

Original Articles.

CONTUSIONS OF THE ABDOMEN.¹

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ACUTE abdominal emergencies command the attention of physicians and surgeons alike. The subject which I have the privilege of presenting for your consideration and discussion this evening, "Contusions of the Abdomen," embraces a highly important group of acute abdominal emergencies due to traumatism.

There being no external wound, the physician is first summoned. Upon him rests grave responsibility, for the mortality in these cases is very great—deplorably great. Many cases are fatal if left to themselves and the physician. Surgical intervention, to be successful, must be early, perhaps before a diagnosis is completely made. The physician must be on the alert to the proper interpretation of the signs immediately succeeding the trauma. Patients of this class, who are ignorantly watched, frequently die. Few, even with an hospital experience, meet many of these emergencies. It is for this reason that I have attempted to present this subject in a somewhat systematic fashion, that we may review the facts as they exist today in these important cases. It is impossible to present here, in brief space, all the evidence for and against the views expressed. The evidence presented in literature has been carefully studied, and the following observations seem reasonable in the light of our present knowledge.

INJURIES TO THE URETER.

Rupture of the ureter following a contusion of the abdomen is a rare injury. That it may happen has been demonstrated by the 2 reported cases of Poland and Mackenzie.

Rupture of the ureter is caused either by compression of the abdomen, forcing the ureter against the transverse processes of the third, fourth and fifth lumbar vertebræ, or by traction on the ureter, tearing it at its two most fixed portions. The two fixed portions of the ureter are a little below the pelvis of the kidney and at the brim of the bony pelvis. All ruptures are above the true pelvic brim. Tuffier's experiments and Poland's case confirm these observations.

Twenty-three cases are recorded in medical literature as rupture of the ureter following abdominal contusion. Ruptures of the pelvis of the kidney and of the kidney tissue proper have been improperly reported as ruptures of the ureter. Of the 23 recorded cases, 12 have some good pretension to being classified as injuries to the ureter proper. Of these 12 cases, 5 presented contracted ureters, associated with hydronephrosis following trauma. Five were very probably rup-

tures of the ureter, 2 cases proved without any doubt to have been cases of ureteral rupture.

The general symptoms of shock may be present. These may subside within a few hours. If no lesion of an abdominal organ complicates ureteral rupture, no very grave symptoms will appear. If, after the subsidence of shock, a little blood appears in the urine, it is evidence of injury to the genito-urinary tract. If the amount of blood is small, perhaps only an occasional tiny clot, the suspicion should be great of rupture of the ureter. If, along with this very slight and intermittent hematuria, there is a persistent pain in the side, the evidence for rupture of the ureter is still stronger. The pain may be associated with local tenderness over the ureter. Transient hematuria may easily be overlooked.

If the ureter is torn across, a retroperitoneal accumulation of urine will form. This tumor of urine and blood does not appear for several days. Upon its recognition the diagnosis of injury to the pelvis of the kidney or ureter can be made. This tumor can be palpated through the anterior abdominal wall. Seven days is the shortest time for the development of this retroperitoneal fluid tumor. It is impossible to distinguish clinically between a ruptured pelvis of the kidney and a rupture of the ureter.

If there is complete prolonged obstruction of the ureter, an atrophy of the kidney will occur. If there is partial obliteration of the ureter, and the patient lives, after months or years, a renal abscess, a pyo- or hydronephrosis or a cystic kidney will form.

Wounds of the ureter have very little tendency to spontaneous repair. Wounds of the kidney, on the other hand, heal without great extravasation of urine.

If there is no associated serious injury, and if the peritoneum is uninvolved near the ruptured ureter, there is no especial danger to life in these cases. If the peritoneum is involved, extravasation of urine and blood into the peritoneal cavity adds greatly to the gravity of the accident. It is characteristic, then, of injuries to the ureter that the symptoms which will assist in localizing the lesion are often delayed in appearing. The delay in some cases may be due to the fact that the injury to the ureter is primarily a bruising, which subsequently ruptures through necrosis of the ureteral wall.

As yet no surgical treatment has been attempted upon the ureter itself. When cases are seen early after the injury, immediate suture or anastomosis is the ideal treatment.

After infection has occurred in these cases of retroperitoneal accumulation of urine and blood from ureteral rupture, it is extremely difficult to find the rupture in the ureter. Even if it could be found easily, it is questionable whether success would attend any attempt at anastomosis under the existing septic conditions. Lumbar incision and drainage is indicated in these cases. Nephrectomy should be the secondary operation. Puncture and aspiration of these retroperitoneal cysts

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is a measure of doubtful curative utility, although it has been successful in a number of cases.

