result even though the intestine itself has not been injured. In such cases, however, the appearance of the emphysema is delayed. The important bearing of leucocytosis on peritoneal involvement in intestinal wounds, to be ascertained by a prompt blood count, should not be disregarded. Nor should we forget that a profound complicating sepsis may mislead by inhibiting leucocytosis.

DIAGNOSIS.—The diagnosis of contused and lacerated wounds can readily be made from wounds of all other forms, but to differentiate between these two is more difficult. There will be a history of abdominal injury received in some such way as already indicated. There may be external evidences of such injury, though in some instances there are none. If the intestinal wound is a *contused* one, there will be evidence of shock. Respiration may be modified by the pain attendant on the act of breathing. Vomiting is a frequent but not constant symptom. Pain is usually present in the beginning, not so acute as in lacerated wounds, but dull, deep-seated, and burning, denoting a beginning inflammation. These symptoms may subside in a few days, or they may be quickly followed by a sudden increase in the pain and more urgent manifestations of peritonitis, or by collapse. These unfavorable symptoms may be caused by the rapid increase of a localized inflammation, by a sudden hemorrhage from a previously contused vessel, or more commonly by a sudden extravasation following sloughing of some portion of the intestinal wall. The constitutional symptoms keep pace with the local. The temperature rises, the pulse becomes more frequent and harder, and the patient soon shows evidence of collapse.

The degree of tympanitic distention of the abdomen is usually proportionate to the extent and intensity of the inflammation. The tympanites may be due to the presence of air in the peritoneal cavity or in the intestine. In the former condition it comes from a wound in the gut, and in cases of contused wounds it will therefore occur at or soon after the exacerbation of symptoms, while in lacerated wounds it follows quickly the intestinal injury. Tympanites due to intestinal distention comes more slowly and is less in degree. In *lacerated wounds*, faecal extravasation occurs as a rule. It was present in 107 out of 113 cases (Curtis). The symptoms for this reason appear earlier than in contused wounds and are more severe. In both varieties there may be vomiting of blood, particularly if the duodenum or jejunum is injured. Vulliet noted hæmatemesis in but one of 114 cases of lacerated and punctured wounds of the intestine, although the stomach was injured in 15 of these cases. The same writer found this manifestation in 10 of 85 cases of projectile wounds. Blood may also be passed at stool, and if it is small in quantity and clotted, it indicates injury to the ileum. If the blood traverses a considerable portion of the intestine, it will be darkened in color and increased in consistence by the action of the intestinal fluids. The possibility of coincident diseases of the intestines causing hemorrhage must not be forgotten.

Nor must it be forgotten that a patient may have received either a contused or a lacerated wound of the intestines, and yet present no symptoms for a few hours. MacCormac has reported one such case, and two others in which vomiting was the only symptom, yet in all three there was rupture of the intestine and death occurred within forty-eight hours.

Hydrogen gas is recommended by Senn as a means of determining whether or not, in a case of penetrating abdominal wound, perforations of the intestine coexist. Senn has demonstrated that under slight but steady pressure, the patient being relaxed by an anæsthetic, the gas may be forced from the anus past the ileo-cæcal valve to the mouth. If perforations exist the gas escapes into the peritoneal cavity, its presence being denoted by general tympanites, loss of liver-dulness, etc., or it will appear at the abdominal wound, where it may be ignited. If

the distention follows the line of the colon, and, after passing the valve, is confined to the umbilical and hypogastric regions, it indicates that the intestine is intact. The gas in passing the valve causes a blowing or gurgling sound which may easily be heard with a stethoscope. The method of using it is as follows: Hydrogen gas, generated in the ordinary manner (care being taken to have it pure), is collected in a rubber bag holding about four gallons. This bag is connected with a rectal tip by means of a rubber tubing and stopcock. The rubber bag being filled, the rectal tip is inserted and the margin of the anus pressed against it to prevent the return of the gas; the bag is now subjected to gentle pressure, the valve yielding to a force varying from one-half to two pounds. If the external wound points to the possibility of stomach injury, then insufflation should be practised through a stomach tube. The disadvantages of the method are that it prolongs the operation, sometimes makes the returning of the bowels a very difficult matter, and occasionally, when perforations exist, it fails to reveal them—items which, according to the majority of observers, outweigh its advantages. In addition to this, there exists the danger of forcing a portion of the intestinal contents into the abdominal cavity, particularly if such contents are fluid and located near or at the point of perforation.

