Echoes of the Past.

TWENTY YEARS AFTER.

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III.—Gunshot Wounds of Abdomen.

Case 5.—Acute Pyelo-Nephritis.

Clinical History.—Nature of wound: Bullet wound of sacral region.

Signs and symptoms: Temperature 101° F. shortly after admission, and increasing each night, rising to 105° F. Needed to be catheterized; urine is slightly turbid. Pulse 120. Abdomen: Distended in lower portion but not rigid.

X-ray report: There is a rifle bullet to left side of the sacrum.

Operation: Wound opened up and drainage tube put down to the depth of the wound.

Survival: Fourteen days.

Post-mortem Result.—Abdomen: Peritoneal cavity, normal, except slight adhesion of small bowel to the bladder, which was distended. Bullet was found on the left side of the pelvis extraperitoneally; just where the X-rays had located it. The track of the bullet was extraperitoneal throughout; the cellular tissue was quite healthy. The bladder showed most acute inflammation; the ureters were also inflamed; the left kidney was very much enlarged, and showed intense pyelo-nephritis; the right kidney was normal in size, and also showed most acute pyelo-nephritis. (There were hæmorrhagic pus foci on the cortex.)

Pathological report: Examination of the urine some days before death showed abundant pus cells, and a pure culture of streptococci.

Comments.—The clinical diagnosis was pelvic cellulitis and suppuration, but this was wrong. Death was due to acute pyelo-nephritis, as the result of infection by the catheter.

Case 6.—Wound of Small Bowel and Bladder.

Clinical History.—Nature of wound: Multiple wounds of right buttock, sacral region, and lower part of left rectus.

Signs and symptoms: Liver dullness present.

Survival: Several hours.

Post-mortem Result.—Abdomen: Small bowel wounded in eight or nine different places; in one place there was a complete wound through

into the mesentery in two places, isolating a loop two inches or so long. In the other positions the wounds were through one wall only ; in each case the mucosa was extruded, giving a rosette-like appearance. There was a little hæmorrhage (not more than half a pint) into the peritoneal cavity, chiefly in Douglas' pouch ; no fœcal contents were seen. The symphysis pubis was shattered, and the bladder could scarcely be recognized ; it was completely torn away.

CASE 7.—Wound of Small Bowel and Colon.

Clinical History.—Nature of wound : Shrapnel in abdomen and face.

Signs and symptoms : Conscious though very collapsed ; deaf ; pulse not palpable. Abdomen : Wound in left hypochondriac region ; no distension, not much rigidity. Liver dullness present.

Operation : Was immediately put under an anæsthetic (oxygen, and ether warmed). Given a pint and a half of intravenous saline and 1 c.c. pituitrin ; median laparotomy ; piece of shrapnel found just near the wound projecting into iliac colon ; removed and wound sewn up. Also small intestine wounded in two places, both through-and-through. (In one, wound of the mesentery also.) Bowel sutured. At the other wound about two inches of bowel were resected. Some dark fluid blood and blood-clot in the peritoneal cavity, but no active bleeding.

Survival : Several hours.

Post-mortem Result.—Abdomen : The wounds were in the lower part of the jejunum ; the bowel for three feet above and six or seven feet below contained a large quantity of dark blood. The upper part of the jejunum and stomach were dilated.

CASE 8.—Wound of Small Bowel. Shock.

Clinical History.—Nature of wound : Bullet wound of the abdomen. Said to have been about 1,000 yards behind the Front Line.

Signs and symptoms : Pain across the lower abdomen ; is cold, pale and collapsed. Pulse 108, fair volume. The day after operation pulse was not palpable, colour slightly livid ; quite conscious. Was moved to the operating theatre for a blood transfusion, but the movement caused him to become worse, and he died on the table.