RUPTURE OF THE URINARY BLADDER.

Since the monograph by Rivington, in 1884, nothing more than isolated cases and groups of cases has appeared in medical literature upon this subject.

Rupture of the urinary bladder is infrequently seen. It follows some kind of injury to the lower abdomen. It is frequently met with in connection with fracture of the pelvis. Uncomplicated cases are unusual. The mortality is large. The rupture in these uncomplicated cases takes place at the posterior and upper part of the bladder and in a vertical direction, if the rupture is intraperitoneal. If the rupture does not pass entirely through the muscular wall of the bladder at the time of the accident, no very acute symptoms will appear. At the time there will be a delay in the appearance of these symptoms until the necrosis of the bladder wall completes the perforation. Hoyerstedt reports a case in which the delay was three days.

The following initial symptoms of rupture of the bladder are common to both the intra- and extraperitoneal forms, namely: Pain in the abdomen referred to the hypogastrium or umbilicus; a feeling of something having given away within the belly; difficulty in standing and walking; a certain amount of shock or depression; nausea; rectal tenesmus; temporary relief to the desire to make water, followed by a more urgent desire, but inability to do so; catheterization, bringing away blood or bloody urine or nothing at all. The patient may come to the surgeon complaining of retention of urine, so-called. Suppression of urine if present may be reflex and does not prove a bladder rupture to have occurred.

It is sometimes difficult without laparotomy to distinguish between intra- and extraperitoneal rupture. The intraperitoneal ruptures are attended with the most severe symptoms of shock, and peritonitis appears usually after a few hours.

A few cases have been recorded in which clear urine, not bloody, has been drawn by catheter and yet the bladder has been ruptured. The catheter may pass beyond the bladder into the abdominal cavity if rupture is present.

In extraperitoneal ruptures the symptoms of peritonitis will not be present unless the peritoneum has been injured by the violence which occasioned the rupture of the bladder or becomes involved secondarily, by urine under it or by infection through the sloughing sub-peritoneal tissues consequent upon extravasation of urine. Sooner or later, appear signs of septicemia.

Now, if the bladder is emptied by catheter and a measured quantity of warm boracic acid solution injected, if all injected water returns through the catheter, this is pretty good evidence that the bladder is intact. If there is intraperitoneal rupture the patient may feel the injected water enter the abdomen.

Walsham has once injected the bladder, following contusion of the abdomen, with air, as Keen has suggested. The escape of air into the general peritoneal cavity being recognized, it was concluded that an intraperitoneal rupture of the bladder existed, and such was found to be the case at operation. Free fluid in the abdomen will suggest intraperitoneal rupture. Unilateral hypogastric tenderness and tumor will suggest extraperitoneal rupture. Treatment should remove the extravasated urine, render clean the peritoneum or the extraperitoneal cavity, close the intraperitoneal bladder wound, if possible, and temporarily drain the bladder. Suture of the extraperitoneal bladder wound should not be attempted. If there is doubt as to whether the rupture is extra- or intraperitoneal, the abdomen should be opened. The Trendelenberg position and the rectal bag will facilitate the suture of intraperitoneal ruptures.

RUPTURE OF THE LIVER.

It is often associated with lesions of other organs. A blow upon the lower right thorax and falls from a height are the common causes of hepatic rupture. A very small wound of the liver may cause fatal hemorrhage. A large wound of the liver is, of course, most serious. Of 543 cases of injury to the liver more than one-half died within the first twenty-four hours of hemorrhage. Wounds of the liver have only a slight tendency to cease bleeding spontaneously. Usually the right lobe is torn upon its convex surface, and in an anteroposterior direction. The shock present is often out of all proportion to the hemorrhage.

Pain in the abdomen, both local and general, is severe and continuous rather than intermittent. The pain may radiate toward the umbilicus and the right shoulder. Jaundice may appear after a few days. It is rare before the second day. Bile may be found in the urine.

In the treatment of wounds of the liver, suturing, cauterization and tamponing have been successfully employed. Sutures may tear through the liver tissue, although often holding well. Tamponing will be of service in deep tears. Cauterization is adapted to superficial wounds.

The healthy gall bladder is rarely torn.

CONTUSIONS OF THE KIDNEY.

Maas's collection of 71 recorded cases of contusions of the kidney prior to 1878, combined with Spencer's collection of 118 cases reported between 1878 and 1896, make a total of 189 cases of what must be regarded as an unusual injury.