TREATMENT.—Local Treatment of Hemorrhage.—Hemorrhage through the abdominal wound may either arise from the wound itself or have an intra-abdominal source. In either case the indication is to secure the bleeding vessel. This can be easily done if it is situated in the abdominal wall, although it may be necessary to enlarge the opening for that purpose. Bleeding from within the cavity is considered in the great majority of cases a positive indication for laparotomy. Its treatment in connection with laparotomy will be referred to in the section on gunshot wounds. If, in a given case, for any reason laparotomy may not be performed, the treatment should be palliative. The patient is kept quiet, and cold applications are made to the abdomen. The external wound should remain unobstructed, so as to permit the free escape of blood that might otherwise collect in the abdominal cavity. A dressing of moist antiseptic gauze will serve the double purpose of protecting the wound and acting as a drain. In these admittedly hopeless cases, it is probable that pressure on the abdominal aorta, combined with saline transfusion, will prolong the patient's life. Should the hemorrhage thus be controlled, laparotomy during continuance of the pressure on the aorta may yet offer an additional means of preserving life. Compression of the abdomen by means of a tightly drawn body bandage may, in some instances, prove serviceable in the control of bleeding.

Lacerated and Contused Wounds.—A lacerated or contused wound of the intestine may or may not call for abdominal section. There is less danger of faecal extravasation in such a wound than in one associated with abdominal penetration, as the penetrating agent may carry infection from the intestinal wound into the peritoneal cavity. If the symptoms are mild and rupture seems improbable, the expectant plan should be adopted. At all events, the performance of laparotomy should be deemed unwise in these cases after sufficient time has elapsed to permit the formation of adhesions contiguous to the injured portion. Severe hemorrhage or serious visceral lesion demands prompt operative interference. Laparotomy to be serviceable must be done early, and not deferred until peritonitis sets in. In a collection of eleven cases operated on after a few hours had elapsed, and as peritonitis was beginning, all terminated fatally. Shock, usually great in these cases, is much increased by a long operation. For this reason, when resection of the gut is necessary, many advocate the formation of an artificial anus. The choice between this and enterorrhaphy will depend in a measure on the experience and preparation of the operator. A wound located so high up in the intestine that rapid impoverishment of the patient would follow the formation of an artificial anus should be treated

by enterorrhaphy, even though the patient might thereby be exposed to greater immediate danger.

Punctured and Incised Wounds.—Incised wounds of the intestines are more dangerous than punctured ones, because of the greater liability to hemorrhage and extravasation. Their general treatment is similar to that of other varieties. In performing laparotomy the incision is usually made in the line of the wound rather than in the median line, because it affords the most direct route to what is usually a limited injury.

Gunshot Wounds.—In opening the peritoneal cavity, in the case of a gunshot wound, the incision should be made in the median line, especially when it appears that an opening made at the seat of injury will not offer an adequate opportunity for a proper inspection and treatment of the injured parts. The probable direction taken by the missile should be considered in all such instances. It has been advised, and wisely, that, when the intra-abdominal wound is probably limited to the more fixed portions of the intestinal tract or to other abdominal viscera, in the absence of symptoms of hemorrhage, the incision be made in the line of the abdominal wound. After the peritoneal cavity has been opened, in the place of forceps, which bruise the tissues, long sutures of silk or catgut should be passed through the peritoneal borders in order to prevent retraction, being held by an assistant or otherwise properly anchored.

