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# THE GONOCOCCUS IN THE PUERPERIUM, WITH REPORT OF SEVENTEEN CASES<sup>1</sup>

By W. S. STONE, M. D., and ELLICE McDONALD, M. D.

THE relation of gonorrhœal infection to the puerperium has not been studied as fully as the importance of the subject demands. Some obstetricians have asserted that it causes little or no morbidity, while others have reported cases with severe constitutional symptoms, high fever, and even death from infection in which the gonococcus was the only organism isolated. While this study has little bearing upon gonorrhœal infection during pregnancy, save for a suggestion as to its relation to premature termination, the results of the study will be better understood if the literature of both conditions is briefly reviewed.

Seitz (1) states that after the disappearance of the acute stage of gonorrhœa, conception may occur, as sufficient number of normal epithelial cells remain in the uterine mucosa. A post-conceptional gonorrhœal endometritis may occur during the first three months of pregnancy.

Bumm (2) and Wertheim (3) think that the gonococci disappear with the further development of the pregnancy, and, when the decidua reflexa unites with the decidua vera, the cavity is free from micro-organisms. Exacerbations may occur immediately after labor from the bacteria remaining in the deep cervical glands.

Sänger (4) considers a growth of gonococci to be possible during pregnancy, for he has found them in pieces removed by curettage, and small abscesses have occurred, as a result of which hemorrhages and abortions are not infrequent; in spite of such changes, however, pregnancy may continue.

Frühenholz (5) thinks gonorrhœa is less often a hindrance to conception than is generally supposed, and that it is an infrequent cause of interruption of pregnancy, although gonococci have been found in the placenta by Fabre (6), Maslowsky (7), and Draghiesen (8). Frühenholz believes the occurrence of acute symptoms in the beginning of pregnancy to be due to the lighting up of a chronic process. This will account for both mild and severe puerperal

disturbances in cases in which no vaginal examinations have been made.

Fehling (9) thinks that the infection usually occurs with or soon after conception, and that tubal disease develops before labor.

Audebert (10) says that gonorrhœa causes pregnancy to terminate prematurely in two out of three cases.

Noeggerath's (11) classic paper, based upon his own clinical experiences before the discovery of the gonococcus, still forms the basis of our present knowledge of this special relation of gonorrhœa, as well as that of the more general subject of chronic gonorrhœa. Noeggerath's opinion of the importance and frequency of this infection in the puerperium was first corroborated by Sänger's study of 230 cases in which 35 (or 15 per cent) had adnexal disease that could have been ascribed to the puerperium. He believes, however, that severe disturbance, as in the case reported by Graefe, in which the symptoms began 12 hours after labor, is rare.

Steinbuchel (12) studied 328 cases of pregnancy and found the gonococcus to be present in 70, and in three others, in which the findings were negative before labor, the gonococci were identified in the lochia during the puerperium. Sixteen per cent of these cases had a puerperal morbidity, while of 245 cases of pregnancy with negative findings, only 11 per cent had a morbidity. Of 274 cases with a normal puerperium, gonorrhœa was diagnosticated either clinically or microscopically in 18 per cent.

Kronig's (13) study of this subject is most complete, and contains practically all of the literature up to the year 1897. He found that in 296 cases of puerperal fever a gonorrhœal endometritis existed in 31. He calls particular attention to the necessity of excluding the presence of other bacteria which may cause a puerperal infection; it should also be known that the fever is not caused by disease of other organs, and that the infection has spread to a hitherto intact portion of the genital tract.

<sup>1</sup> Read before the New York Obstetrical Society, December, 1905.

Martin (14) has recently given the histories of 13 patients suffering from chronic gonorrhœa in eight of whom there was a rise of temperature during the puerperium. Although he considers the clinical course of this infection to be mild, the temperature rarely reaching 40° C. in any of these cases, yet he does not think the late appearance of the fever to be at all characteristic. In two of his cases it appeared during labor, and in five it began late in the puerperium.

Feis (15) pictures the clinical symptoms as those of an acute salpingitis lasting from three to ten days and beginning early in operative cases. He mentions the possibility of confusing this infection with an appendicitis, and he thinks a high pulse with a relatively low temperature to be characteristic. Fehling also speaks of the relatively high pulse.

