Typhoid Infection of Ovarian Cysts.*

By FRANK E. TAYLOR, M.Sc., M.A. (Vict.), M.D., B.S. (Lond.), F.R.C.S. (Eng.), M.R.C.P. (Lond.), D.P.H. (Camb.), *Physician for Diseases of Women to the North-West London Hospital; Obstetric Physician to the St. Marylebone General Dispensary; Pathologist to Chelsea Hospital for Women; Lecturer on Bacteriology and General Pathology, King's College, London.*

THE occurrence of suppuration in the contents of an ovarian cyst is a well-recognized, though somewhat infrequent, complication of this neoplasm. Indeed, "at first glance," as Bland-Sutton¹ remarks, "it seems somewhat difficult to understand how ovarian cysts should become inflamed, enclosed as they are in air-tight cavities, and having no communication with other organs." He further states that "a little reflection soon reveals several sources of infection. Of these the principal are:—(1) The Fallopian tube, (2) the intestine, (3) the vermiform appendix, and (4) tapping." To these must be added infection by the blood-stream in systemic diseases of infective origin.

Pfannenstiel² expresses the opinion that infection of ovarian cysts is usually derived from the tube or intestine—the latter almost exclusively when the cyst is adherent to bowel, or even near it if the bowel is injured or damaged from any cause, and he considers that the infective agent is quite infrequently transported through the blood in connexion with systemic infectious diseases.

Olshausen³ also lays stress upon the frequency of intestinal infection in suppuration of ovarian cystic neoplasms.

Menge,⁴ too, as the result of careful bacteriological examination of many cases, believes that this is the usual source of infection—adhesions between the cyst and the intestine being almost always found. He does not, however, entirely deny the possibility of infective micro-organisms being transmitted to the contents of new growths by the blood-stream.

In one case, Martin⁵ conclusively proved that infection came directly from the intestine. A firm, flattish adhesion, from bowel to cyst, was found permeated along its whole length by the *B. coli communis*.

The *B. coli communis* and the pyogenetic cocci are the most frequent micro-organisms to infect, and produce suppuration in, ovarian

*Amplified from a communication read before the Obstetrical Society of London, July 4th, 1907, when the specimen was shown. The bacillus with its cultural characters and agglutinating properties was demonstrated at the Medical Research Club of London, June 19th, 1907.

cysts. Infection with the *B. typhosus* must necessarily be of rare occurrence, since it connotes the occurrence of enteric fever in a patient already possessing an ovarian cyst.

In what percentage of cases presenting these coincident conditions an ovarian cyst becomes infected with the *B. typhosus*, and what percentage so infected suppurate, we have no means of knowing.

The following case, for the clinical history of which I am indebted to Mr. H. Speirs, House Surgeon, presents a typical example of this condition :—

H.E.S., 4-para, a widow aged 37, was admitted on April 25th, 1907, into the Chelsea Hospital for Women under the care of Mr. Bland-Sutton. She had lived in India for the last fifteen years, and, except for occasional mild febrile attacks which she considered to be ague, and for which she took quinine, had enjoyed good health until April, 1906. She then had an attack of fever accompanied by severe diarrhoea and acute abdominal pain, for which she was admitted to the Campbellpur Hospital, India, where she remained until the following August. This illness was diagnosed and treated as typhoid fever.

Prior to the onset of this illness the patient had been unaware of the presence of an abdominal tumour. The menstrual function had varied considerably, having sometimes been excessive, but since the commencement of the typhoid fever there had been complete amenorrhoea. During convalescence, when the patient had become very much emaciated, her doctors discovered a small, extremely mobile, abdominal tumour, which was free from pain and tenderness. It had gradually increased in size until admission into hospital. There had never been any symptoms referable to the tumour apart from its size and presence. Since the attack of typhoid, the patient had been quite free from febrile attacks, and had gained in weight. There had been no rigors and symptoms of suppuration had been conspicuously absent.

On examination, the abdomen was found to be occupied by a rounded tumour rising from the pelvis and reaching up to the umbilicus mesially and to the costal margins laterally. Fluctuation and a fluid thrill were readily obtainable. There was dulness on percussion, but a resonant colonic note could be detected on the left and not on the right side. Bimanually the uterus was small and distinct from the tumour, which lay quite above the fundus uteri. The diagnosis of ovarian cystoma was made.

On April 27th coeliotomy through a median subumbilical incision was performed by Mr. Bland-Sutton. A large congested plum-coloured cystic swelling presented, its anterior surface being covered like a veil by a thin sheet of omentum which was extensively adherent to it. There were no other adhesions. The appearance of the tumour suggested an ovarian cyst with a twisted pedicle. It was found to be

a cyst of the left ovary, but there was no torsion of the pedicle. It was removed entire without difficulty. The abdominal wound was closed in three layers, without drainage. An ideal recovery followed: the wound healed by primary union, the temperature never rose above 99°F., and the patient was discharged from hospital in excellent health on June 13th.

The structures removed consisted of the left uterine appendages. The Fallopian tube and mesosalpinx were somewhat stretched and elongated, but were otherwise normal. The ovary was replaced by a unilocular cyst about the size of a man's head, with some ragged omental adhesions attached to its surface. On incision a uniform, greenish-yellow, purulent fluid, free from odour, escaped, to the amount of two and a half pints.

