I need only mention that the outstanding points connected with prevention in a country like England are:

1. Application of the muzzling order for a sufficiently long period.
2. Restriction on the movement of dogs into or from scheduled areas when muzzling is applied locally; in the event of universal muzzling being applied it would still be necessary to restrict the movement of dogs.
3. A strict quarantine for a fixed period on the importation of all dogs from abroad.

On the continent of Europe the question is more difficult on account of neighbouring countries, but in the British Isles this difficulty does not arise.

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ACUTE DIFFUSE PERITONITIS:

A SERIES OF TWENTY-ONE CONSECUTIVE CASES.

BY

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THE peritoneal cavity is one large complex bursal sac containing, in addition to several diverticula, the hollow and solid abdominal viscera. The viscera, which are retroperitoneal, possess a liberal blood supply, particularly the intestine. The main diverticula or pouches are the recto-vesical, the kidney pouches, the retro-caecal, the retro-sigmoid, the hepatico-renal, and the pouches about the termination of the duodenum.

It would naturally be surmised that in infection these pouches would form suitable places for the development of sepsis, and eventually localized abscesses, but in reality they do not. The peritoneum, however, offers a large area for the absorption of toxins, and the rate of absorption is remarkably rapid, being greater in the upper half than in the lower. The lymphatics are very numerous, and eventually form the truncus lymphaticus intestinalis, which opens directly into the receptaculum chyli.

Peritonitis is initiated by access of virulent infection into the peritoneal cavity, the organisms being usually intestinal in origin. Peritonitis may be caused either by trauma or disease.

The war has provided abundant material for the study of this grave condition, and different observations and disappointments have suggested a method of treatment which has given most encouraging results in twenty-one consecutive cases.

When infection has gained access to the peritoneal cavity the first change is one of hyperaemia of and exudation into the subperitoneal tissue of the part around the infected focus. This is followed by the exudation of a fluid, which rapidly becomes turbid, into the peritoneal cavity in the neighbourhood of the infected focus. If the fluid be examined microscopically, it will be seen to contain large healthy staining endothelial cells, a few polymorphonuclear leucocytes, also staining well, but no bacteria. This can always be demonstrated in fluid present in a case of acutely inflamed appendix which has not perforated, and for which an early operation has been performed. Further, if the fluid be allowed to stand or be centrifuged, the cellular element will sink and leave a clear supernatant straw-coloured fluid. Cultures have in some instances shown the presence of staphylococci, but it is doubtful if these organisms did not come from the skin. The fluid, differing in no way from that secreted into a large joint after penetration by a septic foreign body, is highly protective in character, and at first possesses first-rate bactericidal powers. While this fluid is being secreted Nature is making a further effort to localize the diseased focus by the formation of adhesions.

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When the gut is damaged, as in a gunshot wound, there is abundant proof that peristalsis is immediately arrested, and remains in abeyance so long as it is not further stimulated. In other words, extravasation of intestinal contents will be small in extent, especially if the patient be given morphine and kept quiet. Transport over rough ground or by motor is sufficient to start peristalsis anew and so increase extravasation, whereby a larger stream of infection gains access to the peritoneal cavity. It is, then, possible, though there is no direct proof, that in acute abdominal conditions other than gunshot wounds peristalsis is arrested or modified.

Should Nature fail in her attempt to localize the inflammatory focus, and should such failure be intensified by treatment—for example, the administration of an aperient for a pain in the stomach—then infection will certainly be disseminated, either slowly or rapidly, throughout the peritoneal cavity, and no factor is more potent in bringing this about than an active peristalsis. The whole surface, especially that clothing the intestine, becomes actively hyperaemic and swollen, it loses its lustre, protective fluid is poured out, lymph of a plastic nature is deposited on the gut binding together coils of small intestine, the flanks and pelvis contain turbid fluid, and the intestine rapidly becomes distended.

The next stage is an impairment of the vitality of the fluid poured out into the peritoneal cavity. The fluid is slowly converted into pus, and this is enhanced by the increasing intra-abdominal tension brought about by an ever-distending gut, which exerts a serious brake upon the circulation in the vessels of the mesentery. The rate of destruction of the vitality of the protective fluid depends upon the degree of intra-abdominal tension, the virulence of the infection, and the patient's general resistance.