Taussig (16) says the symptoms begin on the sixth day, with a profuse yellowish and odorous discharge that is very irritating to the external genitals. Rigors or a distinct chill then occur, followed by a temperature of 103° F. and a pulse ranging from 100 to 110; colicky pains, headache, and general malaise are also present. The fever may be high for two or three days without the irregularity seen in streptococcus infections.

Kronig (13) found that the fever was the first symptom to appear, and reached its maximum in the largest number of cases on the third day. The infection either remained localized and symptoms disappeared in three to four weeks, or was transferred to other parts of the body. He has seen a salpingitis from gonorrhœal infection on the eighteenth day of the puerperium, and acute pelvic peritonitis with the formation of a purulent exudation in Douglas's cul-de-sac on the twelfth day. He particularly emphasizes the fact that gonorrhœal endometritis may exist in the puerperium without fever, as this occurred in 9 out of 50 observations that he made.

Although the transference of this infection from the genitalia of puerperal women to other parts of the body has been noted by a few authors, yet recent investigations upon gonorrhœal urethritis in the male have shown that general infection is not uncommon.

Young (17) has reported such cases, and

Wynn (18) has given a description of the post-mortem lesions of several cases of general gonorrhœal infection.

C. K. Winne, Jr. (19), in a scientific review of some of the extragenital lesions due to the gonococcus, has included some references that are of considerable importance in connection with this paper. He mentions Bichelonne's case of general infection with secondary localization, showing how a mild urethritis may be the starting-point for a much more serious condition, either by extension of the infection to neighboring organs of the genito-urinary tract, by actual invasion of the blood-current with the organisms, or merely from an absorption of their toxins. A reference is made to Pidoux, who, in 1866, called attention to the pallor, cyanosis, and slight but rapid emaciation as a manifestation of a toxæmia. In addition to the work on gonococcus toxins by De Christmas and Wasserman, two cases are given of gonorrhœal infection, reported by Krause (20), with proofs of the existence of the gonococcus in the blood, showing the possibility of this condition in the puerperium.

Harris and Dabney (21) have recently reported a fatal case of gonorrhœal endocarditis in the puerperium, and refer to two suspected cases.

Heller (22), in a paper on *Phlebitis Gonorrhœica*, collects 24 cases from the literature, and reports one case. More extended observations may show this infection is the cause of some cases of phlebitis and thrombosis occurring in the puerperium without any other discoverable evidences of infection.

The seventeen cases here reported were studied in the wards of the Lying-in Hospital<sup>1</sup> in 1904, and were collected from 172 cases of pregnancy. The clientèle of this hospital is mainly recruited from the lower East Side of New York, and the cases include many nationalities. Only selected cases were examined for the gonococcus, and in suspicious cases repeated examinations were made until a definite positive or negative result could be obtained.

In this hospital, bacteriological examinations are made as a routine in all cases of fever

<sup>1</sup>We are indebted for assistance in the bacteriological part of this study to Dr. Martha Wollstein, formerly pathologist to the Lying-in Hospital, and her assistant, Dr. Caroline Finley.

in the puerperium, and the taking of intra-uterine cultures offered an opportunity to examine for the gonococcus by means of smears. In addition, many cases were examined for the gonococcus without intra-uterine cultures being taken. Among these were cases in which the fever was not high enough or too transient to offer an indication for intra-uterine examination, and cases in which there were other indications for examination for the gonococcus. In all, 53 cases were examined for the gonococcus, and some of these were examined many times, for, unless the organism was distinctive and characteristic, repeated smears were made until the diagnosis was decided.

All our cases came under observation after labor had begun, so that we were unable to watch the effects of the disease during the course of pregnancy. Several cases had evidences of a possible gonorrhœa, as a history of vaginal discharge with or without the presence of condylomata and vulvo-vaginal abscess, but these were not considered in the study until the gonococci could be demonstrated microscopically, although such cases were treated at labor with great care, so as not to spread infection from the original focus.

