There is evidence also that in former ages the period during which conception was possible to the human female in each year was limited. In different countries there is a marked excess of births at some or other period of the year, and in general terms it may be stated that the tendency is for women both to commence menstruation and to bring forth children in the warmer months. Westermarck considers that the evidence points to two special seasons of sexual activity—spring and autumn—and that the activity is greatest towards the end of spring in the south of Europe and rather later in the north.

Though closely associated, conception and menstruation are separable functions and not necessarily interdependent, for conception may occur in the prolonged absence of menstruation. But statistics show an enormous preponderance of conceptions as occurring immediately after cessation of the menses, while a minimum is reached just before their commencement.

INFLUENCE OF DOMESTICATION AND CIVILISATION.

The advantage to primitive man and to wild animals of a limited sexual season is that the young may be born at the most propitious season of the year, when food is most abundant and climate most favourable. Once an artificial supply of food and of warmth is assured, independent of season, the necessity for a special season of sexual desire and a special breeding season disappears, and gives place to a type of greater frequency, regardless of season. It is just these things that domestication and civilisation afford.

Under domestication the frequency of œstrus is increased, and all the evidence goes to show that food and temperature are the chief efficient agents in producing the change. As to temperature, it is a familiar fact that in the bitch winter œstrus does not last so long as summer œstrus, and in the human female the menstrual flux is more readily established in summer than in winter. We may well look in the same direction for an explanation of the fact that, other things being equal, town-bred girls commence menstruation several months in advance of those reared in the country. Hard fare and laborious life tend to diminish the menstrual flow, while luxury and ease tend to increase it. In some parts of this country the hard-working farm girls still wear no protection during menstruation. Blood in the discharge is far more abundant in domesticated animals than in wild.

We see, then, that the circumstances of domestication and civilisation tend to an increase and a greater frequency both of œstrus and of menstruation; perhaps one other parallel condition may help us a stage further in the attempt to unravel the process of transformation. We know that in most mammals non-satisfaction of sexual desire by intercourse tends to a quicker return of heat than normal; and it may be that the greater frequency of menstruation in the human female may in part be referable to the fact that civilisation has brought it about that in the human female sexual desire is often compelled to go unsatisfied.⁸⁷

CONCLUSION.

These general considerations, and much more besides, are a necessary prelude to any reasoned attempt to answer the question whether the universal human horror of menstrual blood may have initiated the practice of abstinence from intercourse during the menses. Give an affirmative reply and you are still little nearer a solution,

for you will find yourself confronted by the puzzling fact that with some domesticated animals, notably the bitch, there is a strong tendency, not more, to reject intercourse during the period of substantial flux, some preferring the commencement, but most the actual termination of the period of heat.

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THE EARLY OPERATIVE TREATMENT OF GUNSHOT WOUNDS OF THE ALIMENTARY CANAL.

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ABDOMINAL wounds have always aroused great interest not only in the professional but also in the lay mind. There has always been a tendency to demand more care for these cases than for any other class of injury. It is well, therefore, to inquire into the frequency of abdominal compared with other wounds, for in war the medical service must try to do the greatest good to the greatest number; it must not waste effort on a particular class of case to the detriment of a larger but possibly less interesting series of wounded.

Relative Frequency of Abdominal Wounds.

The actual number of men wounded in the abdomen will never be known. The number of abdominal wounds admitted to field ambulances and casualty clearing stations are, subject to certain error, known. The error is caused by the impossibility of accurately diagnosing a perforating wound. The numbers vary with each observer, and the surgeon who believes in the expectant treatment will be inclined to reckon as perforating, wounds which a believer in operative treatment would class as non-perforating. The following are figures taken in certain casualty clearing stations by careful observers:—

Percentage of Abdominal Perforating Wounds to Total Wounds.

A = 1.88 per cent.	C = 0.75 per cent.
B = 1.5 „	D = 0.62 „

If we take the statistics from 9 field ambulances and from 7 casualty clearing stations for a period of six months we get the following figures:—

Percentage of Abdominal Wounds to Total Wounds.

Field ambulances	 1.92 per cent.
Casualty clearing stations	 0.72 „

The difference is probably accounted for in two ways: 1. The mortality among abdominal cases at field ambulances is very heavy. 2. There is more time for accurate diagnosis at the casualty stations. The important fact brought out is the relatively

small number of abdominal wounds that a surgeon is called upon to treat. The above figures apply to a period in which there was a disposition to adopt a policy of non-interference. The figures have been a good deal modified since.

Mortality of Abdominal Wounds.

One is surrounded by all sorts of difficulties when trying to reckon the mortality, and all figures are only approximate.

Into 9 field ambulances over a period of six months there were admitted 1098 abdominal wounds, with 333 deaths—a mortality of 30·33 per cent.

Into 6 casualty clearing stations during the same period there were admitted 131 cases of perforating abdominal wounds, with 74 deaths—a mortality of 56·49 per cent.

From these figures it appears that the total mortality at the front is about 70 per cent. This figure is most probably approximately correct, as something about the same percentage is arrived at by different means of calculating. There are also deaths at the base in France and England to be added. It is not probable that there would be any large saving of life even if the patients could be transmitted within a few hours of injury to the best equipped hospital in England. From the nature of the injuries the mortality must be high.

Influence of Position of Wound and Direction of Missile on Probable Nature of Internal Injury.

Regions above Transpyloric Plane.

Antero-posterior wounds in this region are among the least serious of all abdominal penetrations. Side-to-side wounds are serious, especially if they are far back. Wounds which enter the abdomen from above downwards, which may be described as vertical wounds, are also serious.

Epigastric wounds.—True antero-posterior wounds in the midline are seldom seen in hospital; this is due to the fact that the aorta and vena cava lie in this region, and it is probably due to the same fact that wounds of the duodenum are so seldom met with.

On the right side the liver will be hit, on the left the stomach as well as the liver. The lesser curvature and a large portion of the right extremity of the stomach lie within this area. Wounds in this region are usually accounted as wounds of the stomach, and recovery after such a wound is often reckoned as an instance of spontaneous healing of a penetrated stomach. It may well be that such is the case, but it is possible for a bullet to traverse the left part of this region and miss this viscus. The actual operative proof of this is at present wanting, but cases have been seen in which the lesser curvature was only just involved. Wounds in this region usually involve both surfaces of the organ.

Antero-posterior hypochondriac wounds.—On the right the liver will be perforated, and on the left the cardia and greater curvature of the stomach. Towards the lateral line of the body the kidney will be involved on the right, and the kidney, spleen, and splenic flexure on the left. As far as the liver and stomach are concerned they are as favourable as similar wounds in the epigastric region. (Fig. 1.)