The cyst wall was about $\frac{1}{4}$ inch in thickness, and its internal surface was rough, dark red, and necrotic-looking. Microscopically it consisted of two layers, an outer fibrous layer, infiltrated with small round cells, and an inner layer of diffusely staining necrotic tissue. Epithelial elements were wanting. No micro-organisms could be observed.

The purulent contents were examined microscopically in films stained with Löffler's methylene blue. They consisted of granular detritus in which were a few degenerated leucocytes. No bacteria could be detected in the films.

Cultures were at once made on agar slopes, and these were incubated at 37°C. A sparse greyish-white growth of rounded colonies slowly developed, there being only slight growth at the end of forty-eight hours. The growth was found to consist of delicate slender rods, with slightly rounded ends, which were not very actively mobile, were non-spore-bearing, stained readily with the ordinary aniline dyes, and were gram negative. In sub-cultures on various media, mobility became very active, and typical *B. typhosus* developed.

The following were the sub-cultures which were made, with the results as stated:—

Agar streak: thin, translucent, shiny, spreading, greyish growth.

Gelatine streak: grey, glistening growth, with irregular borders, no liquefaction.

Gelatine stab: growth in depth; no liquefaction.

Potato: white, almost invisible growth; no discolouration of potato.

Broth: growth with uniform turbidity.

Glucose Agar stab: growth along needle track, no gas production.

Neutral red broth: no change.

Litmus milk: no coagulation, slight permanent acidity.

Lactose peptone water: no change.

Dulcitate peptone water: no change.

Glucose peptone water: acid, no gas.

Mannite peptone water: acid, no gas.

Durham's peptone water: no indol formation.

Conradi-Drigalski plates: Blue growth, no reddening of medium.

Capaldi-Proskauer medium, No. I.: no growth or change in reaction.

Capaldi-Proskauer medium, No. II.: growth with markedly acid reaction.

All these culture reactions are typical of the *B. typhosus*, and serve to differentiate it from allied members of the typhoid-coli group and from the para-typhoid bacilli.

Agglutination tests, which are specific for the *B. typhosus*, were then undertaken as follows:—

A rabbit received injections of typhoid bacilli at intervals, until its serum was found capable of agglutinating the laboratory cultures of *B. typhosus* in dilutions of 1:4000. This serum was also found to agglutinate the bacilli obtained from the ovarian cyst in dilutions of 1:4000. As a control, the agglutinating power of the serum of an untreated rabbit with this bacillus was tested, and was found positive in dilutions of 1:200, but negative in dilutions of 1:400, *i.e.*, it was negative with dilutions ten times stronger than that of the treated animal-producing agglutination. The macroscopic methods were used in all these cases.

Widal's reaction with the patient's serum and the laboratory culture of typhoid bacilli was performed: agglutination was well marked in dilutions of 1:100, and present, though less perfect in dilutions of 1:1,000 with the time limit of one hour.

Pfeiffer's phenomenon, *i.e.*, the production of bacteriolysis in the peritoneal cavity of a guinea-pig injected with the bacilli and with the serum of an immunized animal, could not be obtained. This was due to lack of virulence of the bacilli, as control animals, *i.e.*, guinea-pigs injected with the bacilli and with normal rabbit's serum, were unaffected. For the production of this phenomenon the use of virulent bacilli is essential, otherwise the bacilli are destroyed in the guinea-pig's peritoneal cavity. Pfeiffer's phenomenon could, however, have been produced in an indirect manner, even with this non-virulent strain, if it was employed in the preparation of an immune serum, and the serum so obtained were tested along with a known virulent culture of typhoid bacilli. The performance of this method was deemed to be unnecessary.

In the case before us, then, a bacillus was obtained in pure culture from the pus of a suppurating ovarian cyst, eight months after an attack of typhoid fever. This bacillus, from a comprehensive study of its morphological, tinctorial, cultural and serum-agglutinating properties, has been definitely proved to be the *B. typhosus*. Further, the agglutinating power of the patient's serum with typhoid bacilli proves that the febrile illness from which she suffered last year really was typhoid fever.

I believe, however, that the bacillus isolated from the cyst contents had almost lost its vitality, seeing that it was not pathogenic to guinea-pigs, that at first it grew slowly and feebly on agar, possessed only feeble mobility, and was present in such scanty numbers that it could not be observed in the pus. [Pus is known to possess well-marked bactericidal properties.] It seems probable that if the cyst had been allowed to remain unoperated upon for some time longer its contents would have become sterile from the death of the bacilli.

It has long been a recognized clinical fact that suppuration occasionally occurs after an attack of typhoid fever as in cases recorded by Walzberg⁶ and Kümmel.⁷ It is, however, only within the last dozen years or so that the purulent contents have been studied bacteriologically, and only more recently still have we been possessed of methods which suffice to identify the *B. typhosus* with certainty. The first to obtain typhoid-like bacilli under these conditions was Werth, in 1893. Since then eleven more cases have been placed on record. It was not until the discovery of scientific agglutinins that the *B. typhosus* could be identified with certainty and could be differentiated from the various members of the typhoid coli group and from para-typhoid bacilli. Wallgren, in 1899, seems to have been the first to apply sero-diagnostic methods to the bacilli obtained from the contents of suppurating ovarian cysts after typhoid fever.