Demonstration of a biscuit-shaped intracellular diplococcus, of the morphology of the gonococcus and negative to Gram's stain, was considered sufficient evidence upon which to base a diagnosis of gonorrhœa. Other diplococci, negative to Gram's and corresponding to Bumm's coccus, were found; but it was possible, by repeated examinations and their extracellular character, to differentiate them from the gonococcus. Smears were taken at various times in the puerperium, and it was found difficult to demonstrate the gonococcus until pus-cells appeared in numbers in the lochia. Smears taken in the early part of the puerperium were found to be obscured by blood-cells. Demonstration of the organism was seldom successful before the fifth day, and increased success was obtained as the puerperium advanced. The site in the genital canal, which gave the greatest success in finding the organism, was within the cervix and about the level of the internal os. Vaginal smears were occasionally successful, but it was found difficult to distinguish the gonococcus

on account of other organisms, which were more prevalent as the puerperium advanced. Several unsuccessful attempts were made to cultivate the gonococcus; in three instances there was overgrowth with other organisms. Streptococci were found associated with gonococci in two cases, and the colon bacillus in one case. These cases will be indicated in the tables. In three cases, intra-uterine cultures were negative, while gonococci were demonstrated in smears by special staining. In eleven cases without intra-uterine culture, the gonococcus was demonstrated upon cervical smears by special staining; in four of these it was the only organism noted, and in the other five, other organisms, as "Gram-negative bacilli," "Gram-positive bacilli," and "Gram-negative cocci," were found.

Acute purulent conjunctivitis in the infant has been accepted in some studies as evidence of gonorrhœa in the mother.<sup>1</sup> This was found in our investigation to be fallacious, and was only considered an indication for the thorough bacterioscopic examination of the lochia. In all institutions, in spite of great care, there is the possibility of infants acquiring gonococcus conjunctivitis by other causes than vulvar discharges. Every precaution was taken to prevent such infection, and when such infections occurred, the infants were immediately isolated. Infants with purulent conjunctival discharge, not known to be due to the gonococcus, were kept separate until a bacterioscopic examination could be made. No convalescent mother was allowed to carry or touch any baby save her own, and wet-nurses were examined for gonococci before they were permitted to nurse healthy babies. All babies with infected eyes were brought by special nurses to their mothers for feeding. Their eyes were carefully bandaged, and every precaution was taken to keep them apart from the other babies. Nurses attending mothers were not permitted to care for any of the babies, nor were the baby-nurses permitted to attend the mothers. In spite of these precautions of isolation and special care, two infants with healthy mothers acquired gonococcus conjunctivitis during this time, and repeated bacterioscopic examinations of

<sup>1</sup>The Influence of Gonorrhœa in the Puerperium. Transactions North of England Obstetrical and Gynecological Society, 1900.

mother's uterine and vaginal discharges, at various periods in the puerperium, showed that the gonococcus was not present. For this reason no cases have been included in this series, save those in which the gonococci were found in the vaginal or uterine discharges.

Holt's recent study of gonococcus infections in children has shown that it is practically impossible to prevent the occurrence of the disease in institutions.

#### CASE 1. PREMATURE LABOR—INFECTION WITH STREPTOCOCCUS, GONOCOCCUS, AND COLON BACILLUS

Primipara, aged 18. Premature labor occurred six days before admission to the hospital. A seven months' child lived only one hour. Since the second day of puerperium, she had had abdominal pain and fever. Upon admission to the hospital the temperature was 104° F.; pulse 110, regular, of high tension. Neither abdominal tenderness nor rigidity was present. Uterus was well involuted. Vaginal examination showed many vulvar condylomata and a profuse purulent discharge. The uterus was anteverted, soft, tender, and immovable. The os admitted one finger, and no retained gestation products could be felt. The lateral fornices were extremely tender, and on the right side there is a fixed mass of moderate size. A rectal examination corroborated the vaginal. A smear from inside the cervix showed gonococci and streptococci. Culture from the interior of the uterus gave a pure growth of streptococci. The blood-culture was negative. Leucocyte count was 29,000, of which 90.5 per cent were polymorphonuclears. Urine showed a trace of albumin with hyaline casts. Leucin and tyrosin were absent. The diagnosis at this time was septic endometritis with gonorrhœal salpingitis. On the seventh and eighth day her condition was unchanged. Bowels moved freely. Evening temperature was 102°, with morning remission. There was a slight pain in the hypogastrium. On the eighth day the temperature was 103° in the evening and pulse 100. No abdominal rigidity was present. On the ninth day, at 4 A. M., after a large movement of the bowels, the patient complained of sudden severe abdominal pain and difficulty in breathing. Pain was referred to the epigastrium and right lumbar region. It was peristaltic in character, intermittent, and intense. Tongue was dry, and there was slight vomiting of clear green fluid. Pulse rose to 120, and was thready. Abdomen was very markedly rigid and tender. Expression was anxious, and patient cried out with pain. Vaginal examination showed slight fullness in the cul-de-sac, with marked tenderness, otherwise as before. Leucocytosis at this time was 11,000, of which 89.2 per cent were polynuclears. Patient was put on the operating-table four and one-half hours after onset of acute pain and rigidity. Laparotomy was done under ether anæsthesia in Trendelenburg position, with median incision. On opening the peritoneum large quan-