Oblique epigastric and hypochondriac wounds.—When the wounds are oblique from side to side no distinction can be drawn between the two regions for the projectiles traverse both. These wounds are decidedly more dangerous than the antero-posterior ones—indeed, they become more fatal as they become more oblique. On the right side a greater length of liver is traversed, and the danger

of hæmorrhage and disruption increased. On the left the stomach is perforated more and more obliquely until a point is reached when the axis of flight of the bullet becomes parallel to the anterior wall or to the greater curvature. The result is either a long slit or a double hole through which the contents leak freely. The spleen, kidney, and splenic flexure will also at times be involved with the stomach, according to the direction and degree of the obliquity.

Vertical epigastric or hypochondriac wounds.—These are nearly always somewhat inclined downwards and inwards, but cases are met with of almost vertical wounds in which both exit and entrance wounds are on the anterior surface of the body and nearly vertically above one another; indeed, it is difficult to understand the position of the body which allowed the projectile to enter and leave the body on the anterior surface. When the projectile passes in these directions the injury of the liver or stomach is complicated by one of the colon or small intestine. In one case both the antrum of the stomach and the transverse colon were almost completely cut in two.

Vertical wounds on the lateral surface of the body appear at first as thoracic wounds, since there is usually no exit. On the right side they are not so dangerous, since they only traverse the liver; but on the left they may wound the stomach and spleen, or, worse still, the colon. It is unfortunate that symptoms of abdominal injury are at first absent or masked by the thoracic injury.

Posterior and lateral wounds of hypochondriac regions.—As usually met with, these are single entry wounds. When a bullet enters at one side and reaches the other it causes a "side-to-side" wound. These are serious, especially if towards the posterior surface of the body, and as a matter of fact are not commonly seen. The reason of their fatality lies in the fact that they may traverse liver, stomach, spleen, kidney, and pancreas, even if they miss the great vessels.

Wounds between the two axillary lines often exhibit the omentum protruded through the ribs. On the left the spleen and kidney and splenic flexure are in danger of being wounded, and for this reason are more serious than those occurring on the right. Such wounds are often caused by shrapnel and shell fragments. They are difficult to treat, as access to this region is not easy, and the infiltration of the retroperitoneal tissue renders detection of colon perforation difficult even if the spleen and kidney can be successfully dealt with. Posterior wounds, whether in the costo-vertebral angle or through the lower ribs, cause similar injuries to those on the lateral body surface.

Wounds between Transpyloric and Intertubercular Planes.

This region is a very fatal one. Above the umbilicus the injuries resemble to a large degree those met with above the transpyloric plane, but below the umbilicus we have to deal largely with small intestine injuries.

Antero-posterior wounds.—These are again seldom met with near the midline. On either side of the spine in the upper part of the region perforations of the transverse colon are met with and are usually easily dealt with. Lower down but still near the middle line the small intestine is wounded and the gravity of the cases at once rises. Towards the sides, that is, in the lumbar regions, wounds of the ascending or descending colon are encountered. If the peritoneal surface alone is involved the

danger is not so great provided no large destruction of the wall has taken place. Wounds of the left lumbar region are, however, very much more dangerous than those on the right for here the coils of jejunum overlies the great bowel. There is another point of interest about flank wounds and that is the possibility of the escape of the colon or peritoneum owing to the thickness of the muscles of the abdominal wall at this point. As a matter of fact the colon lies further from the lateral line of the body when seen from the front than might be supposed.

Wounds entering the back in this region are more fatal on the whole than those that enter on the other side of the body; not only do they wound the viscera, but they plough up the retroperitoneal tissue or cause it to be stripped up by blood infiltration. Single entry wounds in the loin often wound the retroperitoneal tissue as they pass into the colon. If the wound is caused by a shell fragment a large hole may be established through which fæces pass. Such a condition is grave, but the

injury was a small perforation of the small intestine and in the other a small tear in the colon. Again, a study of Fig. 3 will show that no injury may result.

Below Intertubercular Plane.

This will also include wounds through the hips, buttocks, and thighs. All wounds here are very serious.

Antero-posterior wounds.—In the hypogastric region these are among the most fatal, in contradistinction to antero-posterior wounds in the epigastric region. The small intestine is nearly always perforated and torn in many places. Mid-line wounds are fairly frequent as there are no great vessels to cause death before hospital is reached. The bladder, if full, will be involved, but it is a somewhat remarkable fact that such injuries are not common. The pelvic colon and the rectum may be injured.

Towards the side of the body, in the iliac regions, wounds of the cæcum and iliac colon are

FIG. 1.

Shows entrance and exit wounds in a series of cases sent to the base without operation.

FIG. 2.

Shows the paths of the projectile in a series of cases which were fatal without operation. The posterior wounds are not differentiated from the anterior, but many tracks ran obliquely from back to front or vice versa. All the wounds below the groin lines were posterior.

FIG. 3.

A compound chart made by plotting the entrance wounds and joining them to the exit wounds when these are present. It shows the paths travelled by projectiles that traversed the abdomen (as shown by celiotomy) without wounding a hollow viscus. The circles represent posterior wounds.

extent of the injury can be seen and free drainage provided, and this may limit the septic absorption. When a similar course is taken by a bullet or small shell fragment there is a hidden leak into the retrocolic tissue, which may cause death before sufficient relief can be given by a free incision or a colostomy.

Side-to-side wounds.—These are very fatal (see Fig. 2). They furnish wounds of the large as well as of the small intestine. It might be thought that both vertical colons as well as the small gut would be involved, but no such case has come under my notice. The descending colon lies far back, and for a projectile to catch both colons and the intervening small gut it would have to pass so near the posterior body line as to wound the great vessels or the spine.

The amount of damage done is very striking in some cases. Thus the small gut has been torn in several places and the transverse colon and the antral portion of the stomach all but completely divided by one bullet. At the same time the very opposite may happen. Two post-mortem examinations have been done on cases of peritonitis following a side-to-side bullet wound. In one the only

encountered. There may be perforations or large tears.

Side-to-side wounds.—These may involve cæcum, small gut, and pelvic and iliac colons. Such injuries are very fatal, the small gut wounds being nearly always multiple. The bladder and rectum are wounded both intra- and extra-peritoneally. The pelvic vessels may also be injured and cause death from direct hæmorrhage or its after-effects.

Vertical wounds.—These are caused by missiles that enter the buttock, perineum, or thighs. The lesions are the same as those met with in wounds in other directions. They are important to remember, as a wound in the buttock or thigh is often unconnected in the surgeon's mind with the possibility of an intestinal lesion. One point of interest may be mentioned in this connexion—namely, that such wounds nearly always cause pain in the abdomen; indeed, in some cases the soldier thinks that he has been hit in this region. The fatality of such cases is partly due to the abdominal injury being overlooked and time being lost, as well as to the fact that a wound of the rectum is quickly fatal from peritonitis. Death may also occur from a wound of the iliac vessels.

Possibility of Escape of Viscera in Penetrating Wounds.

It has always been a much-debated point as to whether a projectile could traverse the peritoneal cavity without wounding the hollow viscera. There has never been any doubt that the liver and kidneys could be damaged without the involvement of other organs. The point that required settling was the escape of the stomach in the upper part. Those who believed in treating abdominal wounds by rest and starvation pointed to cures by this means of patients in whose cases, from a study of the track of the bullet, it appeared that some hollow viscus must have been perforated.

