bullet, and the position of the latter marked on the skin by means of the ring localizer, which for this purpose should be provided with two wires crossing in its centre at right angles, as great accuracy is necessary. The diaphragm is then fully opened and the tube moved a distance of 5 in. If the bullet is at any depth, its image, of course, moves in the opposite direction to the tube. The new position is marked on the skin by the ring localizer, care being taken that the same part of the bullet shadow is used as a guide in each case. The distance between these two points is measured. Next, the distance between the upper surface of the patient's body and the couch top must be found. The overhead compressor attachment supplied with the Ironside Bruce couch by some firms can be readily utilized for this purpose; otherwise some simple form of calipers must be used, or an arrangement such as used for measuring the height of recruits can be employed. Finally, the second dot should be rubbed out, the tube replaced in the vertical position, and the mark made under the body by the localizer in the usual way.

Suppose the measurement between the two surface marks is 1 in. The sliding pointer X is moved along E B to the right for that distance and clamped. Suppose, further, that the measurement from couch top to surface of patient is 6 in.; G is moved that distance below C and clamped (that is, $E C + 6 \text{ in.} =$ the total distance between target and upper surface of patient). The lever G H, which has been resting against M, is now brought to the left till it is stopped by X. The pointer Z is moved downward till it meets the lever, and the distance E Z is the vertical depth of the bullet.

The above instrument is designed to enable the depth of a bullet to be gauged with a maximum of convenience, speed and accuracy. The principle may, however, be employed in a home-made fashion as follows:

Paste on to the wall at a convenient height a sheet of white paper of suitable dimensions. Draw scales as described. Mark off E C to the length of the couch you work with and number E F in inches and quarters from above downwards. Take a two-foot rule (which is long enough in most cases), place its lower and left-hand corner against the proper scale mark, and, holding it in place by the left hand, bring the upper right-hand edge to the required distance along E B. Then read off the distance E Z. The rule must be kept flat against the wall, and one must see that the lower end is still in place before making the final reading. Be sure to interpret the distance E X liberally, so as not to underestimate the depth.

The above method of calculating the position of a bullet is recommended only where cross markings cannot be readily obtained. The latter are greatly preferred by most surgeons, as they serve as guides after the vertical relationships have been disturbed by the progress of the operation. In the case of limbs it is a good plan to make corresponding marks on the sound side. This is readily done by means of the band of flexible metal referred to in my previous paper. Where cross markings are impossible, as on the lower abdomen, we should never neglect to mark the patient below as well as above. In addition, the surface on which the incision is to be made should be marked by a cross consisting of lines 4 to 5 in. in length, cutting each other at right angles, the point of intersection being the original dot. By this precaution the position of the latter can be judged even after considerable "sagging" has taken place; and by the aid of the opposing dot the line in which the bullet lies can be reconstructed. It has been objected that it is difficult to make a mark beneath a patient by means of the ring localizer; but, if a little care is used, the latter can be quite easily held in place while the patient is tilted sufficiently for the purpose. An all-metal ring localizer, sterilizable by boiling, is made by Messrs. W. Watson and Sons, Great Portland Street, W. It has cross wires, and also an arrangement for making a mark beneath a patient's body without disturbing him. They are also prepared to supply to order for immediate delivery "wall-diagrams," and have in preparation a mechanical device based on the principles shown in Fig. 2.

Many operations for the removal of bullets are difficult, even when they have been clearly seen on the screen, and properly localized by cross lines. Where bullets are lodged in the fleshy parts of limbs screen localizing is usually the only method of value. By this I mean that no additional information of value can be obtained from

plates. But in the case of a bullet which has lodged near a joint or entered a bone, the whole resources of the radiographic art should be placed at the surgeon's disposal. I have seen a surgeon of much experience fail to extract a rifle bullet which had lodged in the astragalus, although he had a lateral radiograph and exact cross markings on the skin. In this case stereoscopy might, perhaps, have turned failure into success.

As to the relative value of stereoscopic views and those taken at right angles to each other, whenever the latter can be properly obtained they are of more assistance than the former. The vertical line of the bullet must be first found by the screen. The bullet image on the plate can then be fitted over the skin marks if desired.