Rupture of the kidney due to trauma is unilateral; occasionally only is it bilateral. The rupture is rather constantly transverse to the long axis of the kidney, in the grain of its development, so to speak.

The following have been some of the accidents causing contusion of the kidney: Falls from a height striking the loin upon a blunt object like a beam, a fence rail, or a stone; a squeeze from a

moving car; compression of the abdomen by a heavy cart wheel; kicks by a horse.

The damage done may be a simple contusion of the kidney substance, a tearing of the capsule overlying the lacerated kidney, a rupture of the pelvis of the kidney, a tearing of the renal vessels, or a complete crushing of the kidney. Various combinations of these lesions may be found in any individual case. If the kidney is simply contused, hemorrhage will take place within the kidney capsule; if the renal capsule is torn, hemorrhage will occur into the perinephritic tissues forming a pseudo-hydro-hematonephrosis; if the peritoneum is torn, it is possible for both urine and blood to accumulate within the abdominal cavity.

Herzog finds that in falls and blows upon the lumbar region, the hilus of the kidney is torn, and that retroperitoneal hemorrhage is present. On the other hand, he finds that in crushes from in front, the kidney is torn anteriorly and crushed, and that hemorrhage usually takes place into the general peritoneal space. Keen has called attention to the fact of a greater frequency of intraperitoneal rupture of the kidney in childhood, as compared with that in adult life. This he thinks due to the late development normally of perinephritic fat tissue. In childhood the peritoneum lies directly in contact with the anterior surface of the kidney with no intervening fat tissue; hence the greater liability to involvement of the peritoneum in rupture of the underlying and contiguous kidney substance.

Hematuria is a sign of injury to the kidney. Of 189 cases of kidney subcutaneous injury, hematuria was absent in only 10 cases. In these 10 cases the absence of hematuria was occasioned by a clot in the ureter, a thrombosis of renal vessels, associated with considerable damage to the kidney substance, and a pre-existing stricture of the ureter. These are rather exceptional conditions, but they must be reckoned with. One case should be mentioned in this connection, that of Newman, in which, following a blow upon the loin, hematuria was present. In this instance no rupture of the kidney existed, but the history of the case determined that the hematuria was due to a pre-existing papilloma of the bladder.

Hematuria may be absent immediately after the accident and appear after several days.

Anuria sometimes follows an injury to one kidney, but is more likely to exist after an injury to both kidneys.

Pain in the region of the injured kidney is usually constant and pretty severe. It may radiate toward the groin.

In extreme laceration of the kidney, the force may have been so great as to cause lesions of other important organs, and all the evidences of kidney lesion may be so concealed as to render it impossible of recognition.

Hemorrhage and sepsis are the two dangers to be feared after rupture of the kidney. If the peritoneum is torn over the injured kidney, the hemorrhage is not restrained by the pressure of

perinephritic tissues. The patient may show evidences of intra-abdominal hemorrhage. An immediate laparotomy and probably a nephrectomy will be necessary in order to check this hemorrhage.

Normal urine is not infective, but if the genito-urinary tract is opened into the peritoneal cavity, an infection atrium is present.

Hematuria is a very unsafe guide to the amount of hemorrhage that is going on. It is no criterion as to whether to operate or not. Hematuria is of value only as a diagnostic sign. It indicates only that the urogenital tract has been wounded.

It is possible that hemorrhage may occur to an alarming extent, entirely extraperitoneally. This will be indicated by signs of hemorrhage in general, and locally by a rapidly forming tumor in the loin which is usually palpable through the anterior abdominal wall, is dull on percussion and is independent of any change in the position of the body. Under the above circumstances immediate lumbar incision and a checking of the hemorrhage is demanded. Nephrectomy may prove necessary. If immediate laparotomy or lumbar incision is unnecessary, an expectant treatment is to be followed. If the extravasation of blood and urine extraperitoneally becomes infected, a lumbar incision and drainage, and possibly a secondary nephrectomy will be indicated.

The mild cases of kidney contusion demanding only expectant treatment and rarely operation, usually recover. Fortunately the mild cases are the most numerous. The graver cases do not recover without operation.

Statistics demonstrate that in primary nephrectomy the mortality is less than in secondary nephrectomy after sepsis is present. Therefore, the following is a wise course to pursue, namely: If there are severe or dangerous symptoms of either hemorrhage or sepsis present, operate in an exploratory way and be guided by circumstances as to whether a nephrectomy is done or not, remembering that the early nephrectomy is safer than the late one. If possible, one should not wait for sepsis to appear. Keetley,² in 1890, did a partial nephrectomy upon a lacerated kidney; the man recovered. Bardenheuer³ resected one-third of the kidney and the patient recovered satisfactorily. This procedure of partial nephrectomy is one to be seriously entertained. Every particle of kidney tissue should be saved rather than to sacrifice any unnecessarily.