Until quite recently, when coeliotomy became the routine treatment of abdominal wounds, a proof that such escape was possible was wanting. Fig. 3 shows a chart made of cases in which the abdomen was opened and explored and no hollow viscus found injured. One case, in which the liver had been perforated but the stomach had escaped, has been included because it appeared certain that the stomach must have been perforated. The abdominal cavity in these cases was usually full of blood which came from wounded mesentery, omentum, or abdominal wall.

In the course of many abdominal operations bruising and tears of the peritoneal coats of the hollow viscera, stomach or intestine, are not infrequently seen, showing that even a modern bullet can push aside the visceral wall witho actually perforating it. These tears and bruises may also explain some of the cases in which a faecal fistula or an intraperitoneal abscess appears some time after the receipt of the wound.

We have therefore a series of cases of penetrating wounds in which the injury to the bowel increases in severity:—

1. Peritoneal penetration without visceral injury.
2. " " " " " " " " but with blood effusion.
3. Peritoneal penetration with abrasion of visceral wall.
4. " " " " a single perforation or tear.
5. " " " " multiple perforation and tears.
6. " " " " complete division of the gut.

Actual operative proof that a bullet can perforate the left epigastric region without injuring the stomach is at present wanting, but cases have been seen in which the bullet has just nicked the lesser curvature and in which a very slight alteration in direction would have caused it to miss the organ altogether.

Determination of Peritoneal Involvement.

With all possible care, with an extensive experience and a full appreciation of the numerous fallacies, it is frequently difficult to make sure that the wound is penetrating. If it is difficult when there is an entrance and exit wound, it is still more so when there is only one wound. It may be that symptoms such as shock, hæmorrhage, rigidity, signs of peritonitis, or rapid pulse will be present, but in some cases that are received early there will be no such guides. As there is a distinct relation between the length of the interval since the receipt of the wound and the mortality it is important to be able to determine the probability of penetration. Antero-posterior wounds are the easiest to judge; the only point to remember is the thickness of the flank muscles. Transverse or tangential wounds are more difficult.

Below the transpyloric plane a wound with the entrance on the right of the midline and an exit anterior to the right lateral line of the body is very likely non-penetrating or one that only just opens the peritoneum. Above the transpyloric line such a wound is almost certainly perforating. A bullet which passes in and out between the semilunar lines probably does not open the belly, while one that passes in and out outside these lines probably does. In the longitudinal direction a bullet which enters near the costal margin and emerges above the groin has most likely traversed the abdomen.

Where it is a question of single entry wounds there is really nothing except the symptoms to guide one, as it usually is impossible to tell the direction of the projectile. One case may be quoted. A man was shot just beside the umbilicus. The shape of the wound suggested a bullet. It was determined to explore the abdomen. As the wound was in a convenient situation the exploratory incision was made through it. It was then found that the rectus muscle was torn the length of the incision. This was enlarged downwards to the pubes, the muscle being much torn but the sheath and peritoneum being intact. The bullet appeared to have gone behind the pubes, but as there were no bladder symptoms nothing further was done, and the case was sent to the base.

In the above-quoted case the wound was situated so that exploration was easy, and the incision could be used for the abdominal exploration. In other cases the exploration of the wound will not give good access to the abdomen. Here it is most probably best to explore the peritoneal cavity by a well-placed incision and to use the original wound for drainage or an artificial anus. This applies especially to wounds in the loin where there is doubt as to the wounding of the colon or peritoneum.

Again, there are the vertical wounds entering from the thorax and those from the buttock. The former may give no sign for some time, but the latter often declare their involvement of the peritoneum by the sensation of abdominal pain at the time of the injury.

As a criterion of visceral penetration no reliance is to be placed on the non-obliteration of the liver dullness.

Bomb wounds require some notice. The fragments into which a bomb is broken on explosion are often very small, but so high is their velocity that they have great power of penetration. The abdomen of a man injured in a bomb explosion is often a mass of small, irregular, and insignificant-looking wounds. It is often hard to persuade oneself that any of them are penetrating. It may be possible to explore one or two, but if they are multiple and there is the slightest likelihood of bowel injury it is best to make an abdominal incision in a convenient place and examine the peritoneal surface and deal with the injury found. I have known small bomb fragments to enter the back of the abdomen and cause as many as 14 perforations of the small gut.

The symptoms pointing to peritoneal involvement which are usually looked for are: (1) rigidity of the belly wall; (2) a rise in the pulse-rate; (3) the signs of hæmorrhage; and (4) absence of liver dullness.

Rigidity of the abdominal muscles due to peritoneal infection is seldom absent after 4–5 hours, and a rise in the pulse comes on about the same time. In the case of the muscular rigidity care

must be taken to distinguish that due to local trauma, which can usually be done by noting that the pulse has not risen too. In the case of wounds in the lower thorax the well-known reflex stiffening of the abdomen must be borne in mind.

The signs of hæmorrhage are difficult to distinguish from those of shock, as blanching and a rapid pulse occur in both. There is very seldom any restlessness connected with the hæmorrhage or failure of sight or air-hunger. It is well known that the amount of blood has to be very great before it can be relied on to give notice of its presence by the appearance of dullness.

Hæmorrhage into the retroperitoneal tissue will give rise to very decided abdominal rigidity. With this type of hæmorrhage there is often well-marked shock, which is considerably increased in cases of gas infection. Such cases present all the signs of an acute peritoneal infection.

Causes of Death.

These are shock, hæmorrhage, peritonitis, and septic infection of the retroperitoneal tissue.

Shock.

The amount of shock present within a short time of the injury varies within wide limits, but on the whole it is usually fairly severe. On the other hand, men have undoubtedly walked considerable distances who have afterwards died from a wounded intestine. Sometimes the wound knocks a man out at once; at other times the onset of shock is more gradual. One man five hours after being wounded smoked a cigarette and expressed himself as feeling well; he died from peritonitis within 36 hours.

What actually causes the shock is undecided. It has some relation to the amount of injury. On the other hand, there may be a considerable exposure of the viscera, especially in the upper part of the abdomen, without profound shock, and three small perforations of the ileum have produced grave shock, while in a double perforation of the stomach the shock was hardly noticeable.

Stripping up of the retroperitoneal tissue is accompanied by shock, but this is probably connected with the loss of blood, though it may well be caused by disturbance of the sympathetic. In disruption of the liver shock is great, but here again the loss of blood is a factor.

Hæmorrhage.

Hæmorrhage plays a very important part in wounds of the abdomen, and is perhaps the most frequent cause of death, not only within a few hours of the receipt of the wound but also at a distant period. Hæmorrhage may occur from the following places: (1) Great vessels; (2) mesentery; (3) omentum; (4) abdominal wall and retroperitoneal tissue; and (5) solid viscera.

