General Hospital this was the routine treatment, and doses of half a drachm to a drachm were given every three or four hours. I am by no means convinced that it has any special action; nor, so far as I know, has any medicine, given internally, a definite control over the course of the disease.

Of local treatment, the injection of antiseptic solutions at the margin of the spreading areas has been much practised. Two per cent solutions of carbolic acid, the corrosive sublimate and the biniodide of mercury have been much used. The injection should be made not into but just a little beyond the border of the inflamed patch. F. P. Henry has treated a large number of cases at the Philadelphia Hospital with the latter drug, and this mode of practice is certainly most rational.

Of local applications, ichthyol is at present much used. The inflamed region may be covered with salicylate of starch. Perhaps as good an application as any is cold water, which was highly recommended by Hippocrates.

XVII. SEPTICÆMIA AND PYÆMIA.

1. SEPTICÆMIA.

Definition.—A general febrile infection, without foci of suppuration, which results from the absorption of toxic materials produced by bacteria. The organisms producing septicæmia are, as a rule, those of suppuration—namely, the forms of streptococci and staphylococci.

Clinical Forms.*—(*a*) *Fermentation Fever.*—This is also known as the resorption fever, aseptic fever, or after fever, and is the simplest of all wound complications. It is the febrile process which is produced after transfusion or the injection of pepsin into the blood. The term fermentation fever was employed by Bergman, as he held that it was caused by the absorption of the fibrin ferments. This fever may follow an injury or operation, particularly if there has been necrosis of the superficial tissues by the solutions used in the dressing. It may also follow the extravasation of blood, particularly when under pressure or tension.

The fever, which appears a few hours after the injury or operation, is not preceded by a chill. It usually reaches its height rapidly, sometimes rising to 103° or 104°. The constitutional disturbance is not great, and it subsides spontaneously in from one to three days. This form is ranked as a septicæmia, since the ferment acts in a manner similar to the toxins produced by micro-organisms. It is not yet certain that bacteria do not play an important part in its production.

(*b*) *Sapræmia.*—This is a septic intoxication caused by the ptomaines produced in wounds by the putrefactive bacteria. There are various forms of these organisms; some are bacilli, others belong to the proteus group.

* I follow here the division in Senn's Principles of Surgery.

In their growth, chemical poisons (toxins) are produced, and under the term sapræmia is included the group of symptoms caused by the absorption of these toxins from any local focus of putrefaction.

The symptoms vary with the dose absorbed. Twenty-four hours, or later, after the injury or operation a chill initiates the constitutional disturbance; the fever rises rapidly, reaching 103° or 104°; the pulse is quick, and there may, in severe cases, be great prostration. Nervous symptoms are common—headache, restlessness, and delirium. The tongue is dry, often glazed, and there may at first be gastric irritation. The clinical picture is that of a severe infection. Three conditions must be present in this form of sepsis—dead tissue, infection of this dead tissue with putrefactive bacteria, and a sufficient time to have enabled the putrefactive bacteria to produce a toxic quantity of ptomaines (Senn). The necrotic tissue may be the blood-clot in a wound, the tissues in the interior of the uterus after parturition, or tissues bruised and rendered necrotic by injury or by the action of cold, heat, or chemical substances.

The outlook in sapræmia depends much upon the dose of the poison which has been absorbed and the possibility of removing and cleansing the infected focus.

(*c*) *Progressive Septicæmia.*—In this the septic intoxication is not the result of the bacteria of putrefaction, but organisms enter the blood from some local septic focus. "The intoxication in this form of sepsis is not only caused by ptomaines which are produced at the primary seat of infection, but ptomaines are also produced in the blood by the microbes which it contains" (Senn). The pus microbes are the most frequent cause of this form of septicæmia, and reach the blood either through the wall of the blood-vessels or through the lymph-channels.

The clinical features of this form are well seen in the cases of puerperal septicæmia or in dissection wounds, in which the course of the infection may be traced along the lymphatics. The symptoms usually set in within twenty-four hours, and rarely later than the third or fourth day. There is a chill or chilliness, with moderate fever at first, which gradually rises and is marked by daily remissions and even intermissions. The pulse is small and compressible, and may reach 120 or higher. Gastro-intestinal disturbances are common, the tongue is red at the margin, and the dorsum is dry and dark. There may be early delirium or marked mental prostration and apathy. As the disease progresses there may be pallor of the face or a yellowish tint. Capillary hæmorrhages are not uncommon.

The outlook is always serious. In severe cases death may occur within twenty-four hours, and in fatal cases life is rarely prolonged for more than seven or eight days. On post-mortem examination there may be no focal lesions in the viscera, and the seat of infection may present only slight changes. The spleen is enlarged and soft, the blood may be extremely dark in color, and hæmorrhages are common, particularly on the serous surfaces. Neither thrombi nor emboli are found.