Though the fluid at this stage may often be referred to as pus, it is only partially pus; it is a question of degree, and degree in this respect is a highly important question. It is possible to gauge this degree clinically to some extent by the severity of the symptoms of toxæmia.

It seems that the presence of many plastic adhesions binding together coils of small intestine is of good omen and indicative of a high degree of resistance. At this particular stage complete resolution may take place with treatment. On the other hand, if the protective fluid dies it forms pabulum for the bacteria present, and it eventually becomes pus. Septic absorption under these conditions becomes extreme, and finally death follows from toxæmia.

There seems to be little doubt that "peristalsis plays a large part in the dissemination of septic material from any one focus throughout the peritoneal cavity."

Symptoms.

Early symptoms are due to Nature's method of coping with the disease. As soon as infection has reached the peritoneal cavity, a splint is applied in the form of a rigid abdominal muscle. There is pain and tenderness coinciding with the hyperaemic condition of the part of the peritoneum affected, and later there is a definite mass to be felt which is formed by adhesions, adherent omentum, and the diseased part of the gut. As the condition progresses the tenderness becomes more general, the whole abdominal wall is now rigid, distension sets in, and vomiting commences. Constipation is absolute, there is no passage of flatus, the urine is diminished in amount and often passed with difficulty. Vomiting increases in frequency, the patient rapidly becomes dehydrated, there is hiccough and a typical abdominal facies, the tongue is dry and coated, sordes appear on the lips and teeth, vomiting later becomes coffee-ground, the pulse steadily becomes more rapid and thready, and finally the patient dies of toxæmia.

Vomiting which increases in frequency has in the case of gunshot wounds proved to be due to an ever-increasing extravasation of intestinal contents into the peritoneal cavity. Vomiting which continues after forty-eight hours and which is biliary in character is toxic, and is Nature's attempt at excretion. Vomiting of the coffee-ground variety denotes a very grave degree of toxæmia and is of very serious import.

Nature in her attempt to make good is bound to fail unless helped artificially, as she can make no provision for the fluid lost by vomiting.

Complications.

The only complication to be feared, apart from toxæmia, localized abscesses, and the like, is intestinal obstruction. This may be a later complication, and becomes evident by a change in the character of the vomit.

Treatment.

Many authorities have advised treatment on the following lines:

- (1) Removal of the cause at the earliest possible moment.
- (2) Drainage of the peritoneal cavity after performing lavage or no.
- (3) Abolition of the distension by means of graduated doses of calomel, subcutaneous injections of pituitrin or eserine, turpentine enemata, artificially emptying the distended bowel, and the like.
- (4) Control, if possible, of the vomiting by various drugs or stomach lavage.
- (5) Administration of saline, either subcutaneously or rectally, and stimulants.
- (6) Suitable nourishment.

On (1) all are agreed, but this should be performed with the minimum of disturbance to the gut and the peritoneum generally.

(2) Can the peritoneal cavity be drained, and if so, what is drained away? *Post-mortem* examinations performed both during the war and before (and such examinations during war time have followed very soon after death) show that a drainage tube is shut off like any other foreign body from the general peritoneal cavity within a few hours of insertion. "The degree in which adhesions are thrown out is a very important measure of the degree of the patient's vitality."

If, then, protective adhesions are being thrown out around drainage tubes, what are we attempting to drain away? A protective fluid of first-rate vitality; in other words, we are attempting to defeat Nature. Provided a case of general peritonitis can receive surgical help early, it is quite sufficient to mop out carefully any obvious pouches in the region of the area of operation with dry sterile swabs and to abandon all forms of drainage.

Should the fluid be frankly purulent, and consequently no peritoneal reaction present in the form of adhesions or deposition of lymph, then drainage may be resorted to, but this type of case is invariably hopeless from the beginning. It is very unwise to disturb any lymph that may be deposited upon the gut or attempt to unravel coils of small intestine that are matted together, for the procedure only increases shock and opens up fresh areas for absorption. It must be remembered that matting together of the intestine reduces the area for absorption to a minimum.

