ACUTE DIFFUSE PERITONITIS.
A SERIES OF TWENTY-ONE CONSECUTIVE CASES.

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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 retro-peritoneal, possess a liberal blood supply, particularly the intestine. The main diverticula or pouches are the retro-vesical, the kidney pouches, the retro-caecal, the retro-sigmoid, the hepatico-renal and the pouches about the termination of the duodenum.

In case of infection it would naturally be surmised that 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 findings and disappointments have suggested a treatment that will be detailed directly, which has given most encouraging results in twenty-one consecutive cases.

What actually takes place when infection has gained access to the peritoneal cavity?

The first change is hyperaemia of and exudation into the sub-peritoneal 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. What is the nature of the fluid poured out? If the fluid be examined microscopically it will be seen to contain large healthy staining cells, a few polymorphonuclear leucocytes, also staining well, but no bacteria. This can always be demonstrated in fluid present in the case of an 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 staphylococei, 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 bactericidal powers of a first-rate description.

While this fluid is being secreted, nature is making a further effort to localize the diseased focus by the formation of adhesions.

What happens in the case of the intestine? 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 morphia 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, (e.g., 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 actively peristaltic gut. The whole surface,
especially that clothing the intestine, becomes actively hyperemic and swollen, it
loses its lustre, protection fluid is poured out on all hands, 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 be often 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 dissemi-
nation of septic material from any one focus throughout the peritoneal cavity.

Symptoms.—Early symptoms demonstrate 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 hyperæmic 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 hiccup
and a typical abdominal facies, the tongue is dry and coated, sordes appear on the
lips and teeth, vomiting later becomes coffee-ground in variety, 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
Clinical and other Notes 523

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.

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 are we draining 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 carefully mop out 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 of 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
Clinical and other Notes

Distension with gas formed by abnormal fermentation taking place within its lumen, again the result of a general toxæmia. Would one suggest to a patient who was suffering with an acute cellulitis of both legs, that he should get up and run about his room 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 morphia and atropine. A quarter-grain of the former drug is given eight-hourly, and one-hundredth of a grain of the latter drug twelve-hourly. The pupils must be carefully watched, and as soon as constriction shows itself the dosage should be decreased to a quarter of a grain twelve-hourly, 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, and this over the series of cases in question has invariably occurred at the end of the fourth or fifth day. It has been suggested that the administration of morphia hinders phagoctysis. 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 coffee-ground nature of the vomit change to that of 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 fecal, 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-cæcal 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, and this supply 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 per rectum, but the subcutaneous method is the one 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 morphia.

Copious drinks of water containing sodium bicarbonate and sodium citrate are given by the mouth, and by these means two ends are attained. Firstly, 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 which escapes from being vomited back. At the end of forty-eight hours the patient starts 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, further 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 tinct. camph. co. 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 per 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 ad lib. 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 be gradually increased. Patients at this stage are often very hungry, but a full meal should not be allowed, as it causes distress or 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.

538811 Pte. M., 6 S.L.I. Admitted to 39th Stationary Hospital, January 1, 1919; diagnosed influenza. On admission, 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 quantity of high-coloured urine passed with difficulty. Maximum tenderness in right lower abdominal quadrant, and a tender mass could be felt per rectum on the right side, while the recto-vesical pouch felt full. Pulse, 110, thready; temperature, 102.8° F. 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. Patient developed broncho-pneumonia, but 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; morphia, quarter-grain eight-hourly; atropine, one-hundredth grain twelve-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.

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 perforation of the gut in 1, pneumococcal in 2.

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

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 vomiting of the coffee-ground variety.

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 fecal 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 from the fourth to the 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 these patients were nursed in a very slightly elevated position, with a bolster placed beneath the knees.