Operation : On the operating table two hours after being hit. Wound one and a half inches below and to the left of the umbilicus ; dark blood oozing out of the wound in good quantity. Liver dullness present. Median laparotomy was performed. Several pints of blood in the peritoneal cavity ; iliac colon wounded in several places ; small bowel shot completely across (transversely), in several places, and wounded in several others. Wounds were sewn up, and end-to-end anastomosis done. Peritoneal cavity washed out with saline, and a drainage tube inserted in the flank. Intravenous saline and pituitrin given. Operation took two and a half hours, pulse remained good until towards the close.

Post-mortem Result.—Abdomen : No fresh lesions or hæmorrhage. Acute hyperæmia of the small intestine due to early peritonitis so that he would have died in a few days in any case.

Comments : Probably excision of a foot or two of bowel rather than taking time sewing up each wound would have been better. Possibly it would have been wiser to use a Murphy's button to save time in the anastomosis. It would have been better if he had not been moved from the ward to the theatre for the proposed blood transfusion.

CASE 27.—Wound of Bladder. Pelvic Cellulitis and Suppuration.

Clinical History.—Nature of wound : Gunshot wound, leg, buttock and abdomen.

Signs and symptoms : Admitted about seven hours after having right foot blown off ; also with a wound of the right buttock, and some wounds of the left leg. Is very pale, collapsed and shocked, though quite conscious. Complains of pain just above left Poupart's ligament, and is tender there on pressure. Abdomen shows generalized rigidity. Liver dullness, normal. Urine is very blood-stained. The day after operation was feeling well, slightly offensive odour on the tube when withdrawn from the space of Retzius. Some distension in the lower part of abdomen, especially in the mid-line. Vomiting. Next day vomiting ceased ; abdomen not rigid ; but he looks very pale and very ill. Temperature normal, pulse 110 feeble. Died.

X-ray Report : Showed large piece of shrapnel about two and a half inches from the symphysis pubis slightly to the left of the mid-line ; the edge of the pubic bones at the symphysis had been chipped, the small fragments being seen in the radiographs at distances varying from one to two inches from the point of origin.

Operation : Given pituitrin and one and a half pints of intravenous saline. The peritoneal cavity was opened but found to be normal. The bladder, when distended with saline, leaked slightly extra-peritoneally just to the left of the symphysis. The bladder was opened extraperitoneally, a piece of shrapnel found in it, and extracted. A catheter tied in and a drainage tube put in the space of Retzius.

Survival : About sixty hours.

Post-mortem Result.—Abdomen : Laparotomy wound in its lower part dark and foul-looking ; tissues in the space of Retzius dark, foul and purulent ; this condition extends down on either side behind the peritoneum on the right side to the muscles near the great sciatic notch, through which the track of the missile led ; on the left side the infection had spread into the muscles on the brim of the pelvis, and was extending slightly down the thigh. Bladder opened ; mucous membrane dark and foul. Kidneys healthy. Peritoneal cavity, normal. The track of the gluteal wound was foul and dark looking, but the muscle around was perfectly healthy.

Bacteriological Report (No. 5 Canadian Laboratory) : The films made

from the pus showed organisms to be present in very large numbers, a Gram-positive coccus predominating ; a large Gram-positive bacillus is also present in fairly large numbers.

Comments : Again the temperature was misleading ; even the pulse was not very informative. Possibly if the space of Retzius had been more thoroughly opened and drained in the first place it might have helped, but the track was so deep and long that probably nothing could have saved him.

CASE 29.—Wound of Splenic Flexure and Stomach. Peritonitis. Wound of Lung and Bronchopneumonia. Subphrenic Abscess.

Clinical History.—Nature of wound : Gunshot wound, chest and abdomen. (Minnenwerfer.)