If for any reason it is not practicable to take photographs where in reality they should be taken, the surgeon's presence at the screen localization is desirable. It is very important that the operator should understand the principles on which his colleague works. This would often avoid the making of impossible requests. On the other hand, the radiographer ought certainly to attend operations. He will then realize better the practical problems which have to be confronted, and perhaps be able to devise further means of help.

If the radiographer values his reputation, he will endeavour himself to do all localizations. Lay assistants may often be trusted to turn out good plates, but prognostications as to the position of bullets are quickly put to the test of surgery, and when failure occurs, as sometimes it will, it is comforting to have the conviction—not always shared by the surgeon!—that no fault can be laid at the door of the x-ray department.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, October 31st, 1914.

A RAPID METHOD OF LOCALIZATION BY X RAYS.

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In order to supply the need felt for a means of localizing foreign bodies which could be applied during the screening of a case, and without the loss of time involved in changing the tube to the overhead position and developing a plate for the Mackenzie Davidson method, the following method was devised, with the assistance of Lieutenant P. Ferguson, F.R.C.S., R.A.M.C.

The principle is that of the Mackenzie Davidson method—namely, that of reconstructing the passage of the rays after a deflection of the tube. The necessary data are the height of the table from the tube, and of the screen from the table; the amount of the deflection of the tube and the amount of movement of the shadow on the screen following the movement of the tube.

The method is as follows: A chart is prepared, and on it is ruled a vertical line about a metre in length. On this line is marked off the height of the table from the tube, which it is convenient to make constant. Above this mark a centimetre scale may be set out for convenience in calculation. At the foot of the vertical line another is drawn at right angles to it, representing the amount of deflection of the tube. It is convenient to make this constant also—say, 10 cm. long.

The part is now screened, the foreign body distinguished, and its position marked on the skin with an indelible pencil. Care has now to be taken that the tube is vertically under the foreign body, and this should be done by careful measurement. The screen is placed as horizontal as possible on the part, and one edge of the foreign body is marked by means of a metal pointer (that supplied with the Mackenzie Davidson apparatus is very convenient). The tube is now moved a measured distance—say, 10 cm.

A, screen; B, foreign body; C, table; D, tube.

—and the pointer pushed on to measure the amount of movement of the foreign body on the screen.

The only remaining measurement is that of the height of the screen from the table. This height is now marked on the centimetre scale on the chart; the amount the shadow of the foreign body has moved is measured out at right angles to the vertical line from this point. If the point thus obtained be joined by a straight-edge to the end of the line representing the deflection of the tube, it will cut the vertical line at a point which represents the vertical depth of the foreign body from the screen and from the table. This measurement and the mark upon the patient usually gives the surgeon all the information he requires.

The method has been found to work admirably, and to form a very efficient substitute for more elaborate means in many cases. The saving of time is an added consideration in a military hospital.

If a more permanent instrument be required it would be a simple matter to substitute a wooden upright with sliding-scale pieces to take the place of the chart.

The Bradshaw Lecture

ON

ACUTE HAEMORRHAGIC PANCREATITIS;

WITH REMARKS ON THE ETIOLOGY OF
CHRONIC PANCREATITIS.

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS
OF ENGLAND.

By SIR FREDERIC EVE, F.R.C.S.,

CONSULTING SURGEON TO THE LONDON HOSPITAL, AND TO THE
EVELINA HOSPITAL.

[WITH SPECIAL PLATE.]

TEN years have passed since Mayo Robson, who had made this subject his own, discoursed in this theatre on pancreatitis. During that period so much light has been thrown on the subject by the experimental pathologist and the clinician that no excuse is required for reopening it.

ACUTE PANCREATITIS.

The macroscopic changes of acute haemorrhagic pancreatitis are extremely characteristic and find no counterpart in any other organ.

Macroscopic Appearances.

In the earlier stages the pancreas is swollen, friable, and mottled red or brown to black with haemorrhages, which lie chiefly near the surface or in the interstitial connective tissue. Areas of opaque white or yellow fat necrosis are observed in the peripancreatic fat and in that of the septa. They are also commonly met with in the fat of the omentum and mesentery. In some cases their distribution is very wide, and fat necrosis may be seen in the subperitoneal fat of the abdominal wall, retroperitoneal adipose tissue, and even in the subpericardial and subpleural fat. A sanguineous or sero-sanguineous effusion is encountered in the lesser cavity of the peritoneum. This fluid is at first often sterile and contains products of pancreatic secretion, but it soon becomes infected; and in cases of some duration, or even at an early stage in some very acute cases, septic peritonitis exists.