ties of seropurulent fluid escaped. Severe general peritonitis was present, with marked congestion of the visceral blood-vessels. Peritonitis was most intense in the pelvic region. Appendix was adherent to right tube and ovary. Right tube was large, much thickened and inflamed, and covered with tags of adhesions. Pus exuded from the fimbriated end. There were the remains of many recent adhesions in the region of the right tube and in the right side of the pelvis. Seropurulent fluid had penetrated to all the interstices of the intestines. Right tube and ovary were removed with the uterus, leaving the left tube and ovary and stump of cervix. Pus exuded from the cut surface of the right broad ligament. The entire peritoneal cavity was flushed with hot saline. Iodoform gauze was passed through the cervix, and abdomen closed by through-and-through silkwork-gut sutures, as patient's condition was poor. Death occurred after four hours, without rally.

Blood-cultures on special media (serum agar and ascitic agar), taken just before operation, were negative. Cultures taken at operation from the peritoneal pus and from the fimbriated end of the tube gave bacillus coli and streptococci; from the inner end of the tube, no growth; from the uterine cavity, no growth. Smears taken at autopsy from the peritoneal pus and from the fimbriated end of the tube showed streptococci, gonococci, and bacilli, which were Gram negative. Gonococci were also found in the inner end of the tube.

Autopsy cultures showed from the heart's blood streptococci; no gonococci on special media; from the peritoneal pus, streptococci and bacillus coli.

Autopsy showed that there was a suppurative lymphangitis extending through the broad ligament and general peritonitis.

*Diagnosis.* Suppurative salpingitis and perisalpingitis. Septic endometritis. Lymphangitis. General septic peritonitis from infection with streptococcus, colon bacillus, and gonococcus.

#### CASE 2. PLACENTA PRÆVIA MARGINALIS — GONOCOCCUS INFECTION

Primipara at full term was brought in by the ambulance, with uterine bleeding and in labor. Os was one finger dilated, long, and rigid, and the placenta could be felt partially overlapping the os. Mother's pulse was 110 and foetal heart was 140. The cervix and vagina were packed tightly with gauze, and patient was put to bed until dilatation progressed. Pains continued with moderate severity, and seven hours after packing, patient was brought to the operating-room and manual dilatation of the cervix followed by bimanual version, and breech-extraction was performed. Placenta was manually extracted and uterus was not packed. A slight skin perineal tear required three sutures. Puerperium was uneventful until the sixth day, when a sudden rise of temperature to 103.8° occurred, with two chills, and a pulse of 130. There was pain and tenderness in the right lower quadrant of the abdomen and moderate rigidity of the right rectus. Cervical smear at this time showed gonococci.

Temperature was normal on eighth day, and continued low, with slight rise; an ice-bag relieved the pain. Further convalescence was uneventful. Baby's birth-weight was 3,250 grammes, and on the thirteenth day it had returned to birth-weight. The child's temperature was slightly irregular, reaching 100.6° and 100° on the second and twelfth days, respectively. There was slight intestinal disturbance with green stools after the sixth day, but recovery by treatment with rectal salines.

#### CASE 3. GONOCOCCUS INFECTION

A primipara at full term entered the hospital during the first stage of labor. Delivery was uneventful. Temperature went up twelve hours after labor at 100.4°, and continued high for eight days, reaching 103.8°, with pulse 120 on fourth day, when the uterus was explored and douched with salt solution. Intra-uterine cultures and blood-cultures at this time were negative, and gonococci were obtained on a cervical smear. There was little or no abdominal pain or rigidity. Convalescence was quick after the ninth day, and at the time of discharge from the hospital, uterus and appendages were free and not tender. Patient returned for examination after six weeks, and uterus was found to be free, well involuted, and appendages negative, but a profuse creamy purulent discharge from the cervix showed numerous gonococci by bacterioscopic examination. Baby's weight at birth was 3,500, and weight at discharge was 2,900. There was irregular temperature, never reaching 100°, and marked intestinal disturbance with green stools. The baby did very badly after leaving the hospital, and was referred to the Babies' Hospital, where it improved with artificial feeding.