Signs and symptoms : Admitted with shell-wound of left side of chest and loin. Temperature 97°, pulse 120. Hæmaturia for three days. After some days, although he was not very ill (temperature 100°, pulse 124), vomiting continued ; the abdomen was not rigid or distended. Laparotomy was performed. He was better for a day, then temperature rose to 103°, pulse remaining about 120. The following day was dressed under an anæsthetic ; the loin wound had not been cleaned up well by the salt pack ; this was altered to eusol, but the temperature and pulse remained up. About four days after the anæsthetic, temperature dropped suddenly to 97°, and he died. (On one day he had a little offensive sputum.)

Operation : Shortly after admission he was operated on and the wounds cleaned up ; one tube inserted into the depth of the retroperitoneal loin wound, another into the pleural cavity. Several days later, laparotomy was performed ; the lesser peritoneal cavity opened, and gas escaped ; no other contents ; a leak of the splenic flexure into the lesser sac was found ; this was sutured, a rubber drainage tube introduced, and brought out through the abdominal wound.

Survival : Lasted about seven days.

Post-mortem Result.—Chest : There was a wound through the rib into the left pleural cavity and through the diaphragm into the peritoneal cavity. Some blood-stained uninfected fluid in the left pleural cavity, and even more in the right. Diaphragmatic pleurisy on the left side ; edge of the lower lobe of the left lung bruised. The whole of the left lung exceedingly œdematous, with patches of bronchopneumonia in the lower lobe. Right lung œdematous to a lesser degree ; no certain bronchopneumonic patches seen (though portions of the lower lobe were suspicious).

Abdomen : No general peritonitis. The splenic flexure wound was apparently all right, but there was a perforation on the posterior wall of the stomach (possibly due to the tube) ; much pus in the lesser sac ; it was escaping out of the foramen of Winslow into the right flank ; it was also subphrenic on the left side. The left kidney was contused at one spot on its convex border.

Bacteriological Report : Smears from both lungs are identical ; they

show a large Gram-positive bacillus (morphologically similar to *Bacillus aerogenes capsulatus*) in large numbers. A lanceolate Gram-positive diplococcus (morphologically pneumococcus) is also present in small numbers.

Comments: Beware of upper abdomen lesions; they may give few abdominal symptoms (although vomiting seems pretty constant).

CASE 31.—Wounds of Small Bowel, and Peritonitis.

Clinical History.—Nature of wound: Gunshot wound, abdomen.

Signs and symptoms: Abdomen rigid. Wound in the left flank; swelling over the right rectus. Cyanotic during the last twelve hours of life. Sputum has been blood-stained. Given oxygen.

Operation: Under ether, median laparotomy performed; shrapnel removed from rectus. Small bowel wounded in several places within a few inches; some contents extruded and early peritonitis present. Extruded matter wiped away, and the holes in the bowel sewn up. A drainage tube put in the loin wound, which was excised.

Survival: About two days.

Post-mortem Result.—Chest: A little blood-stained serous fluid present in both pleural cavities. Lower lobe of the left lung very dark. On section it is extremely congested; no definite area of consolidation seen, but small pieces sink in water. Upper lobe more crepitant. Bronchi of both lungs are very hyperæmic. Right lung is congested, but crepitant. The heart is normal.

Abdomen: Some distension. Stomach, duodenum, and the upper four feet of the jejunum are very distended and hyperæmic, down to a spot where the bowel had been sewn, and to which the omentum was adherent; two loops of bowel were adherent at this spot, causing some kinking, but obstruction was not complete; the bowel below was a little less than normal in calibre, the lower part was quite collapsed.

Comments: Colonel Rigby says that wounds are better sutured (purse-strings) if possible; it causes much less shock than resection. If resection is done, clip the edges of the mucosa away; less liability then of distension of the proximal segment; this is also avoided if the segment of bowel is milked after the anastomosis is performed. Some think lateral anastomosis is better than end to end.

CASE 35.—Wound of Spleen, Colon, and Kidney, with Perinephric Hæmorrhage. Peritonitis.

Clinical History.—Nature of wound: Gunshot wound, abdomen and chest. (Minnenwerfer.)