In packing the wound after nephrectomy, it should be remembered that several cases are recorded in which the gauze packing compressed the colon to such a degree as to cause intestinal obstruction. Israel has mentioned one such case. Before nephrectomy is done, the kidney of the other side should be palpated to be positive of its presence.

Whenever a nephrectomy is done for contusion of the kidney, the urine should be examined to determine the behavior of the remaining kidney. In nephrectomy for disease or new growth, com-

² Lancet, London, 1890, i, 134.

³ Arch. f. klin. Chir., 1891, xlii, 371.

pensatory hypertrophy will have been established in the remaining kidney before operation. In nephrectomy for injury no such compensation exists, consequently, the effect upon the remaining kidney will be quite different from that seen in the first instance.

INJURY TO THE STOMACH.

The stomach wall is very elastic; it is protected by the ribs, the liver and the bowel. Rupture of the stomach, followed by the escape of stomach contents, is rapidly fatal. The anterior wall of the stomach is the location of most ruptures. One case is reported in which operation was done on the fourteenth day; a tear 4 centimetres long was found. The stomach contents had been walled off by local peritonitis. Recovery took place.

An incomplete separation and laceration of the mucous coat of the stomach is not uncommon. Ziegler⁴ reports a cyst which formed in the anterior wall of the stomach, probably from a contusion of the upper abdomen. The cyst was drained and the patient recovered.

Guinard⁵ reports a case of contusion of the abdomen; perforation of the stomach; suture; recovery. The perforation was in the lesser curvature near the pylorus, and was caused by a carriage wheel passing over the abdomen. Blackish vomitus and tarry stools and peritonitis existed.

A severe pain in the gastric region, lasting for a long time, associated with an anxious facies, some restlessness, nausea and the vomiting of blood, is strongly suggestive of stomachic rupture. In 6 out of 11 cases vomiting of blood was especially mentioned. In one instance this symptom was absent, and this proved to be a complete rupture near to the pylorus. Of 11 cases, not including those above, the longest period of life following the accident was fourteen hours.

RUPTURE OF THE INTESTINES.

The form of injury which produces an intestinal rupture is varied. Of 80 cases analyzed, 36 were from horse kicks; 23 from carriage wheel accidents; 13 from man kicks; 8 from spent shells. Violent and sudden percussion of the abdominal parietes is characteristic of all these forms of injury. The force is in each instance exerted over a comparatively limited area of the abdomen. A perpendicular blow is most harmful to the intestine. The small bowel is the seat of the lesion in 75% of all intestinal ruptures due to traumatism. The jejunum and the lower ileum are most often injured. These parts are at the junction of a fixed and movable portion of the bowel. There is usually more than one rupture found in the bowel. The rupture may be caused by a crush or by a bursting of the bowel. If by a crush, the wound in the peritoneum is usually smaller than that in the mucous and muscular coats. If by bursting, the wound in the peritoneum is larger than in the mucous and submucous coats.⁶ There is a suggestion here in treatment.

Be sure that the peritoneum covering all the lacerated mucous and muscular coats is reinforced. It may not be sufficient simply to close the peritoneal wound.

Usually the wounded bowel lies beneath the seat of the contusion of the abdominal wall. Rupture being most frequently due to a crush of the bowel against the lumbar spine, a search should be made, in operated cases, from the seat of the surface contusion back to the lumbar spine. The bowel lying in this line should be very carefully examined. In multiple lesions of the intestine, the lesions are superimposed and are more severe the nearer they are to the vertebral bodies.

If the visceral injury is merely a contusion of the intestinal wall, there being no immediate rupture, the appearance of serious symptoms of perforation may be delayed as much as five or ten days⁷ until the contused area in the bowel has perforated, a necrosis following the contusion.

Contusion of the gut may lead to peritonitis, even when not so severe as to cause gangrene and perforation; the diminished vitality having allowed micro-organisms to penetrate the tissues and initiate an inflammatory process in the adjacent peritoneum.⁸

Rupture of the inner coats of the bowel, with some bleeding into the lumen of the bowel, often occurs when the peritoneal investment remains intact and no perforation occurs.