No good can ensue from peritoneal lavage, for it amounts to washing away a fluid that is highly valuable at this stage, and however carefully performed it aids the spread of infection. It is quite sufficient in the way of drainage to leave a small tube or glove drain down to the primary focus of infection, to be removed at the end of forty-eight hours. This drainage, however, is not always necessary.

(3) What is the significance of a distended intestine? The gut with its serous coat is in a condition of acute inflammation. Its musculature is rendered incompetent partly as an effect of toxæmia and inflammation, partly as a result of distension with gas formed by abnormal fermentation taking place within its lumen, again the result of general toxæmia. Would one suggest to a patient, who was suffering with acute cellulitis of both legs, that he should get up and run about in order to effect a cure? Why then adopt such remedies as calomel, pituitrin, eserine and the like as a means of treating an acutely inflamed gut? Moreover, such treatment by stimulating peristalsis will further disseminate infection and increase toxæmia. There can only be one rational treatment at this stage, and that is rest. It is difficult to understand the significance of the intestinal contents at this particular juncture. They may exert some useful function, they may not. It is sufficient to say that no apparent harm has resulted from leaving them there, and consequently enterostomy and artificially emptying the distended gut has not been practised in any of this series of cases.

The only method of splinting an inflamed gut is by administering morphine and atropine; $\frac{1}{4}$ grain of the former drug is given every eight hours, and $\frac{1}{150}$ grain of the latter drug every twelve hours. The pupils must

be carefully watched, and as soon as constriction shows itself the dose should be decreased to $\frac{1}{4}$ grain every twelve hours, and this is usually called for at the end of forty-eight hours. Administration of these drugs is continued until flatus is passed and the patient has ceased vomiting; over the series of cases in question this invariably occurred at the end of the fourth or fifth day. It has been suggested that the administration of morphine hinders phagocytosis. If this is true, it does not do so to such a degree, when given to the extent recommended above, as to jeopardize the patient's chances, and clinically this treatment has proved to be sound practice.

(4) Vomiting is a symptom of diffuse peritonitis, and is a method of eliminating toxin. Why devise means for checking it? The character of the vomit is important, and affords a clue to the prognosis. Thus, biliary vomiting which gradually gets clearer is of good omen. Coffee-ground vomiting denotes a more severe degree of toxæmia, and is serious. Should the nature of the vomit change from coffee-ground to the biliary type (which it did in three cases of this series), then the prognosis is good. If, on the other hand, the vomit becomes faecal, this denotes intestinal obstruction and further operation is called for. This latter complication occurred in two cases of the series and both recovered; in both cases many adhesions were present, and obstruction had occurred at the ileo-caecal junction. Vomiting at this stage is not so distressing as many would imagine, and the stomach appears to empty itself both easily and painlessly. Vomiting, then, should be encouraged.

(5) Continuous vomiting rapidly dehydrates a patient. To make good the loss of fluid and to aid in a speedy dilution of toxins normal saline is employed. This is run in slowly and continuously beneath the skin. The drip is so regulated that undue collection of fluid in the tissues round the needles is avoided. Nine to ten pints can be given in twenty-four hours; the supply at this rate is maintained for forty-eight hours. Swelling of the feet or waterlogging of the lungs must be guarded against. Should the patient be intolerant of fluid given subcutaneously it may be given continuously by the rectum, but the subcutaneous method is that recommended. At the end of forty-eight hours the patient needs less fluid, and it may be reduced to five pints in the twenty-four hours. The supply of saline should be maintained until vomiting has ceased. These patients have tolerated continuous subcutaneous saline well when under the influence of morphine.

Copious drinks of water containing sodium bicarbonate and sodium citrate are given by the mouth, and by these means two ends are attained—first, the stomach is washed out without undue distress to the patient; and secondly, a diuretic action is obtained, probably through absorption of some of the citrate not vomited. At the end of forty-eight hours the patient begins to pass large quantities of urine, and with this is associated an amelioration in symptoms, for the vomiting becomes less frequent, the vomit clearer in colour, and the patient feels better. Stimulants have not been employed.