#### CASE 4. COLON AND GONOCOCCUS INFECTION

A primipara, aged 17, entered hospital four days before labor. Temperature was normal during this time. Labor uneventful, and a progressive rise in temperature began on first day and continued for six days, reaching 102° on the fourth, fifth, and sixth days. Uterus was explored, douched, and packed with iodoform gauze on the fourth day. Intra-uterine cultures taken at this time showed colon bacilli, while gonococci were found on cervical smears. Rigidity was very marked in the lower abdomen on the second and third days, and disappeared on the seventh day. There was a sharp pain in the right lower quadrant during the early part of the attack, but no mass could be palpated, although vaginal examination showed marked resistance and tenderness in the fornices without a definite mass. Temperature became normal on the ninth day, and examination at discharge showed a subinvolved uterus with tender vaginal fornices.

Baby's birth-weight was 3,100 grammes, and weight at discharge was 2,500 grammes. Child did very badly, with irregular temperature, reaching 102.4° on third and 101.6° on fourth day. Intestinal disturbance was marked, with green stools and inflamed buttocks. On the ninth the eyes showed a purulent discharge, with the presence of gonococci; they were clean on the eleventh day.

Placenta of this case showed areas of necrosis in the chorion, surrounded by small round-cell infiltration. This was limited to a small area, and extended to the villi. No gonococci could be demonstrated in the placenta.

#### CASE 5. GONOCOCCUS INFECTION

A primipara at full term entered hospital in the first stage of labor, which was uneventful. Temperature was normal until the fourth day, when it rose to 101°, and to 101.8° on the fifth day. Irregular temperature lasted for nine days, reaching 101.8° on tenth day of the puerperium. There was slight abdominal pain and no rigidity. The lochia became purulent, and cervical smears showed numerous gonococci in pure culture. Patient has a history of cough for ten years, and had fine and coarse râles in both lungs, without dullness. Sputum was clear and tenacious, and did not show any tubercle bacilli or septic organisms on bacterioscopic examination. Examination at discharge showed uterus small and mobile, appendages free, and a profuse purulent discharge from the cervix.

Baby's birth-weight was 2,950 grammes, and weight at discharge was 2,750 grammes. Child's temperature was irregular, reaching 100° on the ninth and tenth days. There was slight intestinal disturbance, with green stools.

#### CASE 6. GONOCOCCUS INFECTION

A primipara at full term entered hospital four days before labor. Temperature was normal during this time, but pulse once went to 120. Labor was prolonged, and membranes ruptured when cervix was slightly dilated, and clear liquor escaped. Some liquor, which had been caught above the foetal head, escaped at birth, and was viscid and purulent in appearance. Temperature rose on labor-day to 100°, and continued high for nine days, with irregular intermissions, reaching 101° on third day and 100° on fifth day. There was marked pain and rigidity in the lower abdominal region on the third, fourth, and fifth days. On the second day the uterus was explored, douched, and packed with iodoform gauze, which was removed twenty-four hours later. Cultures taken at this time on blood agar, serum agar, and blood serum were negative. Smears were negative after labor, after uterine exploration, and at removal of gauze, but gonococci were found in a cervical smear taken on the seventh day of the puerperium.

Examination at discharge showed a tender subinvolved uterus, an enlarged right tube, and purulent uterine discharge.

Microscopical examination of the placenta showed small infarcts and areas of very marked inflammatory infiltration, with polynuclear leucocytes in the chorionic membrane and villi, as well as in many of the intervillous spaces.

Baby's birth-weight was 3,800 grammes, and weight at discharge was 3,300 grammes. The temperature was irregular, reaching 103° on the third day. Intestinal disturbance was not marked.

## CASE 7. GONOCOCCUS INFECTION.

An elderly primipara entered hospital at full term, and two days before labor. Labor was uneventful, and a second-degree perineal laceration occurred and was repaired. Temperature was slightly irregular, reaching 100° on the first and fifth days. On the fifth day there was pain and rigidity in the lower abdominal region, more marked on the right side. Gonococci were found in a cervical smear taken at this time. Pain and rigidity lasted two days, and was relieved by an ice-bag. After the seventh day, puerperium was uneventful, and examination for discharge showed the pelvis to be negative.