The researches of Cushing⁹ and the lamented Livingood upon the bacterial flora of the intestinal tract are of very great importance in connection with wounds of this part. Peritonitis, following intestinal rupture, is dependent for its characteristics upon the bacterial flora of the canal at the site of the lesion. The prognosis of such peritonitis will be favorable proportionately with the scarcity and innocuousness of the micro-organisms which are present. In the upper portion of the intestinal tract, the bacterial flora is more scanty than in the lower portion. Wounds of the duodenum and jejunum are less fatal than of the lower ileum and colon. It is worthy of note in this connection that in health putrefactive changes, and consequently putrefactive organisms and their products, are absent from the small intestine.

Evidences of injury to the abdominal wall are usually wanting. There is no one unmistakable sign of rupture of the bowel. Shock may be either slight or profound, usually it is slight. It may be wanting. The army cases are valuable in this connection. A cavalry man, when kicked by a horse, exhibits often so little shock that he immediately remounts and rides some distance before being disabled and giving up. Many such cases have had a perforated bowel. The shock is independent of the severity of the blow.

Shock reduces sensibility to pain. Severe, persistent, localized abdominal pain, appearing either immediately after the injury, or after shock has

⁴ *Centrbl. f. Chir.*, April 21, 1894.

⁵ *La Presse médicale*, January 22, 1898, p. 37.

⁶ *Gaz. des hôp.*, Paris, 1895, p. 429.

⁷ L. Muguier. Thèse de Paris, 1883.

⁸ Grawitz Chante. *Annalen*, xi; Jahrg., Berlin, p. 770.

⁹ Johns Hopkins Hospital Reports, vol. ix.

subsided, is the most important sign of rupture of the bowel. Early, frequent and uncontrollable vomiting is suggestive of rupture of the bowel. Tenderness, localized and persistent, is a very valuable sign.

Absence of liver dullness is suggestive of the escape of gas from a rupture of the bowel to between the liver and chest wall and diaphragm. Adhesion of the liver to the chest wall and to the under surface of the diaphragm would prevent this sign from being in evidence. Great tympanites may cause the liver dullness to disappear. Bloody stools are seen in some few cases of intestinal rupture. This is, however, an uncommon sign. The facial expression is often of very great importance. In intestinal rupture a serious, drawn appearance of the face is present, suggesting a grave difficulty.

Injury to the mesentery may, through hemorrhage, complicate a ruptured bowel. There is comparatively little bleeding from the torn edges of the intestinal wound. If intestinal rupture is suspected even, exploratory laparotomy should be done at once.

The fatality of uncomplicated concealed lesions of the intestine is very great. Cases of uncomplicated intestinal rupture group themselves roughly into three classes:

(1) Those in which shock, collapse and death follow each other in alarming rapidity. No surgical intervention is possible.

(2) Those in which the shock clears up in average rapidity and reaction appears. Some of the local signs become prominent, which have already been mentioned. Early operation will save many such cases.

(3) Those in which there is but slight shock, associated with vague signs of abdominal disturbance. The patient grows very gradually weaker. There is a question as to whether improvement is occurring or not. Meantime, sepsis is beginning in a most stealthy fashion, and even with a low temperature. These are cases to be operated early when it is first noted that improvement has ceased.

Persistent pain and tenderness and early vomiting should lead one to operate.

LACERATION OF THE SPLEEN.

A crushing injury or a blow to the lower left chest or to the upper left abdomen may cause a rupture of the spleen without evidence of external injury.

The signs of internal hemorrhage, together with the greater dullness in the splenic region following an injury to the left hypochondrium and lumbar regions, are sufficient to make a diagnosis of splenic rupture.

The dull area upon the left does not disappear upon turning the patient to the right side. The dullness upon the right side does vary as the individual is turned to the left. This is accounted for by the fact that the splenic blood having an unusually large proportion of colorless corpuscles coagulates rapidly. In Mixter's case (soon

to be reported) the blood filling the abdomen was fluid, without much clotting. This is explained by the fact that the spleen was torn from its vessels and that the hemorrhage took place from the splenic vessels directly before entering the spleen.

The danger attending a ruptured spleen is hemorrhage. Most unoperated cases die from hemorrhage. A few cases which escape death from hemorrhage have a subphrenic abscess. There are a number of cases of rupture of the spleen where spontaneous recovery takes place, as shown by several post-mortem scars in spleens of persons who have previously suffered severe abdominal injuries.