Turning to the literature of the subject I have been able to collect the records of twelve cases in which bacilli, believed to be *B. typhosus*, have been found in contents of suppurating ovarian cysts. In all these cases the suppuration followed an illness which was considered to be typhoid fever, though in many cases the examination of the bacilli was too limited to ensure its complete identification as the *B. typhosus*.

I have omitted to include cases in which suppuration in the cyst has followed an illness stated to be typhoid fever, where bacteriological examination of the pus has not been undertaken, on account of the uncertain nature of such cases.

The cases I have collected are arranged chronologically:—

CASE I. Werth,⁸ 1893.

Marie M., aged 29, was admitted on June 2nd, 1892, for abdominal pain and swelling, dating from the beginning of the same year. She had had typhoid fever in October and November of the preceding year. The physical signs were those of a cystic ovarian tumour. Ovariectomy was performed on June 4th, 1892. The cyst of the left ovary was adherent to the omentum and to the anterior abdominal wall. In separating these adhesions the cyst wall was torn and purulent contents, mixed with sebaceous matter and hair escaped. The thickened and inflamed omentum was also adherent to the posterior wall of the cyst, as far as its attachment to the transverse colon.

There were no adhesions to bowel, and the cyst was easily removed. The right ovary contained a distended follicle the size of an orange, and the cystic portion was excised. Recovery was normal.

Microscopically the cyst wall had the structure of a dermoid, and the sero-purulent portion of the contents, which had an unpleasant odour, consisted of granular detritus containing a few leucocytes. No bacilli were observed.

Roll gelatine cultures of the pus were made. Small, round, white colonies appeared, which did not liquify the gelatine. These were subcultured in potato, whey, milk and peptone water (no indol formation), giving the cultural characteristics of *B. typhosus*. The bacilli possessed flagella, and presented the morphological and tinctorial characters of the *B. typhosus*.

These characters do not suffice to prove that the organism isolated from the pus is really *B. typhosus*, nor have we strict proof that the patient had had typhoid fever, in the absence of agglutination, which at that date was unknown. The case is memorable, however, as a first attempt to show that typhoid (or at any rate typhoid-like) bacilli may be present in the pus of suppurating ovarian cysts.

CASE II. Schiperowitsch,⁹ 1894.

A patient, who was known to have a left ovarian cyst, was treated for typhoid fever by Schiperowitsch. On recovery from the fever the patient refused operation, as the cyst gave no trouble. Two months later she returned quite exhausted and complaining of fever, diarrhoea, severe sweats, and vomiting. Schiperowitsch diagnosed suppuration of the cyst. He removed six glassfuls of pus by means of a trocar, and in the pus typhoid bacilli were found. "One must consider, he says, "that the suppuration in the cyst was set up by the typhoid bacilli."

CASE III. Sudeck,¹⁰ 1895.

A sterile, married woman, aged 32, had complained for some years of abdominal pain, constipation, and difficulty of micturition. Seven weeks before admission to the Eppendorf Hospital in Hamburg on November 5th, 1895, the patient had an attack of typhoid fever. Three weeks before admission some abdominal swelling was noted.

Examination revealed all the physical signs of a cystic abdominal tumour, which was accompanied by severe abdominal pain and fever of the hectic type. A suppurating ovarian cyst was diagnosed.

Ovariectomy, November 11th, 1895. The cyst arose from the left ovary and was of the size of the head of a child ten years of age. Adhesions existed between the cyst and the uterus and anterior abdominal wall. Whilst separating these a slight tear was made in the cyst wall, with escape of cyst contents into the abdominal cavity.

Recovery was prolonged but uneventful, slight suppuration developing in the lower angle of the wound, from which staphylococci and typhoid bacilli were obtained.

The removed cyst was unilocular, with a wall 1 cm. in thickness. Its internal surface was covered with thin fluid pus or fibrin. The contents were a chocolate-coloured fluid containing thick, purulent flocculi, and were free from odour. Microscopically only detritus and degenerated leucocytes were seen. No bacteria visible.

Glycerine agar plates were inoculated with the pus, and these were incubated both aërobically and anaërobically at 37°C. A pure culture was obtained of a bacillus with the morphological and staining characters of the typhoid-coli group. Sub-cultures were made on potato and milk, and there was no indol production.

Animal inoculations with the pure culture were then carried out. A mouse died twelve hours after injection. Of three guinea-pigs one died and two survived.

Microscopically the cyst wall was composed of fibrous tissue infiltrated with small, round, cells, and lined by a pyogenic membrane. A few scattered bacilli were observed in the superficial layers of the cyst wall, whilst in its deeper layers were abundant masses of cocci chiefly arranged as diplococci.

CASE IV. Pitha,¹¹ 1897.