Baby did very badly, and ran an irregular high temperature, 101-102° from the first to the seventh days, and on the eighth day temperature was 103°. After this time baby was artificially fed, but continued to sink.

Baby's birth-weight was 3,300 grammes, and weight at discharge was 2,400. Intestinal disturbance was marked, and green stools continued in spite of treatment. Child was removed from the hospital against advice on the fourteenth day, with temperature of 96° and moribund.

## CASE 8. GONOCOCCUS INFECTION

A primipara at full term entered hospital in the first stages of labor. Low forceps-operation was done; a first-degree perineal laceration occurred and was repaired. Patient ran an irregular temperature below 99.8° until the thirteenth day, when it reached 100°, and on the fifteenth day the temperature was 100.8°. After this it became normal, and remained so until discharge. Gonococci were demonstrated in cervical smears on the seventh day of the puerperium. Examination for discharge was negative, and neither pain nor rigidity was noted.

Baby's birth-weight was 3,625 grammes, and weight at death on thirteenth day was 2,550 grammes. Baby's temperature was slightly irregular, going up two days before death to 100.6°. Intestinal disturbance was marked, and there was progressive loss of weight until death occurred on the thirteenth day. A purulent discharge from the eyes appeared on the third day, and contained gonococci. This was absent on the fifth day. Post-mortem examination showed ileocolitis and marasmus.

## CASE 9. GONOCOCCUS INFECTION

A primipara, aged 17, was admitted at full term. There was a history of profuse discharge during pregnancy. Membranes had ruptured. Pelvis was flat, and a median forceps-operation was done. There was no perineal laceration. Temperature was slightly irregular, reaching 100.8° on the fourth day. Gonococci were found in a cervical smear on the fifth day. There was slight abdominal pain. Examination for discharge was negative.

Baby's birth-weight was 2,400, and at discharge on the tenth day the preliminary loss of 200 grammes was regained, and the weight was again 2,400 grammes.

## CASE 10. GONOCOCCUS INFECTION

A primipara at full term was admitted in labor. Labor was uneventful. Temperature was irregular, but below 100° until the seventh day, when it rose to 101.6°, with pulse of 120. Gonococci were demonstrated in a cervical smear at this time. Temperature was normal on the eleventh day, and patient was discharged on the sixteenth day. Vaginal examination for discharge was negative.

Baby's birth-weight was 2,725 grammes, and birth-weight was regained on the sixteenth day.

## CASE 11. GONOCOCCUS INFECTION

A primipara was admitted to the hospital before term, and temperature was normal until labor, two weeks later. Temperature did not rise in the puerperium above 99.4°. Gonococci were obtained from the vaginal smears on the eighth day. Examination for discharge showed resistant and tender fornices, so patient was advised to return for examination. Bilateral salpingectomy was done five months later for purulent salpingitis.

Baby's birth-weight was 2,600 grammes, and weight at death on the tenth day was 2,550 grammes. On the seventh day purulent discharge from the eyes appeared, and gonococci were found microscopically. Baby's temperature at this time went up to 102°, and remained high until death. Post-mortem examination showed pneumonia, acute fibrinopurulent pleurisy, suppurative hypogastric arteritis, and suppurative meningitis, with no evidence of extension along the optic nerves.

## CASE 12. GONOCOCCUS INFECTION

A primipara at full term was admitted in labor, which was uneventful. Course of puerperium was uneventful. Gonococci were found in cervical smears on the eighth day.

Baby's birth-weight was 2,950 grammes, and weight at discharge on fifteenth day was 2,750. Temperature was irregular, reaching 100° on the tenth and eleventh days. There was intestinal disturbance, with green stools and inflamed buttocks.

## CASE 13. GONOCOCCUS INFECTION

A primipara with a history of burning and pain on urination and profuse vaginal discharge four years before, and of two abortions at three months, was admitted in labor. Labor was prolonged, and position posterior. Child was delivered by forceps, Scanzoni's operation being performed. Patient had mitral regurgitation, which complicated an otherwise uneventful puerperium. Gonococci were found in cervical smears on the seventh day.

Baby's birth-weight was 3,450 grammes, and weight at discharge on the fifteenth day was 2,900 grammes. Temperature was irregular, reaching 101° on the third day and 100.6° on the seventh day. Intestinal disturbance was marked, and green stools were present.