Operative treatment may be: (1) Immediate splenectomy; (2) suture of the torn spleen; (3) or packing the torn spleen after cauterization. The choice of operation depends upon the condition of the patient and of the spleen. If the patient has lost much blood, if the spleen is large and extensively adherent, if the tear is favorably situated, suture is to be chosen. If, on the other hand, the capsule is thin and the spleen is soft and the tear is inaccessible, packing the wound is to be considered. Ordinarily, with a normal spleen, and particularly if it is much lacerated so that fragments are detached, splenectomy is the best operation. Hemorrhage is the paramount reason for operating. The loss of the spleen is unattended by such grave dangers as at first was thought probable. Up to date some 25 splenectomies have been done for subcutaneous rupture, with 13 recoveries. Dr. Mixter's case, yet unreported, will make 26 cases, with 14 recoveries and 12 deaths. Two cases were packed, with 1 recovery. One case was sutured, with 1 death.

There have been recorded several instances of unusual injury following contusion of the abdomen, noticeably rupture of the aorta, of the celiac axis, of mesenteric vessels, of the spermatic artery, of the inferior vena cava, of the portal vein, and of the gastroduodenal artery. Rupture of the gall-bladder is recorded. Rupture of the rectus abdominis muscle is reported with fatal internal hemorrhage from a torn deep epigastric artery, the patient dying in six hours after the injury. Rupture of the diaphragm from external injury is recorded in but 3 instances.

INJURIES TO THE PANCREAS.

Rupture of the pancreas uncomplicated by injury to other organs is rare.

The reported cases of rupture of the pancreas may be grouped in two groups: Those almost immediately fatal and those not immediately fatal. Leith recorded 9 fatal cases of the first group. In only 2 of these 9 cases was the pancreas the only organ implicated. Death is due to hemorrhage. In the second group are those cases in which extensive cicatrization may be found post-mortem without any evidence of its presence during life, excepting that at some time severe abdominal injury was received. Pancreatic rupture is as yet unrecognizable. Signs of shock and collapse and internal hemorrhage following

upon sudden trauma to the epigastric region is presumptive of pancreatic hemorrhage. The trauma in the reported instances was directly backward and of considerable severity.

Here should be mentioned cases of "traumatic cyst" of the pancreas. In these cases, the earliest signs of trauma having cleared up after ten days or later, a second group of signs appears: Vomiting, indigestion, an epigastric tumor which occupies the umbilical, epigastric and left hypochondriac regions. It is highly probable under these circumstances that a rupture of the pancreas has occurred, and that a "pancreatic cyst" is forming, or that an epigastric cyst exists, having its origin from the ruptured pancreas.

Lloyd has discussed the relationship which exists between injuries to the pancreas and the accumulation of fluid in the lesser cavity of the peritoneum. It is very likely that many so-called cysts of the pancreas are accumulations of fluid blood and pancreatic secretion in the lesser omental cavity. That such cysts do develop after traumatism is now generally acknowledged. The peritoneum covering the anterior surface of the pancreas is the only barrier in a rupture of that organ to blood and pancreatic secretion, entering the lesser cavity of the omentum. Some 17 pancreatic cysts of traumatic origin are recorded. Early median abdominal drainage is the treatment commonly employed in these cysts.

GENERAL CONSIDERATIONS.

In approaching a case of contusion of the abdomen it is important to bear in mind several facts which are salient. The causes of the contusion should be investigated with great care; too often the effects manifest themselves by blind, delayed and insignificant signs. The resistance of the abdominal walls varies with age, the state of the health and with the amount of contraction of the abdominal muscles. Whether the injury, in other words, was expected or whether the abdomen was taken entirely unawares is worthy of consideration.

The traumatism to the abdominal wall may be severe, the resulting injury may be trivial and *vice versa*. A trivial blow may result in serious damage to intra-abdominal viscera. Usually, in these cases, the greater the force the greater is the injury. A diffused crushing blow results in bruising and laceration. A blow by a small instrument, acting locally, results in local rupture. Even in comparatively simple injuries, it is difficult to estimate the force of the blow. Who can measure the kick of a horse?

A hollow organ, if distended, is more vulnerable than if empty. Inquiry as to the previous meal time and as to the last micturition will afford valuable information. The exact direction of the violence is important; whether it is perpendicular, parallel or oblique to the anterior abdominal wall. The clothes of the patient should always be examined for they may offer some indication as to the injury.

The question to be immediately settled follow-

ing an abdominal contusion is whether or not operative intervention is necessary. The evidence at hand will often be sufficient to justify, even if not to demand, an exploratory operation. On the contrary, the evidence may be insufficient for the making of an exact diagnosis. If an exact diagnosis is waited for, the favorable moment for a successful operation may be lost. The surgeon today is tempted to operate in an exploratory way upon slight provocation. Indiscriminate early exploratory operating for a diagnosis is to be deprecated. It is certainly better, however, to have operated many times and found no lesion than even once to have neglected operation when it might have saved a life.