A single woman, aged 25, was admitted to hospital on Feb. 6th, 1897, four months after an attack of typhoid fever. In the fifth week of this illness the patient first noticed a tumour in the lower part of the abdomen, which was not sharply defined, and was accompanied by pain. Later the tumour became more defined and completely filled the lower part of the abdomen as high as the umbilicus. Local anti-phlogistic treatment caused no alteration in the condition of the mass. Menstruation had been absent since the commencement of the illness.

On examination the mass seemed to be composed of three parts, one occupying the left side of the lower part of the abdomen, the second was mesial above the symphysis, and the third, the largest, completely filled the right side of the lower part of the abdomen, reaching as high up as the umbilicus. The tumour completely filled the pelvic inlet and bulged the posterior vaginal fornix. It was immovable and a little tender, and fluctuation could be elicited in parts. The uterus was pressed upwards and forwards close to the symphysis. The external genitals were virginal. Rectal examination confirmed these findings, the tumour being soft and fluctuating in places, whilst in others it consisted of harder portions. The diagnosis was made of a post-typhoid suppurative mass in the pelvis of undetermined origin.

Feb. 24th, operation by Prof. Pawlik. By puncture of the mass above the right Poupert's ligament with a Pravaz syringe, some pus

was obtained, and this was at once microscoped. Many polynuclear pus cells, for the most part degenerated, were found, but no micro-organisms. The purulent nature of the mass being thus ascertained, it was decided to evacuate and drain it *per vaginam*. A trocar was pushed through the bulging posterior fornix, and the pus escaping was collected aseptically for bacteriological examination. An incision was then made by the thermocautery, and three litres of pus, mixed with hair, were withdrawn. After washing out, the finger explored the parts through the incision, and a multilocular dermoid cyst was found. It was impossible to remove this *per vaginam*, so laparotomy was performed. The cyst was found to spring from the right ovary. It was firmly adherent to bowel, to the bottom of Douglas's pouch, to the pelvic walls, and to the right broad ligament, rendering removal very difficult. The abdomen was closed in three layers without drainage. Satisfactory recovery followed.

The extirpated cyst was a multilocular ovarian dermoid with thick inflamed walls, showing in places necrotic changes. In a small cystic portion to the left of the main mass were pieces of bone and cartilage. The cyst also contained a quantity of black hair. Microscopically the wall of the cyst was characteristic of a dermoid, containing hair, sebaceous glands, bone, cartilage, and acinous glands. There was everywhere much small, round-celled infiltration, and on the inner surface of the cyst were necrotic portions. No micro-organisms could be found in the cyst wall.

The purulent contents were a thin fluid of a yellowish colour and free from odour. They were inoculated into various culture media, and a pure culture was obtained, possessing all the morphological and biological characters of *B. typhosus*. Widal's test with the patient's serum was also performed and gave a positive reaction.

This is the first case in which the value of Widal's reaction was recognized, proving that the patient had had typhoid fever. That the bacillus obtained in pure culture was *B. typhosus* is very probable, but as no animal injections were made, and the agglutinability of the isolated bacilli with the serum of an immunized animal was not ascertained, the identification of the bacillus was imperfect and cannot be accepted as proved.

CASE V. Wallgren,¹² 1899.

A married woman, aged 39, was admitted to the gynecological clinic at Helsingfors on Sept. 20th, 1898. She had enjoyed good health until the previous summer. In 1893 she had first noticed a freely movable tumour in the lower part of the abdomen, about the size of a fist. Since then the tumour had gradually increased in size, but had caused no other trouble. In June and July, 1897, the patient had an attack of fever lasting six weeks, but as she did not consult a doctor, no further particulars are available. Since then she had felt

pain in the tumour and had never been well. She had frequently had rigors and fevers, especially in the evenings.

On examination the hypogastrium was bulged forward by a tumour which reached up to the umbilicus. It was movable, tense, smooth and slightly tender, and was diagnosed as an ovarian cystoma.

Ovariectomy, Sept. 23rd. The peritoneum was thickened and oedematous, and the tumour was slightly adherent to the anterior abdominal wall. There were no other adhesions. Whilst the adhesions were being separated the cyst wall was torn and yellowish-green cyst-contents, containing purulent flocculi, escaped. The tear was clamped, the incision enlarged, and the cyst removed entire. The left ovary showed cystic degeneration and was igni-punctured. The abdominal wound was closed in three layers without drainage. Recovery was uneventful.

The cyst contained a litre and a half of thin, yellowish-green fluid, containing purulent flocculi, mixed with a few hairs. The cyst wall was $\frac{1}{2}$ cm. in thickness and showed microscopically the structure of a dermoid, with much small, round-celled infiltration. No micro-organisms could be found in the sections.

Cultures were made aërobically on slope gelatine agar and slope ascites agar tubes, and anaërobically in ascites agar and glucose agar. Actively mobile, non-gram staining medium-sized bacilli, with rounded ends, were obtained, showing flagella when stained by van Ermengem's method.

Characteristic culture reactions were obtained on broth, agar, gelatine plates, gelatine stabs, glucose and lactose media and milk. Indol was not formed. The bacillus was moderately pathogenic to guinea-pigs; two died and two lived. A sero-purulent peritonitis resulted from the injections, and the peritoneal fluids contained the bacilli.