Signs and symptoms: Very cold and collapsed, but conscious. Temperature 97°, pulse 156 very feeble. Wound on the left side of the abdomen through which omentum is protruding.

Operation: Under open ether the omentum was ligatured off, and two tubes put into the peritoneal and pleural cavity. Died several hours after operation.

Survival : About twelve hours.

Post-mortem Result.—Chest : In the anterior axillary line, going through the ninth rib and ninth interspace, was a wound leading through the lowest part of the left pleural cavity (in which there was a large amount of blood) ; the lower lobe of the lung was quite collapsed.

Abdomen : Through the diaphragm there was a wound just grazing the anterior border of the spleen, and leading to a lacerated wound (or wounds) of the transverse colon just beyond the splenic flexure. There was some free blood in the lesser peritoneal cavity ; also in the greater.

Behind the descending colon and around the left kidney there was effusion of blood. The upper pole of the left kidney was also contused. Some fæcal contents (not in great amount) were free in the peritoneal cavity. A few coils of small intestine were distended, and hyperæmic as if in the early stage of peritonitis.

CASE 36.—Volvulus and Peritonitis following Wound of Bladder and Bowel.

Clinical History.—Nature of wound : Gunshot wound, abdomen, thigh and buttock, with compound fracture of tibia and fibula.

Signs and symptoms : Pale and collapsed, temperature 98°, pulse 142. After operation, bladder drained well, and he did well for several days. Temperature between 100° and 101°, pulse 140. After gas anæsthesia on the third day for the purpose of changing the leg dressing, he was not so well. Vomited ; conjunctiva slightly icteric (?). Abdomen distended.

Operation : Leg dressed and set. Suprapubic incision made ; tissues overlying the bladder were swollen and œdematous ; some free fluid in the abdominal cavity. A split tube with gauze passed down into the pelvis with the idea of shutting off a lesion of the bladder from the peritoneal cavity. Bladder then drained suprapubicly.

Survival : About four days.

Post-mortem Result.—Abdomen : Wound through the left side of the bladder extraperitoneally, going right through and coming out into the peritoneal cavity on the right side. The last sixteen inches of ileum were very congested, and adherent in several places ; at a spot twelve inches from the cæcum there was a marked bruising (about the size of a shilling) of the ileum, with a very small perforation, which was sealed over ; four inches higher up another bruise, but no perforation. The bowel above was slightly twisted at its junction with this piece ; also markedly distended and hyperæmic. The mucosa of the last sixteen inches of ileum was intensely congested. A Meckel's diverticulum was present. The sigmoid and the colon were distended, so evidently the obstruction was not complete. No free fluid in the abdominal cavity. No leakage of urine.

CASE 37.—Hæmothorax. Perforating Wound of Stomach and Hæmoperitoneum.

Clinical History.—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Collapsed ; cold ; temperature 98°, pulse 135 Vomited blood several hours later. Abdomen rather rigid ; not much movement, particularly in the lower part. Next morning he was very pale, but quite conscious. Pulse very feeble. Abdomen : Liver dullness present. Chest : On both sides the resonance is impaired. Heart : Apex beat not palpable. Conscious almost to the end.

Survival : About twelve hours.

Post-mortem Result.—Chest : Wound at the back of left side of chest. A good deal of dark blood in the left pleural cavity; lung collapsed (especially the upper lobe) ; lower lobe shows hypostatic congestion. Right side, normal except for hypostatic congestion.

Abdomen : Abdomen distended ; gas escaped on opening peritoneal cavity ; dark blood in abundance especially in the right flank and pelvis. Liver normal ; upper surface quite uninjured. Left kidney : Slight hæmorrhage in the upper pole and surrounding perinephric fat, which adjoined the track of a piece of shrapnel which entered the back about two and a half inches from the mid-line ; going through the eleventh intercostal space just into the lowermost part of the left pleural cavity, through the diaphragm, than into the lesser peritoneal cavity, through the posterior surface of the stomach (not far from the cardiac end), embedding itself in the anterior wall of the stomach almost opposite. Spleen : Was very small (due to hæmorrhage presumably) ; uninjured. Other abdominal organs apparently normal. No peritonitis. A peculiar feature was that there was not much blood in the lesser peritoneal cavity, only a little brown grumous fluid (perhaps it had all flowed out ; it was not examined early in the post-mortem).