Great vessels.—A chart has been made of 62 cases of penetrating abdominal wounds, nearly every one of which has been submitted to operation. Among those 62 cases only 2 entered in the midline above the umbilicus. A possible explanation of this is that most of those shot in the midline above the umbilicus died from hæmorrhage from the great vessels. The only large vessels that have been found bleeding at operation are those of the kidney and spleen and the external and internal iliacs. These latter were wounded by missiles entering from the buttocks.

Mesenteric vessels.—These are perhaps the vessels that are most frequently found bleeding when the abdomen is opened. The hæmorrhage is not violent

but it is steady and often has filled the abdomen. It is often the cause of death in otherwise successful enterorrhaphies. The patients leave the table in a fairly satisfactory condition, but slowly die in spite of saline administered under the skin or into a vein.

When the hæmorrhage is due to a wide tear in the mesentery the bleeding point is easily found and tied. On the other hand, when the mesentery is only perforated the bleeding takes place into its substance and the vessel may be hard to find. When the mesosigmoid is wounded the difficulty may be very great, as the infiltration extends into the iliac fossa and over the bladder; in fact, it resembles the retroperitoneal hæmorrhage to be mentioned later.

Omentum.—This, too, gives rise to bleeding, but to nothing like the same extent as does the mesentery. The vessels are smaller and seem to close more easily.

Abdominal wall and retroperitoneal tissue.—As a rule, the hæmorrhage is not severe from the anterior parietes unless a vessel such as the deep epigastric has been divided, as occurred in one case. With the posterior wall it is different. The bleeding here seems to come from the vessels supplying the colon or the pancreas, and possibly from the vessels in the root of the mesentery. It is mostly met with in cases where the projectile has pierced the posterior abdominal wall, or passed transversely across the front of the spine with or without penetration of the peritoneal cavity.

It is met with as a diffuse hæmorrhagic infiltration of the retroperitoneal tissue, which may be limited to a small area, or extend over a very large portion of the posterior wall of the abdomen. It may be so great as to displace the small intestines, raise the colon, and bring the lateral part of the posterior wall into contact with the anterior. Such a hæmorrhage appears as a large purplish tumour when the peritoneum is opened. The peritoneum may be intact over it, or there may be rents in it through which blood slowly oozes.

It is useless to attempt to find the bleeding point, and the most that can be done is to pack the part from which the bleeding appears to come. Sometimes it may be possible to raise the posterior peritoneum and suture it to the edge of the exploratory abdominal wound, thereby shutting off the peritoneal cavity and admitting of an extra-peritoneal packing.

Such cases are often fatal; it may be from direct hæmorrhage or from injury to the pancreas. There is often very considerable shock, which possibly is due, apart from grave injury, to interference with the sympathetic. Another danger is that of gas infection, which runs riot in the infiltrated retroperitoneal tissue, and is almost always fatal. Gas infection of the retroperitoneal tissue, quite apart from colon wounds, has caused death in some cases of intestinal suture.

Spleen, liver, and kidney.—Hæmorrhage from these organs presents no distinguishing features from those met with in civil practice.

Treatment.—It is impossible within the period when operation will be most useful to distinguish between intra-abdominal hæmorrhage and an intestinal lesion complicated by hæmorrhage; nor is there any real need, as a man with a perforating wound of the abdomen should be operated upon on principle. The intestinal lesion must be mended and the hæmorrhage will be incidentally arrested whether it has produced constitutional symptoms or not.

When cases are seen for the first time after the lapse of 24–36 hours there is more need for an accurate diagnosis. Hæmorrhage which has lasted this length of time will either have brought the patient to a state of collapse when operation will only hasten the end or it will have ceased. An intestinal lesion may be still capable of successful treatment.

The difficulty arises from the fact that blood in the abdominal cavity will produce both rigidity and distension of the abdomen, thus giving rise to a suspicion of peritonitis, but it can be distinguished from an infective peritonitis by the slow rate of the pulse. Thus a patient hit through the abdomen 36 hours previously and having a rigid and distended abdomen is best left alone if he is in good condition and the pulse about 80.

Peritonitis.

This is the usual cause of death when this occurs some time after the receipt of the injury, but it may be fatal within 24 hours, especially if the rectum is the source of infection. After fighting there are always men arriving at the field ambulances and casualty clearing stations with well-marked peritonitis. These are the soldiers that the bearers have been unable to collect in the confused fighting which so often takes place. There is nothing remarkable about these cases from a surgical point of view except that their facial aspect leads one to think that they are in better condition than an examination of their radial pulse—which is often non-existent—shows to be the case.

There is another type of peritonitis which is worth notice, and that is the slow dormant form. It is seen in cases which have been shot in the abdomen, and for one reason or another have not been treated by operation. Such cases may or may not show signs of peritoneal involvement, but improve for a day or two and give the impression that recovery may take place. There may have been some vomiting, but this has subsided and the tongue keeps clean. Then the abdomen becomes somewhat tumid, but still the general condition remains fair, and the pulse, though somewhat rapid, is of fair quality. Then the vomiting returns and the patient sinks. Some patients with this type of peritonitis have been sent to the base with the belief that they are doing well. A necropsy there has shown peritonitis, a faecal abscess, and an unclosed perforation of the intestine.

Of the later complications of peritonitis little is seen at the front, but occasionally cases of subphrenic abscess due to stomach lesions are met with and a certain number of faecal abscesses are opened in men who arrive late at the casualty stations. Such cases have nearly always been fatal.

Infection of Retroperitoneal Tissue.

There are two sources of infection: (1) from the bowel; and (2) from infection with the bacillus aerogenes capsulatus.

1. This is usually met with in retroperitoneal wounds of the colon. There may or may not be a faecal fistula, and the external wound may be large, small, or practically healed when the symptoms begin. In the case of shell wounds in the loin the infection may spread with alarming rapidity and the patient die in a short time, although free exit has been given either by the wound itself or by a surgical incision. The retroperitoneal tissue is œdematous and blood-stained, or there may be an actual collection of foul-smelling fluid. In the

case of bullet wounds or small shell fragments the external wound heals and the case progresses well. Then the pulse begins to accelerate and an examination of the flank or iliac region shows a dull area. An incision into the loin reveals the condition above noted.

2. In these cases the wound is usually in the back or the missile has passed in transversely from the loin or hip. The patient is evidently ill and there are rigidity and dullness in the lower or lateral portion of the abdomen. If the abdomen is opened the peritoneum is found raised from the posterior abdominal wall displacing the colon and crowding the intestines to the opposite side. The mass is tympanitic. Such cases are usually rapidly fatal, and the vena cava has been found after death to be blown up by gas formation.

Nature of Visceral Lesions.

Stomach.

These wounds depend upon the projectile and the direction it takes. Bullets passing in an antero-posterior direction cause small perforations through which the mucous membrane does not herniate as it does in the small intestine; this is what would be expected from the nature of the mucous lining. Shrapnel bullets 'cause larger perforations, the edges of which are more excoriated than is the case with bullet wounds. The larger size and rounder form of the bullet cause a bruising of the wall before it bursts its way through. Near the lesser curvature bullets cause rather larger wounds than would be expected, the wound being often V-shaped, due to a gaping of the lesser curvature.