2. PYÆMIA.

Definition.—A general disease, characterized by recurring chills and intermittent fever and the formation of abscesses in various parts, all of which result from the contamination of the blood by products arising from a focus contaminated by the bacteria of suppuration.

Etiology.—As a rule, the disease follows extension of suppuration about a wound or the collection of pus in some part. It was thought at first that the pus itself was taken up by the blood. Virchow showed the important part played by thrombosis and embolism. The works of Lister, Klebs, Pasteur, Koch, and others have demonstrated the important *rôle* of micro-organisms in the disease. The pus microbes are the *streptococcus pyogenes* and forms of *staphylococci*. The streptococcus is most frequently found in the pus at the primary seat and in the metastatic abscesses.

The process which takes place is as follows: In a suppurating wound, for example, the pus organisms induce coagulation-necrosis in the smaller vessels with the production of thrombi and purulent phlebitis. The entrance of pus organisms in small numbers into the blood does not necessarily produce pyæmia. Commonly the transmission to various parts from the local focus takes place by the fragments of thrombi which pass as emboli to different parts, where if the conditions are favorable the pus organisms excite suppuration. A thrombus which is not septic or contaminated, when dislodged and impacted in a distant vessel, produces only a simple infarction; but, coming from an infected source and containing pus microbes, an independent centre of infection is established wherever the embolus may lodge. These independent suppurative centres in pyæmia, known as *embolic* or *metastatic abscesses*, have the following distribution:

(*a*) In external wounds, in osteo-myelitis, and in acute phlegmon of the skin, the embolic particles very frequently excite suppuration in the lungs, producing the well-known wedge-shaped pyæmic infarcts; but in some cases the infected particles pass through the lungs, and there are foci of inflammation in the heart and kidneys.

(*b*) Suppurative foci in the territory of the portal system, particularly in the intestines, produce metastatic abscesses in the liver with or without suppurative pyle-phlebitis.

(*c*) An interesting form of medical pyæmia is produced by malignant endocarditis—the arterial pyæmia of Wilks—in which, as a result of inflammation of the endocardium (either secondary to suppurative disease elsewhere, or following the infection of pneumonia or of certain general diseases), showers of infected thrombi are conveyed from the vegetations in the left heart and produce multiple abscesses in the spleen, kidneys, intestines, brain, and even in the skin.

(*d*) There are cases of so-called *idiopathic pyæmia* in which the primary focus of the disease is not apparent, but in which there are multiple abscesses in various parts of the body.

Symptoms.—In a case of wound infection, prior to the onset of the characteristic symptoms, there may be signs of local trouble, and, if a discharging wound, the pus may change in character. The onset of the disease is marked by a severe rigor, during which the temperature rises to 103° or 104° and is followed by a profuse sweat. These chills are repeated at intervals, either daily or every other day. In the intervals there may be slight pyrexia. The constitutional disturbance is marked and there are loss of appetite, nausea, and vomiting, and, as the disease progresses, rapid loss of flesh. Transient erythema is not uncommon. Local symptoms usually develop. If the lungs become involved there are dyspnœa and cough. The physical signs may be slight. Involvement of the pleura and pericardium is common. The tint of the skin is changed; at first pale and white, it subsequently becomes bile-tinged. The spleen is enlarged, and there may be intense pain in the side, pointing to perisplenitis from embolism. Usually in the rapid cases a typhoid state is gradually developed, and the patient dies comatose.

In the chronic cases the disease may be prolonged for months; the chills recur at long intervals, the temperature is irregular, and the condition of the patient varies from month to month. The course is usually slow and progressively downward.

Diagnosis.—Pyæmia is a disease frequently overlooked and often mistaken for other affections.

Cases following a wound, an operation, or parturition are readily recognized. On the other hand, the following conditions may be overlooked:

Osteo-myelitis.—Here the lesion may be limited, the constitutional symptoms severe, and the course of the disease very rapid. I recall two instances in which the actual cause of the trouble was discovered only at the post-mortem.

So, too, acute septic infection may follow *gonorrhœa* or a *prostatic abscess*.

Cases are sometimes confounded with *typhoid fever*, particularly the more chronic instances, in which there are diarrhœa, great prostration, delirium, and irregular fever. The spleen, too, may be enlarged.

In some of the instances of *ulcerative endocarditis* the diagnosis is very difficult, particularly in what is known as the typhoid type of this disease, in contradistinction to the septic. In *acute miliary tuberculosis* the symptoms occasionally resemble those of septicæmia, more commonly those of typhoid fever.