Agglutination of the patient's serum with typhoid bacilli was obtained with dilutions of 1 in 60 (Widal's reaction), but the serum had no agglutinating effect in dilutions of 1 in 50 of *B. coli communis* or *Proteus vulgaris*. Agglutination of the bacilli obtained from the cyst with the serum of a treated animal, which agglutinated *B. typhosus* in dilutions of 1 in 2,000, was obtained with dilutions of 1 in 4,000.

By the application of Widal's reaction Wallgren proved that the patient had suffered from typhoid fever, but the only febrile disease from which the patient had suffered was one in the previous summer for which she had not been attended by a physician. The case was therefore probably one of ambulatory typhoid.

He also seems to have been the first to apply the sero-diagnostic methods to the identification of the bacilli obtained from suppurating ovarian cysts, the agglutination of the bacilli with high dilutions of

the serum of an immunized animal, as used in this case, being a specific reaction, is essential for the complete identification of *B. typhosus*.

CASE VI. Engelmann,¹³ 1901.

Frau K., aged 38, was admitted to the gynaecological clinic in Bonn, on March 28th, 1901. She had always had good health until November, 1900, when she had typhoid fever of four weeks' duration. There was a relapse in January, 1901, and she became greatly emaciated and suffered from severe abdominal pain and irregular hæmorrhage.

On examination after admission the patient was greatly emaciated and presented the "facies ovarica." The abdomen was enlarged to the size of a seven months' pregnancy by an elastic fluctuating tumour, which was slightly tender. The tumour was diagnosed as a multilocular ovarian cystoma with torsion of the pedicle.

Ovariectomy March 30th, 1901. It was easy and uncomplicated. A few adhesions to omentum only existed. A yellow, thin fluid, mixed with pulaceous matter and hair was evacuated. The left ovary showed small-cystic degeneration, necessitating removal of the left uterine appendages. To diminish the dangers of exudation from the stump the uterus was amputated supravaginally.

Convalescence was smooth until the third day, when there was a slight rise of temperature, with a severe dysentery-like enteritis, the stools being frequent, profuse, bloody and purulent. A bacillus like Kruse's dysentery bacillus was isolated from them. This lasted until the ninth day. Thereafter recovery was uninterrupted.

The tumour was a typical dermoid cyst and its pedicle was twisted through one turn. The contents measured one and a half to two litres.

Microscopically the cyst contents consisted of masses of detritus and degenerated leucocytes. Bacteria were not observed.

Cultures were made on agar plates and the growth so obtained was subcultured on to agar, gelatine, glucose agar, milk and potato giving reactions of the typhoid bacillus.

A bouillon culture of the bacillus obtained from the cyst contents was agglutinated by the serum of a rabbit immunized with *B. typhosus* in dilutions of 1:1200, whereas a laboratory culture of *B. typhosus* showed agglutination in the same serum in dilutions of 1:2000.

Typhoid bacilli were well agglutinated by the serum of the patient in dilutions of 1:100 and bacilli from the cyst 1:50.

After three weeks' treatment with the bacilli obtained from the cyst the serum of a rabbit agglutinated both the cyst bacilli and typhoid bacilli in dilutions of 1:1250.

It is interesting in this case to note the association of torsion of

the pedicle with typhoid infection of the cyst. It would be difficult, if not impossible, to apportion the symptoms of which the patient complained between these two conditions.

CASE VII. Walker,¹⁴ 1902.

A married woman, aged 20, had an attack of typhoid fever which commenced in July, 1901. For four weeks it ran the course of a "typical typhoid." At the end of this time the patient began to suffer pain in the lower part of the abdomen: the fever increased, and a tumour appeared in the lower part of the abdomen. The tumour rapidly enlarged and was accompanied by exacerbations of pain, which were very severe at times. Chills frequently occurred and were followed by rises of temperature. The fever was lower but still continued throughout October and November, and on coming under observation on December 31st the temperature was about 101°. The abdomen was found to be occupied by a large cystic tumour.

A Widal reaction with the patient's serum showed agglutination of the bacilli within seven minutes. [No indication is given of the degree of dilution of the serum].

At operation, January 14th, 1902, a large dermoid ovarian cyst containing a gallon or more of pus was removed. The adhesions were extensive. During the separation of omental adhesions from the superior aspect of the cyst, its wall was torn and a large quantity of pus flowed into the peritoneal cavity, and was widely disseminated. This was wiped out with gauze and gauze sponges. No irrigation was employed. The abdomen was closed without drainage. Recovery was complicated by the formation of some mural abscesses.

From the pus a germ was cultivated "which gave an alkaline reaction, and in all respects [no details of which are given] resembled the typhoid bacillus."

Widal's reaction was again tested, using the bacilli obtained from the tumour "with the same result as before."

"There is no reasonable doubt [in the author's mind] that the bacillus had found their [sic] way from the intestines into the ovarian cyst and infected it."

CASE VIII. Lewis and Le Conte,¹⁵ 1902.