The agents employed for repair of the intestine are the usual materials for ligatures, sutures, etc. Carbolized iron-dyed silk may be employed for both purposes, or aseptic catgut of small sizes may be used exclusively for ligatures, although some prefer to rely solely on silk. The needles required for sewing peritoneal and intestinal surfaces will depend on the preference of the operator, some using curved needles of small size and without sharp edges, others ordinary straight, slender sewing needles. The latter are particularly serviceable in introducing the Lembert suture. In addition, there are required thumb and mouse-tooth forceps to raise the borders of the wound, artery and needle forceps for obvious purposes, large catch-forceps with horseshoe-shaped blades to close the openings of a similar shape at the side of the intestine, two or three long-bladed catch-forceps with the blades protected by rubber tubing to compress the intestine transversely, holding back its contents above and below the wound. (Several instruments have been devised for this, but the fingers of an assistant are best and safest.) Curved and straight scissors, aneurism needle, grooved director, scalpels, and other common surgical instruments also, are necessary.

After the abdominal cavity has been opened, the blood and faecal matter under observation should be removed with small aseptic sponges or pads as soon as seen. This should be done very carefully, when possible by gentle pressure rather than by wiping movements, as the latter provoke the further spread of the infecting agents, and also impair the integrity of the serous surface. In either case the sponge or pad should be changed with each effort at removal. The bleeding points immediately under notice should be tied. It is important to remember that penetrating intestinal wounds should be closed as soon as found, otherwise they may escape from notice, and thereby furnish an additional risk of infecting the peritoneal cavity. The introduction of the finger or of an instrument into the intestine through the wound, to detect the presence in the gut of a foreign body, should not be practised, since little or no good can follow, and exceeding harm may arise through infection at the point of entrance or through manipulative extrusion of the intestinal contents at a possible wound in another part of the gut. This same precaution may be wisely heeded in wounds of the stomach.

The repair of the intestine should be accomplished by one of two methods: (1) by direct closure of the openings; (2) by excision of a portion of the intestine and the union of the divided extremities, which union may be accomplished by either circular enterorrhaphy or lateral anastomosis (page 178). The former method may be adopted

when the closure of the wound will not diminish the intestinal calibre more than one-third; either of the latter methods, when the gut is extensively injured. In certain wounds when direct closure will narrow the calibre more than one-third, additional room may be gained by closing the wound transversely. To do this it may be necessary to increase the size of the wound by making longitudinal incisions of suitable and equal lengths at either end of it. The intestinal wall is then grasped at corresponding points on opposite sides and drawn upon; the longitudinal wound is thus converted into a transverse one, and in this position its borders are united. By this means a certain amount of "elbowing" is produced. While, as a rule, it is unwise to trim the borders of intestinal wounds, yet care should be taken to examine the border of a wound contiguous to an important vessel, to ascertain if the integrity of the vessel has been endangered; otherwise the closure without this precaution may be followed by secondary hemorrhage.

The wound may then be closed by either the Lembert or continuous sutures. A double row of the Lembert or continuous suture may be made, or a single row of each, or the Czerny-Lembert. Of the continuous varieties, the right-angle continuous suture of Cushing is advisable. (See article on *Sutures*.)

The sutures, to be reliable, should go down to and embrace a thread or two of the submucosa, and not be more than three lines apart. Sutures limited to the serous coat alone are insecure and dangerous, and those entering the lumen, although less seriously considered than formerly, are yet to be regarded with wise distrust. The best material for suturing the intestine is the loose-textured carbonized iron-dyed silk.

If the mesenteric border only of the intestine is wounded, the injured portion of the gut should be excised, because gangrene is liable to follow from injury to the vessels of the part.