## CASE 14. GONOCOCCUS INFECTION

A primipara at full term entered the hospital in labor, which was normal. Convalescence was uneventful, save for purulent lochia, in which the gonococcus was found. At discharge on the tenth day the uterus was fixed and parametria resistant.

Baby's birth-weight was 3,300 grammes, and weight at discharge was 3,500 grammes. Temperature was slightly irregular, reaching  $100.4^{\circ}$  on the sixth day. Stools were green after the fifth day.

## CASE 15. STREPTOCOCCUS AND GONOCOCCUS INFECTION

A primipara, who had been delivered with forceps eight days before by an outside physician, was admitted to the hospital with puerperal infection. Temperature was  $101^{\circ}$  and pulse 120. There was profuse vaginal and uterine discharge and an infected perineal laceration. Cervical smears showed streptococcus and gonococcus. Intra-uterine cultures showed streptococcus. The uterus was curetted, douched, and packed with iodoform gauze. Convalescence was tedious, but uneventful. Baby had very irregular temperature, running up to  $101^{\circ}$ , and green stools, but improved on being nursed by another mother.

## CASE 16. PREMATURE LABOR—GONOCOCCUS INFECTION

A primipara was admitted to the hospital three days after a premature labor at seven months. Puerperium was uneventful, except for a slight irregularity of temperature. Gonococci were found in the cervical discharge on the seventh day of the puerperium.

## CASE 17. PREMATURE LABOR—GONOCOCCUS INFECTION

A primipara at six and three-fourths months of pregnancy was admitted to the hospital in labor. A vulvo-vaginal abscess had been opened the previous day in the dispensary of another hospital. Labor was uneventful, and no vaginal douche was given after delivery.

On the first day, patient had sudden severe pains crampy in character, and located in the lower abdominal region. Breathing caused pain, and there was slight vomiting. Rigidity of the abdominal muscles was marked, and tenderness was extreme. Temperature was  $101.8^{\circ}$ , and pulse ranged from 100 to 140. During the following week the condition improved, and pain was less. Gonococci were found in the vaginal discharge, and intra-uterine cultures were negative. Temperature was normal from the third to the ninth day, when it rose to  $102.4^{\circ}$ , and pulse to 140. Rigidity and pain were not so marked as in the first attack. Further convalescence was uneventful, and examination for discharge showed a subinvolved uterus, tender on pressure, with resistant parametria. There was much purulent discharge.

A consideration of these cases shows some points of pathological and clinical interest.

Case 1, which terminated fatally, demonstrated the coexistence of the lesions of both the gonococcus and streptococcus infection. The purulent inflammation of the right tube, without the presence of the streptococcus except at its fimbriated extremity from the proximity of the peritoneal infection, illustrated the way in which a gonococcus infection travels by direct continuity of mucous membranes. The blood-vessels and lymphatics of the right broad ligament, from the uterine wall to the region of the ovary and outer end of the tube, were distended with pus, showing the common mode of advance of the streptococcus infection. This lesion may be frequently seen in cases of streptococcus infection, in which the tube, although swollen from inflammatory oedema, contains pus only at its outer end, and if the patient survives the infection, the tube returns to its previous condition, in contrast to the anatomical condition subsequent to a gonococcus infection, in which the tube becomes either a pyosalpinx or atrophied and closed by adhesions. The gonococcus infection, in other words, spreads in the same way during the puerperium as it does under other conditions, except that the puerperium furnishes more favorable conditions for its rapid advance. The co-existence of both kinds of infection in this case is also important from a bacteriological standpoint. Kronig studied the relations of the gonococcus in the uterine cavity to pyogenic, saprophytic, and anaerobic bacteria, and, contrary to the opinion of Bumm and Doederlein (23), rarely found gonococcus co-existing with other pathogenic micro-organisms. He does not consider that the gonococcus produces changes in the tissues favorable to the growth of other bacteria. In the present series, case 15 also showed the coexistence of the streptococcus and the gonococcus infection.