A Russian, iv.-para, aged 28, suffered from an attack of typhoid fever five weeks after delivery of a full term child. An abdomen soft and undistended, showing several rose-coloured spots, a vaginal examination, a leucocyte count of 2,600, a positive Widal reaction and a positive diazo reaction in the urine negatived puerperal infection and clinched the diagnosis of typhoid fever. It also ran the course of a moderately severe case of typhoid fever.

During the fourth week the character of the pyrexia changed and

assumed a hectic type. The patient also complained of pain in the pelvic region, with slight tenderness. The blood count now showed 10,400 leucocytes and 55 per cent. hæmoglobin.

Vaginal examination revealed a large, exquisitely tender, fluctuating mass in Douglas's cul-de-sac which bulged the posterior vaginal fornix and pushed the uterus upwards and forwards behind the symphysis pubis.

The patient refused all surgical intervention for a week and then would only consent to a simple vaginal puncture to evacuate the pus. About a quart of fetid greenish pus containing many cheesy particles was evacuated. Cartilage and bone were recognized in the cyst wall. It was therefore a suppurating teratomatous cystoma.

From the pus *B. typhosus* was obtained in large quantity and in pure culture. [No cultural details or methods of identification of the bacillus are given].

The temperature now subsided, but five days later it again commenced steadily to rise, with large spleen, rose-spots and leucopenia. It ran the course of a typical, though severe, relapse. Recovery ensued.

Cœliotomy was performed in March, 1902. A left ovarian cyst of about the size of a lemon was found, lightly but universally adherent to the surrounding organs. It was removed along with the left Fallopian tube. Recovery was uneventful.

Microscopically the tumour presented the structure of an ovarian teratoma.

CASE IX. Lewis and Le Conte,¹⁵ 1902.

A woman, aged 30, was married in September, 1900, and had a miscarriage at the third month. She was curetted in May, 1901, by Dr. B. C. Hirst and a month later the pelvic organs were quite healthy. She remained well until December, 1901, when typhoid fever developed, giving a prompt and positive Widal's reaction. On the thirty-seventh day the temperature again rose and a relapse was diagnosed, although the temperature was of the hectic type. On the twenty-fourth day of the supposed relapse, as the course of the disease rather suggested some septic condition, the pelvic was explored by vaginal examination. A bulging was felt in Douglas's cul-de-sac on the left side: it was sensitive to pressure. Abdominally no tumour could be felt, but a sense of fluctuation was conveyed to the examining finger while percussing the left lower quadrant of the abdomen. A pelvic abscess was diagnosed.

Cœliotomy was performed, and a large cystic tumour was exposed, adherent to the rectum and left Fallopian tube. In attempting to remove it entire it ruptured and a large quantity of coffee-coloured, rather grumous offensive material escaped, soiling the peritoneum.

Owing to its firm adhesion to the bowel the cyst wall could not be entirely removed, though most of it was cut away. Gauze packing was introduced for drainage.

On the fifth day the temperature rose to 104°F. and subsequently remained about 102°. The question arose as to whether there was further trouble in the abdomen or whether there was a relapse of the typhoid fever. It was decided that it was the latter condition that was present. The surgical progress of the case was uneventful.

A culture from the pus was made at the time of operation and grew typical typhoid bacilli. [No details are given]. No other micro-organisms were obtained.

The excised tumour was a cyst of the left ovary, of the size of a small orange.

Microscopically the deeper layers of the cyst wall consisted of fairly dense connective tissue, and the superficial layers were composed of young granulation tissue. No micro-organisms were observed in the cyst wall.

CASE X. Zatschenko,¹⁶ 1904.

A peasant woman, aged 28, was admitted to the gynæcological clinic at Kasan complaining of an abdominal tumour and fever. She had been quite healthy until August, 1902, when she was admitted to the Government Hospital, Kasan, for typhoid fever. At the same time the patient became aware of the presence of an abdominal tumour which steadily increased in size and was the source of constant pain. After discharge from the hospital, the patient had suffered nearly every evening from rigors, fever and sweats.

The physical signs were those of a large ovarian cyst of the left side, and suppuration within it was diagnosed.

On May 2nd, 1903, the abdomen was opened and the cyst was removed entire, after separating adhesions to the anterior abdominal wall, coils of intestine and the left broad ligament. Recovery was uneventful.

The excised tumour measured 85 cm. in circumference and presented the macroscopic and microscopic characters of a multilocular ovarian cystadenoma, the walls of which were infiltrated with leucocytes. The contents consisted of 4300 c.c. of greenish yellow pus free from odour.

Microscopically the pus consisted mainly of granular detritus with a few well-preserved leucocytes. Short thick bacilli with rounded ends were observed both intra- and extra-cellular.

Cultures were made in broth, gelatine, agar, glucose broth, milk, potato and litmus whey, and gave characteristic reactions.

CASE XI. Dirmoser,¹⁷ 1904.

A married woman, aged 20, suffered from typhoid fever. Six months later she had an attack of diffuse abdominal pain with vomiting. This recurred in four to six weeks. To the right of the uterus was a tumour tender to pressure. Laparotomy showed this to be an exceptionally mobile cystic tumour of the right ovary. It was equal in size to a child's head and contained stinking greyish-yellow thick pus. The right Fallopian tube was also suppurating. The uterus along with the appendages of both sides was extirpated.