As soon as the vomiting has ceased administration of saline is withheld. The inflammatory condition is now subsiding, but on no account should purgatives be given. Flatus is now passed, and generally an offensive liquid stool. Bismuth and compound tincture of camphor can be given with benefit as soon as the vomiting has ceased.

(6) For the first forty-eight hours no nourishment is required; saline is all that is necessary. On the third and fourth day glucose is given by the rectum. As soon as the vomiting has ceased, Brand's essence and albumen water sweetened with glucose may be given in small quantities frequently and regularly. Water may be administered freely. At the end of a week milk and soda water, raw eggs, and a little custard may be given, and from this date the diet may gradually be increased. Patients at this stage are often very hungry, but a full meal should not be allowed, as it causes distress and distension. On the tenth or twelfth day castor-oil may be given, and from this date all anxiety is usually at an end.

One case from twenty-one consecutive cases of diffuse peritonitis may be quoted here; space, unfortunately, does not permit of more.

Pte. M., 6th S.L.I., admitted to 39 Stationary Hospital on January 29th, 1919, with the diagnosis of influenza. The symptoms were persistent vomiting of a greenish material, face

sunken, looking very toxic and slightly jaundiced, abdomen not moving with respiration and legs drawn up. No passage of flatus for thirty-six hours, small quantities of high-coloured urine passed with difficulty. Maximum tenderness in right lower abdominal quadrant; a tender mass could be felt per rectum on the right side, and the recto-vesical pouch felt full. Pulse 110, thready; temperature 102.8°.

Laparotomy performed through right rectus. A gangrenous perforated appendix which was hanging into the pelvis was removed. The pelvis was full of a very offensive fluid and a concretion was found free in the fluid. Diffuse peritonitis was well established; the intestine was acutely inflamed and distended; large patches of lymph were present on the small intestine, whose coils were matted together. The pelvis was mopped dry, but the remainder of the peritoneal cavity was not touched. A small drain was left for forty-eight hours down to the bottom of the recto-vesical pouch. The abdomen was closed in three layers.

Subsequent History.—Biliary vomiting continued for three days. No passage of flatus until the third night. A very offensive liquid stool passed naturally on the fourth day. The patient developed bronchopneumonia, but the abdominal condition remained satisfactory. Distension had entirely gone at the end of the eighth day. Tube removed at the end of forty-eight hours. Despite the pneumonia the patient made a very satisfactory recovery.

Treatment.—Continuous subcutaneous saline up to the third day, copious drinks of water containing bicarbonate and citrate, glucose per rectum. Morphine gr. $\frac{1}{8}$ hourly, atropine gr. $\frac{1}{16}$ 12-hourly for forty-eight hours, and discontinued after the end of the third day. No aperient until the ninth day. Very light diet up to the ninth day, when diet was gradually increased.

SUMMARY OF CASES.

Briefly the series of twenty-one cases is as follows:

The cause of the condition was due to appendix abscess in 6, perforated gastric ulcer in 1, penetrating wounds of the abdomen in 8, intestinal obstruction with gangrene of the gut in 3, intestinal obstruction with perforation of the gut in 1, pneumococcal in 2.

There was one death—a case of intestinal obstruction with gangrene of the gut. Most noticeable in this case was the absence of any healthy reaction of the peritoneum; clinically it was a very severe example of general toxæmia.

The two cases of pneumococcal peritonitis both showed symptoms of subacute intestinal obstruction. Median laparotomy was performed and the obstruction freed.

One case of appendicitis and two of penetrating abdominal wounds were associated with coffee-ground vomiting. One case of appendicitis and one of a gunshot wound developed intestinal obstruction requiring further operation. In both there was a healthy peritoneal reaction in the form of plastic adhesions and fluid, and both survived the necessary operation. One case (appendix) developed a faecal fistula which subsequently closed.

In only one of the cases was the peritoneal fluid frankly purulent, and in all but this one lymph and plastic adhesions were present. In no case was an attempt made to drain or wash the peritoneal cavity; nothing was disturbed beyond the necessary area of operation. No case proceeded to the formation of localized abscesses in the peritoneal cavity.

All (with the exception of the one death) ran almost identically the same course, in that vomiting ceased on the fourth or fifth day, and flatus was passed about this period. Distension subsided in all by the end of the tenth day; in some cases it was earlier.