If the patient survives, varying degrees of necrotic and of suppurative changes are observed in and around the pancreas. Cases have been recorded in which the pancreas was necrosed and sequestered in its entirety. This may have occurred, but Dr. Turnbull informs me that the sequestered necrotic masses he has met with were composed of blocks of peripancreatic adipose tissue, and not of the pancreas itself. In two cases the house-surgeon assured him that the whole pancreas had sloughed through a laparotomy wound; but in both instances the pancreas was found in its normal position at the necropsy.

Suppuration of a diffuse character occurs mainly in the tissue around the pancreas; at times, in less acute cases, a localized abscess forms in the pancreas itself.

The original subdivision by Fitz of acute pancreatitis into haemorrhagic, gangrenous, and suppurative, merely represents the outstanding pathological features of different cases exhibiting varying stages and degrees of the malady. The haemorrhages are always associated with necroses, although one may be more conspicuous than the other; and they are both the primary result of the same morbid process. This, of course, does not imply that a primary haemorrhage into the pancreas from changes in the blood or blood vessels never occurs; but such an apoplexy would be distinct from acute haemorrhagic pancreatitis.

Histology.

The specimens I have studied confirm the description of the histological appearances given by Opie.¹ The chief features are: Areas of necrosis involving the parenchyma and also the interlobular septa; haemorrhages most abundant about the periphery of the gland and around the necrotic areas; in addition, a diffuse infiltration of the septa, and, to a less extent, the gland substance with red corpuscles; there are also patches of fat necrosis involving the periglandular fat and the adipose tissue in the septa (see Plate, Figs. 1 to 4).

Of six specimens in the Pathological Institute of the London Hospital all but one showed definite evidence of inflammation, such as masses of polymorphonuclear leucocytes and areas of purulent infiltration around patches of necrosis (see Plate, Fig. 2), in the septa, and beneath the peritoneum. The veins in some instances contained red or mixed thrombi, and occasionally the arteries were thrombosed.

In one case only (see Plate, Fig. 1) out of six the leucocytic infiltration was very restricted, and limited to a few areas around necroses, although the patient died on the sixth day, while in all the others death occurred on or before the fourth day. Opie, among five specimens examined microscopically, observed one in which there was little or no inflammatory reaction.²

Some writers regard all the changes in acute pancreatitis as the result of the action of the pancreatic secretion on the gland. Chiari³ describes it as a tryptic auto-digestion; others (Fitz, Körte) regard the disease as an acute haemorrhagic inflammation leading to necrosis. Guleke recognizes two forms of the disease—a necrotic form, which he calls “pancreatic necrosis”; and an inflammatory form, provoked by bacterial inflammation, which he names “acute pancreatitis.” He considers that the two forms are not sharply defined.

I propose to show that both the digestive and the inflammatory hypotheses are in part true, in that the process in the initial stage is due to aseptic or bacterial infection, which not only lowers the resistance of and damages the gland tissue, but also liberates trypsin. The action of this proteolytic ferment, together with that of the steapsin, give to the morbid process its characteristic changes.

The pancreatic juice presents this peculiarity, that when secreted its principal digestive agent is inert. The trypsin or proteolytic enzyme is secreted as an inactive substance—trypsinogen—and this is activated or transformed into trypsin by enterokinase, a substance said to be an enzyme, which is produced by the intestinal mucous membrane. The activation of the pancreatic secretion takes place after it is poured into the intestine, and therefore under normal circumstances the pancreas runs no danger of self-digestion.

According to Professor Starling, the juice obtained from the pancreatic duct by the use of secretin contains only trypsinogen. And Dr. H. M. Vernon, whose work on the pancreatic secretion is well known, writes to me that “probably under ordinary circumstances enterokinase is the only agent that can start the activation of trypsinogen; but both juice and extracts contain also another ferment in zymogen-form, which, when set free, is much more powerful than enterokinase. So long as this ferment is present as zymogen the juice will remain inactive, whether in the ducts or elsewhere, and it is only when it is rendered active by the slow action of free trypsin that it is able to exert its rapid activating influence on trypsinogen.”

This new fact, just discovered by Dr. Vernon, would appear at first sight to have no bearing on the etiology of acute pancreatitis, for the trypsin is, under normal