The *post-febrile arthritides*, such as occur after scarlet fever and gonorrhœa, are really instances of mild septic infection. The joints may sometimes proceed to suppuration and pyæmia develop. So, also, in *tuberculosis of the kidneys* and *calculous pyelitis* recurring rigors and sweats

due to septic infection are common In this latitude septic and pyæmic processes are too often confounded with *malaria*. In early tuberculosis, or even when signs of excavation are present in the lungs, and in cases of suppuration in various parts, particularly empyema and abscess of the liver, the diagnosis of malaria is made. The practitioner may take it as a safe rule, to which he will find very few exceptions, *that an intermittent fever which resists quinine is not malaria.*

Other conditions associated with chills which may be mistaken for pyæmia are profound anæmia, certain cases of Hodgkin's disease, the hepatic intermittent fever associated with the lodgment of gall-stone at the orifice of the common duct, rare cases of essential fever in nervous women, and the intermittent fever sometimes seen in rapidly developing cancer.

On two or three occasions I have met with intermittent pyrexia persisting for weeks, in which it seemed to be impossible to give any explanation of the phenomena—cases in which tuberculosis, malaria, or septicæmia could be almost positively excluded.

Treatment.—The treatment of septicæmia and pyæmia is largely a surgical problem. The cases which come under the notice of the physician usually have visceral abscesses or ulcerative endocarditis, conditions which are irremediable. We have no remedy which controls the fever. Quinine and the new antipyretics may be tried, but they are of little service. Quinine is probably better than antipyrin and antifebrin, which lower the temperature for a time, but when a careful two-hourly twenty-four-hour chart is taken, it is often found that the depression under the influence of the drug is made up at some other period of the day; a morning may be substituted for an afternoon fever.

The brilliant and remarkable results which follow complete evacuation of the pus with thorough drainage give the indication for the only successful treatment of this condition.

Unfortunately in too many cases which the physician is called upon to treat, the region of suppuration is not accessible, and we have to be content with the employment of general measures for the support of the patient's strength.

XVIII. CHOLERA ASIATICA.

Definition.—A specific, infectious disease, caused by the comma bacillus of Koch, and characterized clinically by violent purging and rapid collapse.

Historical Summary.—Cholera has been endemic in India from a remote period, but only within the present century has it made inroads into Europe and America. An extensive epidemic occurred in 1832, in which year it was brought in immigrant ships from Great Britain to Quebec. It

travelled along the lines of traffic up the Great Lakes; and finally reached as far west as the military posts of the upper Mississippi. In the same year it entered the United States by way of New York. There were recurrences of the disease in 1835–'36. In 1848 it entered the country through New Orleans, and spread widely up the Mississippi Valley and across the continent to California. In 1849 it again appeared. In 1854 it was introduced by immigrant ships into New York and prevailed widely throughout the country. In 1866 and in 1867 there were less serious epidemics. In 1873 it again appeared in the United States, but did not prevail widely. In 1884 there was an outbreak in Europe. Although occasional cases have been brought by ship to the quarantine stations in this country, the disease has not gained a foothold here since 1873.

Etiology.—In 1884 Koch announced the discovery of the specific organism of this disease. Subsequent observations have confirmed his statement that the comma bacillus, as it is termed, occurs constantly in the true cholera, and in no other disease. It has the form of a slightly bent rod, which is thicker, but not more than about half the length of the tubercle bacillus, and sometimes occurs in an S-form. It is not a true bacillus, but really a spirochæte. The organism grows upon a great variety of media and displays distinctive and characteristic appearances. The bacilli are found in the intestine, in the stools from the earliest period of the disease, and very abundantly in the characteristic rice-water evacuations, in which they may be seen as an almost pure culture. They very rarely occur in the vomit. Post mortem, they are found in enormous numbers in the intestine. In acutely fatal cases they do not seem to invade the intestinal wall, but in cases with a more protracted course they are found in the follicles and even in the deeper tissues.

Modes of Infection.

(*a*) **Contagion.**—It appears probable that cholera is not highly contagious in the same sense as small-pox and scarlet fever, but in this respect is very similar to typhoid fever. Physicians, nurses, and others in close contact with the patients are not often affected. On the other hand, such persons as washer women, who are brought into very close contact with the cholera stools and the linen of the cholera patients, are particularly prone to the disease.

(*b*) **Infection.**—The leading authorities now agree that the disease is propagated chiefly by the contamination of water used for drinking, washing, and cooking. It is quite possible that articles of food may be contaminated, particularly vegetables, such as lettuces and cresses and others, which have been washed in infected water; but this is probably a minor danger in comparison with impure drinking-water. The bacilli, under suitable circumstances—that is, when much impurity is present—may develop to some extent in the water; Koch, as is well known, found the bacilli in a tank in India, from which the inhabitants were supplied with water for drinking and washing. Strongly in favor of this view is the fact