When the axis of flight of the projectile becomes more or less parallel to the wall of the stomach the wounds become larger. Sometimes they are linear slits, sometimes a linear slit followed by a perforation. When the projectile passes in through the epigastrium and out by the axilla the slits are more or less parallel to the greater curvature. When the missile passes in about the nipple line and takes a downward and oblique direction towards the right, the wounds are more or less at right angles to the greater curvature, and two cases have been seen in which the antral portion of the stomach was almost completely divided.

In the case of shell fragments the wounds are more irregular. When the fragments are large and enter between the axillary lines large holes are produced in the cardiac end often complicated by spleen or colon lesions. When shell fragments carry away portions of the abdominal wall over the stomach area this organ—sometimes wounded—is prolapsed together with the colon or even the small gut.

The escape of gastric contents depends upon the position of the wound, its size, and on the presence or absence of food within the viscus. It is most likely to occur when the wound is large and near the middle of the greater curvature. The contents certainly do escape in a fair number of cases. Secondary complications are not usually seen at the front, but one case has been met with in which a left subphrenic abscess followed by a right empyema was the result of an unoperated bullet wound of the anterior stomach wall.

Treatment.—It may be granted that a certain proportion of stomach wounds heal without operation, but those simple perforating antero-posterior wounds are very easily closed by operation, whether they are on the anterior or on both surfaces. When the missile passes obliquely through the body it may produce a wound as long

as 4 inches, and, as stated above, it has been known to all but completely divide the antral portion of the organ. Such wounds cannot be expected to heal unaided. It seems therefore wiser to make no exception in the case of the stomach but to operate on principle.

Missiles entering in the axilla, especially shell fragments, produce ragged holes and, in addition, may wound spleen and colon. Such cases are usually fatal, but operation gives the best chance. In such cases it is necessary to divide the rectus or to use a subcostal incision. The splenic flexure wound is likely to give more trouble than the stomach injury. A posterior wound is best found and sutured through an opening in the gastro-colic omentum, such as is used in a posterior gastro-jejunostomy.

Small Intestine.

The character of the small gut wounds varies in some degree with the projectile that caused them, but not to the extent that one might expect. A bullet will inflict as severe an injury as a piece of high explosive shell. To think that a patient shot through the abdomen with a bullet has a better chance than one injured by a bomb or shell fragment is to commit a grave mistake. On the whole, the wounds caused by bomb fragments are the least severe.

Bullet injuries.—The most simple injuries are the perforations made by the bullet striking the intestine at right angles to its long axis. Here there are two perforations through which the mucous membrane pouts to form a small round rosette. Apparently, as the flight of the bullet becomes more tangential to the circumference of the gut the perforations become slits, but these are still two separate wounds. These wounds gape somewhat, and the mucous membrane overlaps the cut muscular coat so that a considerable mucous surface meets the eye. The general appearance still suggests a rosette. The two slits may enlarge until the continuity of the intestine is only maintained by two narrow strands of intestinal wall.

In other cases there is only one wound involving different portions of the circumference of the intestine; it may reach from near the mesenteric border to near the free margin, or involve the free margin only. In other cases the free margin is slit right back to the mesenteric border so that only a narrow strip of bowel wall remains. It is remarkable that the last piece to be divided is usually the attached portion. Here there is a wide gaping wound with an extensive exposed mucous surface.

In extreme cases the gut is completely divided. In another extreme form of injury a portion of the intestine is only represented by a long, narrow, ragged strip of bowel wall as if some animal had gnawed or worried it.

The surgeon must be prepared to meet with all the above-named injuries distributed over several feet of small intestine.

Escape of intestinal contents.—The escape of the intestinal contents takes place very much less often and to a less extent than would be believed. This does not depend entirely on the extent or nature of the wound. The intestine may be widely laid open and in more places than one, and yet very little contents escape. The small wound is plugged to a certain extent by the protrusion of the mucous membrane, but the amount of peritoneal soiling seems to depend on the length of time elapsed since the wound and the state of the man's bowels. It

does not seem that transport in ambulances has much to do with it.

Movements of injured portion.—After injury the gut is paralysed for a certain period. What the actual duration of this period is it is not possible to say. At first the injury will be found to lie underneath the wound in the abdominal wall. When some time has elapsed the injured gut may be found at some distance from the external wound. This shows the importance of a complete examination of the intestines. The initial traumatic paralysis is probably a large factor in preventing the extrusion of the intestinal contents, since the non-extrusion is to a great extent independent of the size of the intestinal wound; a coil of small gut may be completely cut across without faecal escape.

Treatment.—It is very important to limit the duration of any operation. Simple suture should always be employed where possible, even if it involve some narrowing of the gut; fortunately the transverse direction of the greater number of the tears lends itself to this method of repair. On the other hand, the nature of the injury entails a resection in the majority of cases.

In most cases the injuries occur close together, but in a small proportion multiple resections have to be faced. Sometimes time has to be gained by leaving the injured portion outside the abdomen, but on the whole these cases do not do well because of the shock produced by the injury and loss of blood. When the injury is high up resection must be faced as the only chance.

When a knuckle of small gut is prolapsed, or prolapsed and perforated, it is a nice point as to the best course to be pursued. If the patient is in anything like good condition the abdomen should be explored, as a single injury is unusual. If, on the other hand, the patient is bad, or the injury of long duration, the injured coil is best secured *in situ*, care being taken that it is not strangulated by the abdominal wall.

Circular end-to-end suture has proved satisfactory, and appears as safe as the longer and more tedious lateral union. It has been very seldom that failure of the suture line has had any bearing on the death of the patient.

Causes of death.—Death usually results from shock due to the injury or to loss of blood. Probably loss of blood is accountable for most of the deaths which occur after operations performed within a favourable interval since the receipt of the wound. The patient may leave the table in very fair condition and slowly and gradually sink. The importance of early operation is more to be insisted upon on account of hæmorrhage than on account of faecal contamination. The increased loss of blood due to transit is less than the increased loss due to detention between the firing line and the operating centre.

A certain number of cases die from septic peritonitis. This may be acute or of a slowly progressive nature, the patient gradually going down hill and emaciating. It is possible that failure to remove the blood in the abdominal cavity is a factor in the occurrence of this septic peritonitis. Again, death occurs from what is called obstruction. In the greater number of cases this obstruction is that due to peritonitic inflammation, such as is seen in acute appendicitis. The infection is due to the wounds, hardly ever to failure of the suture line.

In a few cases obstruction occurs without infection. Three such cases can be mentioned. In all three the abdomen was again opened and the block

short circuited. One case recovered. In all these cases the suture was perfect. The upper segment of the bowel was distended, the lower segment collapsed. It has been suggested that the upper segment suffered from a persistent traumatic paralysis. It is possible, however, that the lower segment was at fault and did not take up the peristaltic wave, which originated in the proximal portion of the bowel, but lay inert and caused a physiological block. The solution of continuity of the bowel had interrupted the mechanism which transmits the peristaltic wave.