When the intestine is completely severed, either by the original injury or by the knife of the surgeon, the difficulty of adjusting the cut borders is much increased. The portion to be repaired must be drawn well out of the abdominal wound and carefully isolated by sponges and pads that completely prevent blood, feces, etc., from entering the abdominal cavity. The uppermost extremity of the divided intestine will be known by the greater amount of fecal matter seen at its open end. The intestinal contents must be pushed aside for some distance from the part to be operated on, and the bowel occluded above and below. This occlusion may be effected by using the clamps already referred to, or by making a hole in the mesentery and ligating the intestine with either a cord of iodoform gauze or a flat india-rubber band. The fingers of an assistant serve better than anything else. The clamps may cause sloughing if carelessly or continuously applied. The excision is made with sharp, straight-bladed scissors usually at a right angle to the long axis of the intestine. The length of the portion removed will depend on the extent of the injury; it should always be sufficient to include the seat of injury, even though it may be six or eight inches in extent, and when multiple perforations exist near each other, it is advisable to include them all in one resection, even if the portion of intestine removed must be three or more feet in length.

The vascular supply of the intestine at the seat of injury should be carefully examined, and all that portion of gut excised that has an impaired supply of blood, else gangrene of the bowel may ensue. In fact, it is a wise precaution in excision always to divide the gut at a point which will afford the best vascular supply to the extremities to be united—that is, close to the entrance of a mesenteric vessel into the uninjured portion. The mesentery corresponding to the portion of gut removed can be cut away in the form of an isosceles triangle, the base of which shall correspond to its intestinal attachment, or it may be ligated *en masse* or in sections at its point of attachment, and allowed to remain free in the abdominal cavity. The latter plan is unsafe, since, owing to the feeble vitality of its tissue, gangrene of the distal extremities of the

mesenteric stumps frequently ensues. Parkes advised that the entire mass be included in one ligature drawn tight enough to check the bleeding, and that then, after the intestine has been united, the stump be stitched to the seat of operation, thereby forming again as nearly as possible a continuous mesentery. Another method is to make two incisions, one on each side of the mesenteric attachment and at a distance of about half an inch from it, through the wall of the intestine in its long axis corresponding in length to the portion of the intestine to be removed. The mucous lining of this mesenteric strip should then be torn away and its peritoneal borders united by a continuous suture of fine catgut. After the excision is completed and the ends of the intestine have been united, the mesenteric strip will present a looped appearance due to the approximation of the intestinal extremities. The opening of this loop should be united by sutures, and the opposed surfaces of mesentery should also be transfixed, to prevent the formation of a pocket there. When the ligature *en masse* is employed, it is not considered safe to use catgut.

As soon as all hemorrhage has been checked, the divided ends of the intestine are approximated by an assistant and some form of suture is introduced. The suturing is begun at the mesenteric border, care being taken to close tightly the triangular space at this point caused by the reflexion of the peritoneum from the walls of the intestine. After this, the protruding mucous membrane is pushed into the intestine and a suture is introduced at each of the three remaining aspects of the bowel, and then the intervening spaces are properly sewed. This is a better plan than to begin to sew at any given point and go directly around. If a Lembert is used, at least three or four lines of peritoneum should be included in the grasp of the suture at each extremity of the intestine. A suture should be drawn only sufficiently tight to bring the severed borders in close apposition, for if drawn too tightly the tissue grasped by it will slough. If a single row of sutures is to be made, they should be placed about 5 mm. apart. If a double row is to be employed, those of the first can be deposited within 6 or 7 mm. of each other, and those of the second at intervals between the former. After the bowel is united, it is well to return to the mesenteric border. This is the weakest portion of the wound. It should be covered by stitching the two peritoneal layers of the mesentery over it, or by an omental graft.

Omental Grafting.—In certain experiments on dogs, Senn fixed a flap of omentum over the seam of an enterorrhaphy, the free or distal end being attached over the seam, the proximal remaining continuous with the omentum. These soon grew in place and thus reinforced the bowel. To avoid the danger of strangulation occurring through the loop thus formed, isolated grafts were employed and fixed round the suture. In every instance they retained their vitality. In performing the operation, the intestinal peritoneum is lightly scarified before the flap is put in position, and in a few hours it is adherent. Intestinal end-to-end or lateral approximation, by means of Senn's plates, Murphy's button, and various analogous procedures, and also by the different methods of suture, is elsewhere fully described.