The bacteriological examination of the pus was undertaken by Ghon. Cultures (agar-streak only) showed a bacillus "belonging to the type of the typhoid-coli group." Ghon states that although the exact diagnosis of the typhoid bacilli was not completely ascertained, he "could not withstand the belief that he had to deal with the typhoid bacillus."

The bacteriological examination in this case was very incomplete. In the absence of anaërobic cultures, of agglutination tests, and animal inoculations the nature of the bacilli obtained cannot be considered as definitely ascertained. The stinking nature of the cyst contents would rather militate against a pure typhoid infection.

CASE XII. Bensis,¹⁶ 1906.

A woman, aged 40, had noticed an abdominal swelling for sixteen months. It presented all the physical signs of an ovarian cyst. At first it grew rapidly and caused no other symptoms, so that the patient considered herself to be pregnant.

She had an attack of typhoid fever two and a half months before coming under observation. After the fever the cyst rapidly increased in size and the temperature remained normal. The cyst was punctured and a purulent fluid was withdrawn, in which Eberth's bacillus was found.

With a view to operation the patient was transferred to the surgical clinic, where the cyst was emptied by tapping. Five to six kilos. of pus were evacuated. The patient died a few hours later, either from effusion of pus in the peritoneal cavity or from heart failure.

The original account of this case is inaccessible to me and the scanty details above given are from a short abstract in the *Zentralblatt für Gynäkologie*. The description of bacteriological details is wanting by which alone a judgement of the real nature of the organism obtained can be formed.

The salient features of these cases may be seen at a glance from the appended table.

The difficulty of diagnosing typhoid fever from clinical signs and symptoms alone is well known. Suppurating ovarian cysts (not caused by typhoid infection) have been known so closely to simulate typhoid fever, as to be diagnosed and treated as cases of this disease, until the discovery of the tumour has made the diagnosis clear.

In some of the earlier recorded cases, prior to the application of Widal's reaction, in which a febrile illness (diagnosed and treated as typhoid fever) has occurred and later a suppurating ovarian cyst has been removed, may have been of this nature and not typhoid fever at all. That in my case the previous illness was really typhoid is proved by the positive "Widal" obtained with the patient's serum.

Now-a-days, by the application of modern clinical methods, it would not be difficult to distinguish between typhoid fever and a febrile illness caused by a suppurating ovarian cyst simulating typhoid fever. In typhoid fever blood examination would reveal a leucopenia (*i.e.*, diminished number of leucocytes), the urine would give a positive diazo-reaction, with the patient's serum a positive Widal's reaction would be obtained, whilst the *B. typhosus* could be cultivated from the blood. In suppurative ovarian cystitis there would be a leucocytosis (*i.e.*, increased number of leucocytes in the blood), a negative diazo-reaction with the urine, and a negative Widal's reaction with the patient's serum.

A case recorded by Lewis and Le Conte (q. v.) shows the value of a blood examination in these conditions. A patient with an ovarian cyst developed typhoid fever, which was accompanied by a leucopenia. Suppuration then occurred in the cyst and a leucocytosis was noted. The cyst was then tapped vaginally, reinfection from the cut surface resulted in a relapse and a leucopenia again resulted.

Two points of interest are suggested by the case here recorded, viz. :

1. Infection of the cyst contents by the *B. typhosus* through the blood stream.

2. The production of pus by a pure typhoid infection.

In the absence of bowel adhesions the bacilli must have been carried to the cyst by means of the blood stream. That typhoid bacilli may enter the blood stream has been proved by the employment of improved cultural methods. Thus Castellani¹⁹ obtained typhoid bacilli from the blood by culture in twelve out of fourteen cases.

Further, in a recent and exhaustive research on the bacteriology of the blood in typhoid fever Coleman and Buxton²⁰ have arrived at the following conclusions:

1. The typhoid bacillus is present in the blood in every case of typhoid fever.

2. The bacillæmia in typhoid fever does not constitute a true septicæmia, but it represents an overflow of bacilli from the lymphopoietic organs.

3. The clinical picture of typhoid fever results only from the infection of the lymphopoietic organs by the typhoid bacillus, with invasion of the blood stream and destruction there of vast numbers of bacilli.

4. The endotoxins of the typhoid bacillus are not cumulative in action and convalescence from the typhoid fever *per se* is established within a few days after the disappearance of the bacilli from the blood.

On these grounds the metastatic transference of the bacilli to various regions and organs of the body, and the occurrence therein of post-typhoid suppuration is not difficult to explain. Such suppuration has been observed, not only in ovarian cysts, but also in the lungs, lymph glands, the diaphragm, the salivary glands, the testis, the thyroid, the gall bladder, the joints and, with greatest frequency of all in the bones, as a suppurative periostitis.²¹⁻²³

Since the bacilli rapidly disappear from the blood stream, infection of these organs must have occurred during the bacillæmia of the acute stage of the disease, and the bacilli must have lived in their local nidus since the attack, which may have occurred months or even years before.