The urinary outflow (a very important factor) at first diminished, increased rapidly after forty-eight hours, and with this was noticed a change in the character of the vomit and improvement in the patient's general condition.

Treatment in all cases was identical, and has already been detailed in the text. All the patients were nursed in a very slightly elevated position with a bolster placed beneath the knees.

DR. WILLIAM H. WELCH has presented to the College of Physicians of Philadelphia the first account of vaccination published in the United States. The author was Benjamin Waterhouse, the first professor of the theory and practice of medicine in the University of Harvard. He states that he had received the virus from England, and forthwith vaccinated his own children. To prove that immunity had been established he afterwards took the children to the Boston small-pox hospital, where they were inoculated with small-pox virus taken directly from a patient in the hospital. Finding that no effect followed the procedure, Waterhouse exclaimed, "One such fact is worth a thousand arguments."

FIFTEEN CASES OF LIVER ABSCESS:

AN ANALYSIS OF SYMPTOMS AND TREATMENT.

BY

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THE reports of the Medical Research Committee on the prevalence of infection with the *Entamoeba histolytica* or its cysts, not only among troops returning from Mesopotamia and the Eastern Mediterranean, but also among members of the civilian population who have never been out of England, will increase the interest taken in the complications traceable to this parasite.

Of 450 non-dysenteric soldiers in the Liverpool Tropical Hospital, Professor Warrington Yorke found that 7.8 per cent. were infected. MacAdam and Keelan, after examining over 2,000 men at Deolali, India, estimated that at least 33 per cent. of the troops returning from Mesopotamia were carriers of the entamoeba or its cysts. The men thus infected may be potential cases of dysentery or liver abscess.

In Mesopotamia cases of liver abscess were not confined to the hot season, but developed also in the winter months, when the temperature approximated to that of the English spring months.

To diagnose the first case of liver abscess seen is not easy. A well known manual of tropical diseases gives a list of between twenty and thirty signs and symptoms which may occur in this condition. The following analysis of the signs, symptoms, and treatment of fifteen cases of proved liver abscess which came under my treatment in fifteen months at Baghdad is an attempt to indicate the relative value of these signs, symptoms, and treatment, and may be of assistance to practitioners who have not had an opportunity of seeing these cases.

Analysis of Signs and Symptoms.

History of dysentery was present in 6 out of 15 cases. This is not of much value in diagnosis, as such a large proportion of the troops were carriers of entamoeba without having had any signs of dysentery.

Pyrexia was present in every case; it was continuous in 9 cases and remittent in 5. The temperature rarely rose above 102.4°. In 2 cases the pyrexia associated with the abscess formation commenced one week after the end of an attack of dysentery. In its early stages the pyrexia of liver abscess is frequently mistaken for that of malaria or enteric group. Rigors were present in 6 cases and heavy cold sweats in 12. They occurred at 9 to 10 p.m. and during the night.

Pallor was present in 12 cases, and was usually very marked. Slight jaundice was present in one case only.

Wasting was present in 14 cases. This appears to come on very rapidly when pus has formed and sweats are occurring.

Pain.—Local pain in the form of a tender spot on palpation over the liver was present in 14 cases. This fairly constant sign was useful in localizing the position of the abscess. The most common site of the tender spot was in the intercostal spaces over the liver in the axillary line. In these cases the abscess was usually found in the posterior part of the right lobe of the liver. If the tender spot was below the ribs on the right side the abscess was nearer the front of the right lobe. One patient with an abscess in the left lobe had a tender spot in the epigastrium. Referred pain was present in 8 cases, chiefly in the right shoulder. Three of the patients in whom the pain in the right shoulder was unusually severe afterwards developed lung complications involving and extending through the diaphragm. The diaphragm and the skin over the right shoulder are supplied by the fourth cervical nerve.

Increase of Liver Dullness.—Every case showed a general enlargement of the liver. In one case where the abscess was near the front of the right lobe a rounded mass could be felt below the ribs in front. At the back of the chest it was difficult to determine the upper level of dullness owing to the impaired note at the right base caused by the lung complications which were present in most cases. Examination with the fluorescent screen confirmed the enlargement of the liver.