Aside from the signs of lesions of individual viscera, already related in some detail, there are certain general conditions which may be present and which demand consideration in order to intelligently determine whether operation is wise or not. These are the conditions of shock, hemorrhage, and the extravasation of visceral contents causing peritonitis.

SHOCK; HEMORRHAGE; PERITONITIS.

The presence or absence of these three conditions will be determined by a proper interpretation of the pulse, temperature and respiration, by the existence and character of vomiting, nausea, pain, tenderness, rigidity and distension, by a knowledge of micturition and intestinal peristalsis, and last, but of utmost importance, by a true appreciation of the facies of the individual.

Shock.—Death has followed a blow upon the abdomen with no discoverable pathological lesions in the abdominal cavity. Death from pure shock! Almost every abdominal contusion of moment is associated with some degree of shock, whether a visceral lesion is present or not. Hemorrhage exists in many cases of abdominal contusion. Hemorrhage itself, even though not alarming, produces shock.

It is very important, and at times most difficult, to discover the etiological factors of the shock which is present in a given case. It is impossible to say positively that this much of the shock is dependent upon the blow alone, "nervous shock" so called, and that this much is due to hemorrhage, and this much is dependent upon the extravasation of the visceral contents. The differentiation of the causative elements of the initial shock necessitates keen discrimination in the interpretation of physical signs. The accomplishment of this differentiation will often solve the problem of operative interference.

Shock is very variable in individuals suffering from the same lesion. The temperament of the individual (seen, for instance, in the apprehension of a fatal issue), is often a factor in determining the degree of shock. The nationality of the individual influences materially the expressions of shock. These must all be taken into account. Shock will be manifested by a loss of consciousness. The unconsciousness may be more or less profound, dependent upon the degree of shock.

Pallor and perspiration of the face, low temperature, vomiting and nausea, chilliness and coldness of the extremities; a small, irregular compressible and rapid pulse beat; superficial respiration; anuria; less than the normal reaction to stimulation. These are evidences of shock. They all may be present, many may be absent.

A progressive improvement from the conditions of shock is valuable evidence that the patient may bear operative measures. Ordinary shock is recovered from within about three hours of the injury. Signs of reaction appear then and are soon well established. If recovery is somewhat delayed beyond this period there is presumptive evidence of a grave intra-abdominal lesion. Increasing shock after partial recovery from primary shock should suggest intra-abdominal hemorrhage or visceral rupture. Damaged tissues may be giving way. An absence of shock does not mean an absence of a serious lesion. Operation is absolutely contra-indicated in profound and continued shock.

Hemorrhage.—Bleeding inside the skull is harmful because of the irritation due to pressure. Hemorrhage within the abdomen is serious because of the loss in volume of the blood. In intra-abdominal hemorrhage the blood gravitates. Renal hemorrhage may be retroperitoneal. Dullness in the loin or loins, which changes to resonance as the patient is turned to the opposite side, is suggestive of free fluid blood within the abdomen, if other signs of hemorrhage be present.

In hemorrhage there may be shock, together with restlessness, thirst and a sighing respiration. Vomiting of blood may mean injury to the stomach or duodenum. Collapse with sudden exsanguination means rupture of a large vessel or extensive rupture of the liver or the spleen.

Reynier and Quenu have demonstrated that a slight rise of temperature is not incompatible with hemorrhage.

The *pulse*, of course, is variable. If there is shock the pulse will be rapid and feeble. It may be slow rather than rapid, if the depression is extreme. An increasing pulse rate with a low or subnormal temperature means hemorrhage, and demands immediate surgical interference.

The *temperature* is usually subnormal during the initial shock, particularly if the shock is considerable. The gradual rise of temperature to the normal point, associated with a falling pulse rate, denotes a favorable condition. A rise of temperature following an abdominal contusion usually means infection. The height of the rise in the temperature is not indicative of the severity or the extent of the infection.

Pain.—Shock diminishes the consciousness of pain. As the initial shock subsides, evidences of pain may appear. When pain is dependent upon hemorrhage, other signs of hemorrhage will be present. Pain of importance is evident in the face of the individual. The exact meaning of pain is often difficult to determine. Persistent local pain is important. In intestinal injuries it often locates the lesion.

Tenderness is usually general at first in an intra-abdominal lesion, but it soon becomes localized. Honest tenderness, that is, real tenderness, unbiased by the personal equation, coupled with pain, are the two most valuable signs pointing to the localization of intra-abdominal lesions.