Protrusion of Omentum and Viscera.

By this is meant not the exposure of the abdominal contents through a large gap in the abdominal wall, but their prolapse through comparatively small wounds.

The omentum, as would be expected, is most frequently seen in this connexion. It appears in larger or smaller amounts in wounds situated all over the abdomen, and also in those situated in both hypochondriac regions, where it reaches the outside of the body through the interspaces or through broken ribs, where one would hardly expect to see it prolapsed. The method of extrusion is two-fold. It is either (1) carried out by the projectile, or (2) is driven out by the intra-abdominal pressure through either the entrance or exit wounds.

In one case where a shell fragment had entered above the umbilicus in the mid-line and had come out in the right loin just behind the lateral line of the body, the omentum was so firmly carried into the long oblique exit wound that it required considerable manipulation to release it; it was, in fact, strangulated within the abdominal wall, although none showed externally.

Before operation became the rule it was usual to leave these tags to slough off, and probably this is still the best course if the case is seen late and there are no abdominal symptoms. If seen early it is best to treat such cases as other abdominal wounds and explore. In several cases in which this has been done the intestine has been found wounded.

Next to the omentum the small gut is most frequently herniated, and here again, as in the case of the omentum, it may be carried or drawn out. Sometimes a knuckle that has actually been wounded is lying outside. The treatment is influenced by the time that has passed since receipt of the wound. If the injury is of some standing it has been successfully left alone, but a small gut fistula, especially if high up in the bowel, is very objectionable, so perhaps the better course would be to suture it and replace it within the abdomen, ample drainage being provided locally; this has been done with success. If the injury is of recent date the best course is a *coeliotomy*.

The transverse colon has also been seen herniated. Here, again, the same rules apply as in the case of the small intestine. One case of herniated transverse colon may be mentioned. The gut was tightly strangulated in the wound. As the injury was nearly two days old the constriction was relieved and an artificial anus established.

Injuries of Great Gut.

These injuries do not materially differ in their nature from those seen in the small gut except in the fact that the great gut is in places uncovered with peritoneum. The tube may be perforated, torn, or completely divided. The size of this intestine, however, causes complete division to be

comparatively rare and the absence of multiple coils renders multiple injuries less frequent.

Transverse colon.—Perforations are most common in the transverse colon and these are usually caused by antero-posterior wounds. Oblique vertical wounds also cause a similar injury, but in addition may completely or nearly completely divide the intestine. Transverse colon wounds are the most favourable of all great gut wounds provided they are submitted to early operation.

Vertical colon.—The two vertical portions of the colon may be perforated, but usually we have here to deal with slits or tears of varying extent. Such wounds are caused by missiles which pass obliquely across the body and which may or may not also wound the small gut. The involvement of the small intestine is more commonly met with in the case of the descending colon as here the small gut overlies the great gut.

Sometimes the vertical colon may be completely cut in two. Such a case was seen lately in which the bullet entered behind and caused a fairly large wound in the front of the left lumbar region. Through this wound were prolapsed several coils of small intestine. The patient who was only wounded a few hours before was grossly shocked and never rallied. At the necropsy it was found that the colon was completely severed and retracted so as to lie 2-3 inches apart. The contents had leaked into the peritoneal cavity. There was no perforation of the small gut nor was there any other injury.

When trying to form an opinion as to the involvement of the large intestine in more or less antero-posterior wounds it is well to bear in mind the fact that the colon lies rather further from the lateral line of the body than might be supposed. The intraperitoneal wounds of the vertical colons are unfortunately often continued into the extra-peritoneal portion of the gut which renders their treatment much more difficult. Small wounds in the angle where the peritoneum is reflected off the colon on to the lateral abdominal wall are hard to find, and such wounds have escaped detection with fatal results.

Single entry wounds in the loin present great difficulties. In some cases only the retroperitoneal portion of the gut is damaged, but in others both retro- and intra-peritoneal aspects are opened. Unless there is an escape of *fæces* it is often impossible to say whether the bowel is wounded or not. These intraperitoneal wounds are of all sizes from a tiny tear by a fragment of high explosive to a big rent by a more massive portion. The same difficulties arise with bullet wounds. In some cases the first sign of damage to the intestine is given by a rise in the pulse-rate and the appearance of a dull area in the flank.

Again, a patient with a large flank wound with a free exit for the discharges will die rapidly from septic infection, even when a necropsy shows there has been no other lesion. The stripping up of the retroperitoneal tissue by a missile that passes in from the side and wounds the colon on its way is a grave complication, as rapid infection is apt to follow in the blood-infiltrated tissue.

Colon flexures.—Wounds of the hepatic flexure are very similar to those of the vertical colons, but those of the splenic flexure are more dangerous because of its high and deep position which renders exploration difficult. This flexure is very likely to be wounded by a projectile—usually a shell fragment, that enters the lower lateral part of the left hypochondrium—and to be involved along with the

stomach, spleen, and kidney. Such wounds seem to form a class by themselves and are very fatal.

Cæcum.—There have been a fair number of cæcal wounds. Most of them have been small in extent, and have lent themselves to primary suture. In one case, at least, the loss of tissue has been so great that an artificial anus was necessary.

Pelvic colon.—These wounds may be perforations or tears. The number met with has not been great, but on the whole they are favourable owing to the gut being completely surrounded by peritoneum. At the same time, the infection derived from the lower part of the great gut is very virulent if much time has elapsed during which infection may spread.

Rectum.—These wounds are caused for the most part by projectiles that pass across the body at the hip levels and those that pass into the pelvis by way of the buttocks and thighs. They are often, indeed usually, complicated by small intestine lesions and sometimes by those of the bladder. Rectal wounds, in my experience, seem to be very fatal. They may be extra- or intra-peritoneal, or both. Their danger is, no doubt, partly due to frequent involvement of the small gut, but apart from this they seem to be intrinsically serious from the infectivity of the rectal contents.

The above paragraph has reference to what may be called pelvic involvement of the rectum. There are other wounds which complicate buttock or perineal injuries. Here the rectum is either exposed intact at the bottom of a great foul chasm or may be laid open or completely divided. Such wounds are decidedly dangerous in spite of the free exit that is present or can be given.

Treatment of Great Gut Injuries.

Many such injuries are found in the course of an exploratory coeliotomy and may complicate stomach and small gut lesions.

Transverse colon.—Simple perforations or tears in the transverse colon are readily closed by suture and usually do well. With larger lesions it is wiser perhaps to be content with an artificial anus. This is especially the case where the stomach and small intestines have been wounded. It is obvious that such lesions must have the first attention, and it may so happen that no time remains to be expended on accurate suture of the colon. One is more ready to be content with this procedure as the re-establishment of the lumen of this portion of the colon is comparatively easy.