Cleansing the Peritoneal Cavity and Closing the Abdominal Wound.—All the bleeding points must be closed by ligature if possible, if not, then by cautery. It must not be forgotten that the tendency of intra-abdominal vessels to bleed when not exposed to the air is very great; therefore a simple oozing before the closure of the abdominal walls is likely to become a formidable hemorrhage afterward; and even though the secondary oozing be not sufficient to imperil life by loss of blood, it is liable to do so by causing inflammatory or septic processes. The blood and other fluids, fecal matters, and all other foreign agents must be removed from the abdominal cavity, and the surface of the peritoneum with its cul-de-sac thoroughly mopped with soft aseptic sponges soaked in hot decinormal saline solution. Too great care cannot be taken in sponging away the foreign matters, and, as al-

ready stated, the same portion of the sponge should be applied to a serous surface but once, since to apply it repeatedly causes quite as surely the dissemination as the removal of the irritating agents, and the friction impairs and destroys the epithelial surface.

Malcolm, of London, advises flushing out the abdominal cavity for the purpose of adjusting naturally the intestinal folds. The saline solution at the temperature of 110° F. is poured into the cavity from a pitcher until the intestinal folds float up, subsiding later into their normal positions. The fluid is poured in until it returns clear. Flushing with hot fluid cleanses the peritoneal cavity, and, besides, acts as a stimulant. The leaving in the peritoneal cavity of a quart or so of hot saline solution, to dilute infecting agents and facilitate their removal, has the sanction of common practice, supported by favorable results. Whether the normal upward absorption flow should be facilitated by raising the foot of the bed (Kelly) or hindered by lowering it (Fowler) in instances of peritoneal infection, requires further study before a final conclusion can be reached. In this connection it is proper to recall that G. Wegner determined that the hourly absorption capacity of the peritoneum for fluids equalled from three to eight per cent. of the weight of the animal subjected to the experiment.

The abdominal wound should be closed by three rows of sutures. One should be continuous of fine, strong silk, perhaps chromatinized catgut, and should include the serous and subserous tissues and the transversalis fascia. The practice of making a deep row of interrupted sutures widely separated, or of including the whole thickness of the abdominal wall in one such row, is to be condemned. The pockets or dimples of peritoneum which are thereby formed between the stitches invite the occurrence of hernia, and often beget dead spaces. The second row may be of silk or catgut, interrupted or continuous, including the aponeurotic and muscular tissues. The third row should be of interrupted silkworm gut or fine silver wire, and should effect the closure of the integument and subcutaneous part of the wound. Retaining sutures introduced outside of the preceding may be employed if undue tension be present or anticipated. If necessary, the wound may be drained. And last of all, an antiseptic or aseptic dressing is to be applied. The patient should be quieted by small doses of an opiate; the diet should be light at first and of a nature to leave little or no residue. The bowel contents ought to be maintained in a soluble state by means of saline medication when septic intraperitoneal processes are present. The bladder should be evacuated with a catheter.

Prognosis.—Ruptured or lacerated wounds have thus far proved exceedingly fatal. Of five cases reported during the late Civil War all were fatal. Curtis reports eight cases which were operated on, and death occurred in all. Since then several others, in which laparotomy was performed, have been reported, only one of which, that of Crofts, was successful.

The prognosis in cases of gunshot wounds of the intestines, when treated by laparotomy, has of late years vastly improved. In 1887, Morton published a series of 22 cases with a little less than 23 per cent. of recoveries. About the same time MacCormac collected 30 cases in which laparotomy had been performed (Morton's were included), and gave the recoveries at a little over 23 per cent. Since then a collection of 35 cases shows 18 recoveries, or a little over 51 per cent.