Vomiting is very generally an early sign of shock. A simple emptying of the stomach once should not cause alarm. Constant and persistent vomiting means a visceral lesion. Unprovoked vomiting, a regurgitation, means peritonitis. Vomiting without other evidences of shock is significant, and vomiting which reappears after it has once ceased should cause concern.

Distension, with other signs of peritonitis, suggests serious infection.

Rigidity of the abdominal muscles indicates peritoneal involvement. Rigidity of the abdominal muscles and tenderness mean peritonitis. Pain, rigidity, tenderness together are unmistakable evidences of peritonitis.

It will thus be seen that the problem presented to the surgeon when he meets a case of contusion of the abdomen is definite in its demands, but often difficult of solution. These questions must be answered: Is operation necessary? Are there lesions of viscera? Two classes of cases should not be operated upon at first: (1) That class in which little or no shock is present; in which there are absolutely no localizing signs, and (2) that class in which profound shock, amounting perhaps to collapse, exists. Immediate operation is demanded in persistent moderate shock, with or without localizing signs. Immediate operation is demanded in cases of progressing hemorrhage. Immediate operation is demanded in cases of peritoneal infection. Having determined that definite lesions exist in any of the viscera, the form of treatment to be adopted is pretty generally accepted, and has been indicated under the consideration of each organ.

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OBSERVATIONS ON THE USE OF ANTISTREPTOCOCCUS SERUM IN THE TREATMENT OF PUERPERAL SEPSIS WITH A REPORT OF FIVE CASES.¹

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This paper has been prepared in the last few days as a consequence of your chairman asking me to report in a short paper my experience with the use of antistreptococcus serum in the treatment of puerperal sepsis. This paper is not, therefore, in any sense a review of the subject of puerperal septicemia, or even an expression of my views in regard to the treatment of the same, any more than may be pertinent in reporting the few cases in which the serum treatment has been employed, and in commenting on the results and treatment in these particular cases.

The antistreptococcus serum has now been in more or less general use for a number of years, and in this time has been subjected to a fair trial, by a large number of men and under varying conditions. In the aggregate, a considerable number of cases have been reported of its successful

use; for the most part, however, they are reports of single isolated cases, and not reports of series of cases treated on a rational basis. Two years ago the committee of the American Gynecological Society collected over 350 cases in which the serum had been used, among which cases there was a mortality of 33%. This is believed to be higher than the average normal mortality in similar cases.

I believe that the general opinion of the profession at large, on the use of antistreptococcus serum in puerperal sepsis, is, that as a therapeutic measure it is a resource of very uncertain value, not to be relied upon with any certainty of success, and applicable only to a few cases as an accessory in desperate conditions.

My observations are confined to the use of the serum in 5 cases, all occurring in the past year, and these 5 cases I have reported in some detail. Before last year there were a few cases, but the notes of these were not available for hurried reference.

CASE I. C. H., thirty years. First seen in consultation May 15, 1900. On May 4th, patient delivered of a full-term child in absence of physician, and no examinations made either before or after delivery by the attending physician. She was sent to hospital and admitted with a temperature of 103.8°, pulse 120 and respiration of 40. Face flushed, dazed and apathetic at times, at other times wildly delirious. Fine tremor of hands and of tongue when protruded. Abdomen slightly distended and tympanitic, not tender and no spasm. Uterus enlarged, os patulous with considerable discharge. Intra-uterine douches and later curettage was performed without finding any débris of consequence. Urine, albumin trace with few hyaline casts. Patient was pretty sick for ten days, running a temperature from 100° to 103°, and her mental condition at this time was rather bad, depressed at times, at others very delirious; but at no time was her condition considered desperate or her life despaired of. Patient did well while in the hospital, but her recovery of strength and mental equilibrium was very slow, and she remained in the hospital nearly three months before she was ready for discharge.

This patient, before entrance, was given three injections of antistreptococcus serum, one daily, 20 cubic centimetres each time, and these injections were followed by daily remissions of temperature to about normal, the temperature going up again at night. After her admission to the hospital no more serum was administered, because her condition was not considered severe enough to demand it. It is possible that the serum may have influenced the case in its favorable termination, although I have always thought, as I did at the time, that the patient would have recovered without it. Her convalescence was slower than uncomplicated cases of puerperal sepsis, but not longer than septic puerperal manias usually require for recovery.

CASE II. E. F., twenty-five years. Entered hospital October 1, 1900. Italian. No history

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