Case 42.—Wound of Colon, Spleen and Stomach. Subphrenic Abscess.

Clinical History.—Nature of wound : Gunshot wound, abdomen.

Signs and symptoms : Shot through the left 10th interspace just in front of the posterior axillary line. Some shock and pallor for the first two days, with a temperature 97° F. and pulse about 100 ; after vomiting the pulse would rise to 140. Vomiting intermittent, not blood-stained. Improved during the next few days. Vomiting less, pulse 90 and regular ; colour improved. Several days later was not so well ; temperature up to 101° F., and 102° F. in the evening, pulse 110. Some epigastric distension ; bowels normal. Liver dullness, which on the first day was normal, is now very much diminished. Later he had a sunken look ; tongue dry and brown, pulse very feeble ; less vomiting ; chest was normal throughout.

Operation : On the seventh day after admission laparotomy was performed ; blood and gas found ; patient died in a few minutes.

Survival : Seven days.

Post-mortem Result.—Abdomen : Free dark blood in the general peritoneal cavity, not in very large amount ; coils of small bowel adherent in places, no general peritonitis. The wound was in the 10th interspace ;

perforation of splenic flexure of colon; lowest tip of spleen wounded; also perforation of both walls of the stomach (no blood in the stomach). The cavity between the transverse colon and the stomach walled off with omentum; this was smooth-lined and contained much blood; the under surface of both lobes of the liver were covered with blood. Stinking infected blood between spleen and diaphragm. In the transverse colon was a quantity of dark material like dark blood.

Chest: Pleural cavity, normal. Lungs show hypostatic congestion of the posterior portion of the lower lobe. Trachea shows no sign of blood or stomach contents. (It was thought possible that he died of asphyxia under the anæsthetic from stomach contents getting into the larynx and lungs.)

Summary: Perforation of colon, spleen, stomach, with hæmorrhage and subsequent infection (subphrenic abscess).

Comments: Colon wounds. There is a danger of septicæmia coming on rapidly from retrocolic infection. Drain this space through the loin.

(*To be continued.*)

Current Literature.

KERMACK, W. O., and MCKENDRICK, A. G. **Contributions to the Mathematical Theory of Epidemics. V. Analysis of Experimental Epidemics of Mouse-Typhoid; a Bacterial Disease Conferring Incomplete Immunity.** *J. Hygiene.* 1939, v. 39, 271–88, 5 figs.

The object of a mathematical theory, or interpretation of a biological experiment is to express the observed results as concisely as possible, using the simplest hypothesis capable of providing a satisfactory reproduction of the data. One desires to do this because the mathematical expression will permit of inferences which may, in some cases, be tested by further planned experiment; in others, rational judgments may be possible respecting conditions which are beyond the range of practical experiment.

In an earlier memoir, the authors showed that some of the most important features of the epidemics of ectromelia reported by Topley and his collaborators could be interpreted on the assumptions that the infection rate, recovery rate, death-rate, etc., were constant. The ectromelia case presented the peculiarities that the incubation period was short and the order of immunity conferred by passing through an attack of the disease high. Kermack and McKendrick have now turned their attention to the more complex problem of mouse typhoid, a disease of relatively long incubation period and such that complete immunity from it is not conferred by surviving an attack. The authors first show diagrammatically, in a very helpful way, the inter-relations of the sub-categories, unaffected, affected, recovered, dead, under which members of a herd must fall, and the meaning of their terminology. If a steady state, viz. not only a constancy of total numbers