Vertical colons.—Here again the operator may be faced with complications in other parts of the intestinal tract; but apart from these the opportunities for suture will be less. The truly intra-peritoneal lesions may be closed if not extensive, but many cases will be encountered where, from the loss of substance, an artificial anus will recommend itself as the best course. This is all the more the case when the tears run into the extraperitoneal portion of the gut. To bring the gut up it must be mobilised by division of the peritoneum on its outer or lateral aspect. The position of the anus on the abdominal wall will be indicated by the position of the lesion.

When the surgeon has to do with wounds in the posterior aspect of the flanks he is in a difficult position. If the wound is a single one, as it often is, he is uncertain whether the peritoneum has been opened or if another viscus has been wounded.

If he could make sure that only the extra-peritoneal aspect of the gut had suffered, the best course most probably would be to use a loin incision. If he opens the peritoneum either in the midline or semilunar line he may find that there is no small gut injury, and his manipulations to find the wound may allow the highly infective fluid from the retroperitoneal tissue to infect the abdomen by disturbing the apposition of the colon to the lateral abdominal wall, which has so far limited its spread.

There is no definite line of procedure that can be laid down, but should the surgeon have had to open the abdomen to assure himself of the absence of intraperitoneal lesion and found nothing, there is a great deal to be said for closing the wound and exploring the colon and giving free exit to the infective fluids through a loin incision. In some cases when the patient is gravely ill—too ill for an exploratory operation—a free loin incision may turn the balance in his favour.

Flexures of colon.—In some cases of wound of the hepatic flexure a cæcostomy has improved matters, but as a cæcostomy does not completely cut across the lumen of the bowel it cannot be relied upon to cause a cessation of the faecal contamination.

The splenic flexure presents all the above-mentioned difficulties in an acute form. It is best to mobilise it freely and form an artificial anus if there is the least doubt as to what procedure should be followed. A transverse colostomy is useful here and in lesions of the descending colon.

Pelvic colon.—This can be fairly easily dealt with by suture or by making an artificial anus, the choice depending on the extent of loss of tissue.

Rectum.—Where possible it may be sutured; such a procedure is difficult, but is much facilitated by a table which gives an inverted posture of the body. Failing satisfactory suture a transverse colostomy is better than an iliac one, as the lumen of the bowel is easier to re-establish. A colostomy is often indicated in buttock wounds involving the bowel.

The Question of Operation.

It is only recently that abdominal wounds have been treated systematically by operation, and that the rapid collection of the patients for this end has been arranged. The reason for this has been twofold. In the first place, there was the belief held by many that abdominal penetrating wounds were best treated by immediate rest, morphia, and the withholding of fluids and food by the mouth. This was a legacy left us by the South African War. In the second place, the results obtained in the early part of the war were disappointing to the operators. They did not appreciate that the mortality must be high from the very nature of the injury.

The "rest" treatment was based on the belief that penetrating wounds of the intestine would heal by themselves. It was pointed out that many cases who were undoubtedly shot through the abdomen did recover, and it was assumed from the direction of the missile that a hollow viscus must have been injured. Recent operations (see Fig. 3) have proved that the abdomen can be traversed in many directions and yet the intestine escape injury. It has also been proved that many wounds that apparently involve the peritoneum only traverse the abdominal wall.

The presence of the signs of peritonitis in patients who eventually recover has been advanced as a proof that wounded viscera heal without

surgical aid. In answer to this it can be said that blood and bile will both produce these symptoms. In addition, patients passed to the base as cured have died there from faecal abscesses with open wounds in the intestine.

Again, a fairly large series of operations prove that the injuries of hollow viscera are rarely single or simple, and that frequently there are multiple perforations and multiple divisions of the gut, and that a bullet produces as severe injuries as a shell fragment. No one who has seen these injuries believes that spontaneous cure would be anything but very rare.

It can be definitely stated that the old belief in the spontaneous cure of a gut wound is fallacious and dangerous. It was based on insufficient data and has been responsible for loss of life.

The stomach is the only hollow viscus in which spontaneous cure can be looked for, and that only when the missile takes an antero-posterior direction. It may be that the non-protrusion of the mucous membrane in stomach wounds is a factor in their spontaneous cure. In the intestine the pouting of the mucous membrane prevents the peritoneal surface of a contiguous coil from settling down and becoming adherent, while in the stomach the wall of this organ can be applied directly to another peritoneal surface and thus become quickly shut off by adhesions.

If cases are to be operated on early a certain number will present no intestinal lesion, but there will be a peritoneal cavity full of blood. If the bleeding is going on it will be arrested and good will be the result. In other cases the bleeding point will be impossible to find or the hæmorrhage may have ceased. It remains to determine whether more lives will be lost in such cases by operation than will be saved in the case of intestinal lesion or continuing hæmorrhage. Operations that have been performed show that many more lives are saved than are lost by early operation.

It may be objected that moving a patient may increase the hæmorrhage. That may be the case, but less blood will be lost by the jolting in an ambulance than will be lost by leaving a patient to bleed slowly for hours. It may be said with confidence that every patient with an abdominal wound should be moved with all possible speed to a hospital where an operation can be performed. Symptoms of peritoneal involvement—rapid pulse and rigid abdomen—will be present in nearly every case by the time he comes to the hospital, but these should not be waited for if the wound has, in the opinion of the surgeon, penetrated a dangerous area.

Care of Patient before Operation.

Administration of morphia.—It is usually considered bad practice to give morphia to abdominal cases while the question of operation is in the balance. Under war conditions this opinion must be modified. The patient has to be moved under very disadvantageous conditions. It may be down a communication trench the passage of which may last an hour and a half. He then has to be carried to the ambulance car and moved in this to the casualty clearing station or special hospital. There can be no doubt that under these conditions the relief of pain and anxiety afforded by morphia counterbalances the possible masking of symptoms. As has been said above, symptoms should not be waited for but operation performed on principle, so that the objection to morphia fails in great degree.

Withholding of water.—There is no objection to giving fluids in moderate quantities as there is usually little or no escape of intestinal contents, and the distress caused by withholding fluids is painful to watch and harmful to the patient, who most probably is already suffering from a lack of water in the body.

Treatment of shock.—When a patient arrives at an operating hospital the question of immediate operation has to be considered. On the whole, it is better to put the man to bed for an hour or so. Subcutaneous saline is of great value; it can be left running in while other cases are attended to. Most cases improve by this treatment in a very decided manner. If no improvement takes place it usually means that hæmorrhage is going on or that the patient is past help. In such a case operation is the best course if the condition of the patient offers any hope, as thereby hæmorrhage will be arrested and the patient possibly saved. It is a difficult point to decide and will tax anyone's power of judgment. Sometimes six or eight hours' rest will produce such improvement that an operation may be possible where at first the case seemed absolutely hopeless.

Operative Procedure.