As regards the production of pus by a pure typhoid infection, it has long been denied, especially by Baumgarten and Fraenkel, that the *B. typhosus* was possessed of pyogenetic properties, and that when such occurred a mixed infection was present suppuration being caused by the other organism present, or that the pus-producing organism had been overgrown by the *B. typhosus*.

The incorrectness of this view was definitely settled by Kruse³⁰ who collected in Flüggès' Handbook a large series of experimental observations, by himself and others, which have conclusively proved the possession of pyogenetic properties by the *B. typhosus*.

From the bacteriological standpoint, three varieties of post-typhoid suppuration, alike in ovarian cysts and other parts of the body, may occur:

1. A mixed infection, where both pyogenetic cocci and *B. typhosus* are present.

2. A secondary infection, caused by invasion of pyogenetic cocci into an organ whose resisting power has been lessened as the result of typhoid fever.

3. A pure infection by the *B. typhosus* alone.

The case I have now recorded provides a typical example of the last variety.

REFERENCES.

1. Bland-Sutton. "Diseases of the Ovaries and Tubes," London.
2. Pfannenstiel. *Erkrankungen der Eierstöcke in Veit's Handbuch.* Vol. iii.
3. Olshausen. *Krankheiten der Ovarien.*
4. Menge und Krönig. "Die Bakterien des weiblichen Genital-kanals."
5. Martin. "Die Krankheiten der Eierstöcke und Nebeneierstöcke."
6. Walzberg. "Beiträge zur Pathologie und Diagnostik der Bauchgeschwülste."
Berl. klin. Wchnschrft., 1888, p. 1,008.
7. Kümmell. "Verhandlungen der geburtshülflichen Gesellschaft zu Hamburg."
Central. für Gynäkol., 1890, p. 81.
8. Werth. "Über post-typhöse Eiterung in Ovarialcysten." *Deutsch. med. Wchnschrft.*, 1893. No. 21, p. 489.
9. Schipperowitsch. Ref. Wunderli in Brun's *Beiträge zur klinischen Chirurgie*, 1900. Vol. xxvi., p. 715.
10. Sudeck. "Über post-typhöse Eiterung in einer Ovarialcyste: casuistisches Beitrag zur Frage der pyogenen Eigenschaft des Typhus-bacillus." *Münch. med. Wchnschrft.*, 1896. Vol. xliii., No. 21, p. 498.
11. Pitha. "Kasuistischer Beitrag zur post-typhösen Eiterung in Ovarialcysten."
Central. für Gynäkol., 1897. Vol. xxi., p. 1,109.
12. Wallgren. "Ein Fall von Typhus-Infection einer Ovarialcyste." *Archiv für Gynäkol.* Vol. lix., p. 15.
13. Engelmann. "Ein Beitrag zu dem Nachweise von Typhus-bacillen in vereiterten Ovarialcysten." *Central. für Gynäkol.*, 1901. Vol. xxv., p. 633.
14. Walker. "Infection of an Ovarian Cyst by the Typhoid Bacillus." *Amer. Pract. and News*, 1902. Vol. xxxiii., p. 420.
15. Lewis and Le Conte. "Infection of an Ovarian Cyst during Typhoid Fever: Report of Two Cases: Operation: Relapse: Recovery." *Amer. Journ. of the Med. Sciences*, 1902. Vol. cxxiv., p. 590.
16. Zatschenko. "Beitrag zur Frage der Abdominal-typhösen Suppuration der Ovarialcysten." *Monats. für Geburts. und Gynäkol.* Also "Kasuistischer Beitrag zur typhösen Eiterung in Ovarialcysten." *Russkig Wratsch* No. 30 (in Russian).
17. Dirmoser. "Über eitrige Adnexerkrankungen infolge der Typhus Abdominale."
Central. für Gynäkol., 1904. Vol. xxviii., p. 1,177.
18. Bensis. "Eiterungen einer Ovarialcyste, hervorgerufen durch den Eberth'schen Bazillus." *Orient. med.*, Feb. and Mar. (inaccessible), 1906. Also brief abstract in *Central. für Gynäkol.*, 1906. Vol. xxx., p. 1,243.
19. Castellani. "Sul reperto del bacillo tifico nel sanguine." *Riforma Med.* Vol. xvi., Nos. 8 and 9.
20. Coleman and Buxton. "The Bacteriology of the Blood in Typhoid Fever."
Amer. Journ. of the Med. Sciences, 1907. Vol. cxxxiii., p. 896.
21. Loew. *Wiener klin. Wchnschrft.*, 1897. No. 51.
22. Pataki and Werner. *Zeitschr. für Hyg. and Infektionskrank.* Vol. xxvii., No. 1.
23. Miller. Ref. *Central. für Chirurgie.* No. 10.
24. Swain. *Ibid.*
25. Schmidt. *Deutsch. med. Wchnschrft.*, 1896. No. 32.
26. Bruni. Ref. *Central. für innere Med.*, 1897.
27. Bruhl. *Ibid.*
28. Ferret. *Ibid.*
29. Keen. "The Surgical Complications of Typhoid Fever," Philadelphia.
30. Kruse. "Flügge's Handbuch der Mikro-organismen."