In cases of laparotomy for contusions, Gachon (1895) found a mortality of 20 per cent. in early operations, while if the intervention was after the twentieth hour the mortality was 73 per cent. Petry (1896) found that after 42 first-day operations there were 33 per cent. recoveries; and that in 24 cases operated on after the first day there were 25 per cent. recoveries.

Adler (1892) found that in 154 cases of projectile wounds of the abdomen, in only 11 was serious visceral injury absent. Lühe (1890 and 1892) found that in 191 cases, 21 escaped intestinal injury and 6 escaped all visceral injury. Duroselle (1894) found that but 5 escaped

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visceral injury in 155 cases. Vulliet (1897) found that 12 escaped out of 83.

Vulliet mentions a series of 27 cases of lacerated and punctured wounds collected since 1890 which were treated expectantly. The percentage of recoveries was 57. In a series of 43 cases of projectile wounds treated expectantly, the percentage of deaths was 46.5. The same author speaks of the expectancy mortality of lacerated wounds as 37 per cent.; of projectile wounds as 50 per cent., referring probably to all cases since 1890. Reclus and Noguét claim that by the let-alone plan in 88 cases the mortality was but 25 per cent. (this report appears to refer to wounds irrespective of causes).

In Coley's second series (1891) of laparotomies for penetrating wounds of the abdomen, amounting to 165 cases, the mortality was 67.2 per cent. Reclus and Noguét found the same mortality rate, 78 per cent. in 73 cases. Vulliet states that in 40 cases of laparotomy for projectile wounds performed during the first twelve hours, the mortality was 44 per cent.; after the first twelve hours, 50 per cent. Adler's figures correspond closely to those of Vulliet's.

Dörfler, the most recent writer (1897), states that the mortality from laparotomy in cases of projectile wounds performed in the first five hours is 50 per cent.; before twelve hours, 55 per cent.; after twelve hours, 70.5 per cent.

Laparotomy for instrumental wounds in the first five hours has the low mortality of 16 per cent. Fenner reports the following outcome of laparotomy in Charity Hospital, New Orleans, from January, 1892, to January, 1901: Gunshot wound of the abdomen 113 cases with 78 deaths; stab wounds of the abdomen 39 cases with 9 deaths.

Of stab wounds which were operated on, Morton reported 19 cases with 63 per cent. recoveries; MacCormac 18 cases with over 55 per cent. of recoveries. A collection of 19 cases made since then gives over 79 per cent. of recoveries. Joseph D. Bryant.

INTRAVENOUS INJECTIONS.—This method of introducing substances into the body may be said to have a very limited field of usefulness in practical medicine, though it is the common method with animals in the laboratory. The mouth and rectum will always be the readiest ports of entry to the body. When these cannot be used, or when rapidity and certainty of action are needed, the hypodermic needle will usually meet the needs of the case. Rarely will the advantages of the intravenous route outweigh its dangers and difficulties.

The advantages of the intravenous method are: 1. Greater rapidity of absorption. This is certainly a just claim and constitutes the chief indication for the use of the method. 2. Greater certainty of absorption. Ordinarily the absorption of substances introduced under the skin may be reckoned as certain, but sometimes when a patient is *in extremis*, as in severe surgical shock, fluids placed under the skin are taken up but very slowly. 3. It is painless. Some irritating substances, such as mercurials, cause considerable pain when introduced hypodermically, but when injected into a vein they are so rapidly swept away into the general circulation that no local pain can occur. 4. Abscesses are less apt to occur for the same reason. One should not on this account, however, be less careful in regard to asepsis.

The disadvantages as compared to the subcutaneous method are: 1. Greater danger. This arises rather from failure to observe proper precautions than from any faults inherent in the method. When carefully and judiciously used the method is safe enough to be employed in the emergencies in which it is needed. The chief danger is probably from embolism. The substances introduced cause the formation of a clot which is carried to the right heart and thence to the lungs. If only agents known to be harmless when thus used are employed, if they are sufficiently diluted and are introduced slowly, there is little danger from this source. Thrombosis with ulceration has resulted from injections into a vessel in the foot