A paramedian incision is the standard method of opening the abdomen, and it should be used in the first instance in all cases unless there is some distinct indication to the contrary. It is better to prolong it than to make lateral right-angle extensions.

In some antero-posterior wounds near the body line an incision near the semilunar line is perhaps best as the colon is more accessible here, and it is very desirable to limit the operation field on account of the infectivity of the colon contents. It must not be forgotten, however, that on the left side the small gut overlies the colon and is likely to be also wounded. An artificial anus can also be made more readily here if it is found that loss of substance or extraperitoneal wound has rendered this necessary.

The hepatic flexure, too, can be dealt with by a like incision. In the case of the splenic flexure it is possible that a rectangular extension may be required. With splenic injuries and also those of the cardiac end of the stomach a subcostal or a rectus sheath incision with a lateral extension is possibly best where the wound is one involving the left hypochondrium in its lower part. On the other hand, in oblique epigastric wounds the median incision is probably best; it can be prolonged laterally if required.

In some cases of wounds in the back of the loin or in the lateral line of the body there will be doubt as to whether the peritoneum is involved or the colon wounded extraperitoneally. In such cases it is best to open the abdomen first, and if the peritoneum is intact to explore the wound from the loin, and make an artificial anus and provide free drainage of the retroperitoneal tissue. If there is much bruising of the colon, or much loss of substance, so that doubt exists as to the possibility of preventing further infection, it is well, provided the descending colon is divided, to perform a complete transverse colostomy. In the case of rectum wounds a transverse colostomy is best, as the lumen of the bowel can be more easily restored here than in any other place.

In general, it may be said that a long incision in the abdominal wall saves time and therefore saves shock. When once the abdomen is opened the first

care must be the arrest of hæmorrhage; then a systematic examination of the hollow viscera. The small intestine should be taken first, the cæcum picked up, and the intestine followed to the duodenum. Then the large gut is examined, special attention being required at the flexures and the outer edge of the vertical colons.

Circular enterorrhaphy is the best in resection, as it is quicker than lateral anastomosis, and failure of the suture line need not be reckoned among the causes of failure. Resection, of course, is to be avoided if possible, even at the risk of some contraction of the bowel by suture of the rents or perforations. It is hardly necessary to say that the lesions of the small bowel must be dealt with first and the colon treated as the injury and especially as time and the condition of the patient dictate. In multiple injuries of stomach, colon, and small gut the ingenuity of the operator may be considerably taxed.

Results of Early Operation.

It is intended to publish the results of the cases when a good series have been collected and the numbers are large enough to form some estimate of the comparative fatality of the different injuries. The numbers will probably be sufficient when the operative treatment has been in progress six months.

At present it is enough to say that many lives have been saved, that all sorts of injuries have been successfully dealt with, and that no one who has practised operative treatment is in doubt as to the wisdom of the procedure. The mortality at the casualty clearing stations has been reduced, and that in spite of cases, which formerly died at field ambulances, reaching the casualty stations, and in spite of a more accurate discrimination between penetrating and non-penetrating wounds which naturally would tend to increase the percentage mortality. Cases arrive at the casualty clearing stations in a comparatively small number of hours after being hit, the shortest period to date being $2\frac{1}{2}$ hours.

I have myself operated on a number of cases, but the greater part of the operations have been done by the surgical specialists, and it is to their skill and enthusiasm that the improvement is due. The arrival of cases at all hours of the day and night has entailed a good deal of hard work on the part of the medical officers, but it has been well repaid. They will in due course publish the details of their own cases, but I should like here to congratulate Lieutenant-Colonel Crisp English, Captain Owen Richards, Captain C. H. S. Frankau, Captain John Fraser, Captain Heycraft, and Captain Lindsey on the success they obtained.

CORNWALL COUNTY ASYLUM.—At the last meeting of the asylum committee it was reported that there were 1236 patients in the institution, including 228 from the Bristol asylum. The cost of maintenance was 10s. 9d. per patient weekly, which was the same as ten years ago.

THE LATE DR. NICHOLAS PERCY MARSH.—Dr. N. P. Marsh, who died at his residence in Liverpool on Nov. 26th, aged 56, was a well-known medical man who paid particular attention to the diseases of children. He qualified by taking the M.R.C.S. in 1882, and in the following year graduated M.B. at the University of London. He was physician to the Liverpool Infirmary for Children and Infants' Orphan Asylum, and consulting physician to the Children's Convalescent Home, West Kirby. He leaves a widow, two daughters, and a son who is attached to the Royal Army Medical Corps in France.

RESPONSIBILITY FOR CRIME.

BY SIR BRYAN DONKIN, M.D. OXON., F.R.C.P.
LOND.,

LATE ONE OF H.M. COMMISSIONERS OF PRISONS.

A leading article in THE LANCET of August 14th, 1915, entitled "Crime and Legal Insanity," and ostensibly occasioned by the report of the Subcommittee on Crime and Punishment which was finally accepted at the annual meeting of the British Medical Association this year, has lately attracted my attention. Of the six recommendations made in this report the writer of the article appears to me to have missed wholly the great importance of the first, and to have so handled the last as to make it a text for assuming, without any warrant whatever, that the legal and administrative authorities who have to do with such matters have not yet learned to appreciate the full importance of the study of insanity in relation to crime. I propose to confine my comments to the treatment of the two points above mentioned, as the writer passes over the intermediate recommendations, most of them of great value, and some involving important improvements in criminal practice, with the mere remark that they undeniably claim attention.

I. The first recommendation of the subcommittee fully endorses an important modification of the long-accepted legal definition of responsibility, a modification which if adopted in practice will accomplish the desire, expressed many years ago by Sir James FitzJames Stephen, to "remove a misconception between the two great professions of Law and Medicine" that has up till now been the cause of much difficulty in the proper adaptation of punishment to crime.

Until the publication of Dr. C. A. Mercier's well-known work on "Criminal Responsibility" in 1905 no authoritative proposal to amend the old legal definition was forthcoming. This definition, occasioned by the discussion which followed on the Macnaghten case in 1843, made the responsibility or irresponsibility of the offender to depend entirely upon his knowledge of the nature, quality, and wrongness of his act. Dr. Mercier, among other valuable suggestions for reforming this accepted definition, proposed a very weighty addition:—viz., that the accused person, in order to be justly regarded as fully responsible for the crime charged against him, must know *and appreciate* the nature, quality, and wrongness of the act, *and the circumstances* in which it is done. There is neither space nor need to enlarge here upon the patent value and far-stretching importance of this addition. The subject is treated clearly and at length in the chapter on the "Answers of the Judges" in Dr. Mercier's book. What is necessary to insist upon now is that the first recommendation in the subcommittee's report, referred to in THE LANCET article, consists *entirely* of this addition. The article, however, totally ignores this striking recommendation, and makes the inaccurate and misleading statement that the report "commences with the definition of legal responsibility for crime which has not varied much since the Macnaghten case called marked attention to the subject in 1843."

II. The last of the six opinions expressed in the subcommittee's report is "that it is desirable that