Case 11 illustrated the common relation of the gonococcus to the puerperium, which was uneventful, except for the presence of a profuse discharge and a moderate amount of pelvic pain and tenderness. The patient's return to the ordinary duties of life was followed by attacks of pain of varying severity, alternating

with periods of comparative good health. Such a condition finally ended, five months later, in an acute attack of pelvic peritonitis, following which, both tubes, enlarged and filled with pus, were removed by operation. The history of poor health since confinement might have masked the real etiological factors. The writers believe that this often occurs, and accounts for the opinions of those who ascribe a pyosalpinx to the common streptococcus infection of the puerperium.

### PLACENTA

Our efforts to discover any relation of the gonococcus to changes in the placenta were only partially successful. Five placentæ were examined microscopically, and placentitis, limited to circumscribed areas, was found in two. Both patients showed marked constitutional symptoms in the puerperium, having fever reaching to  $102^{\circ}$  in one case and  $101^{\circ}$  in the other. The gonococcus was demonstrated upon smears from the uterine discharges of both, but the intra-uterine culture in one was negative, and in the other the colon bacillus was found. One case had a purulent discoloration of the liquor amnii. Both cases had marked rigidity and pain from the third to the fifth day, and enlarged adnexa were noted in both by the vaginal examination.

### I. TABLE OF ONSET OF FEVER ( $100^{\circ}$ ) IN SEVENTEEN MOTHERS<sup>1</sup>

	Cases
Fever began on labor-day in.....	3
Fever began on first day in.....	1
Fever began on second day in.....	1
Fever began on third day in.....	1
Fever began on fourth day in.....	1

<sup>1</sup> Immediately before this paper was read, there appeared in the *American Journal of Obstetrics*, December, 1905, an investigation, by Little, of the bacteriology of the pregnant uterus, with the report of 50 cases of pregnancy. Gonococci were found in 16 cases; 10 of these were in pure culture, 2 were mixed culture, and in 4 there were doubtful diplococci, which may have been the same organism, not decolorizing with Gram's stain.

He has taken  $100.6^{\circ}$  (mouth temperature) as the standard of fever, and had 10 cases of fever; of these, 3 were gonococcus infections, and all 3 were in pure culture. If, however,  $100^{\circ}$  be taken as the standard of fever, there are 10 cases of gonococcus infection above this temperature; of these 10 cases, 6 were in pure culture, 2 mixed culture, and 2 were doubtful.

Little found the gonococcus but once at the time of labor, and achieved the best success as late in the puerperium as the seventh day. One child was premature and one macerated. Subinvolution was noted in 8 cases, and pelvic inflammatory-disease in 2 cases; 11 were primiparæ and 5 multiparæ.

<sup>1</sup> Fever began on sixth day in.....	1
Fever began on seventh day in.....	1
Fever began on thirteenth day in.....	1
Case admitted on sixth day—streptococcus and gonococcus.....	1
Case admitted on eighth day—streptococcus and gonococcus.....	1
Total cases of fever.....	12

### II. TABLE OF MAXIMUM TEMPERATURE OF TWELVE MOTHERS

	Cases
<sup>2</sup> Maximum temperature from $100-100.8^{\circ}$ in.....	4
Maximum temperature from $101-101.8^{\circ}$ in.....	4
<sup>3</sup> Maximum temperature from $102-102.8^{\circ}$ in.....	1
Maximum temperature from $103-103.8^{\circ}$ in.....	2
<sup>2</sup> Maximum temperature from $104-104.8^{\circ}$ in.....	1

### III. TABLE OF DURATION OF FEVER IN TWELVE MOTHERS<sup>4</sup>

	Cases
Fever lasted 1 day in.....	3
Fever lasted 2 days in.....	2
Fever lasted 4 days in.....	1
<sup>1</sup> Fever lasted 6 days in.....	1
Fever lasted 8 days in.....	1
Fever lasted 9 days in.....	2

### FEVER

A number of these patients had a rise of temperature; 12 patients in 17 had a rise above  $100^{\circ}$  (mouth temperature), and should the cases of mixed infection be eliminated, 9 out of 14 cases of gonococcus infection had such a rise of temperature.

To consider these 9 cases first, the fever was mild in 3, moderately severe in 4, and in 2 was severe. In these 9 patients, the fever began on labor-day in 3 instances; in 5 the onset of fever was distributed over the first week, and in one it was as late as the thirteenth day. The average duration of fever in these 9 cases was 4.1 days, varying from 3 cases in which fever lasted one day to two cases in which it lasted nine days. The fever was in all very irregular and followed no definite curve. In

<sup>1</sup> Colon and gonococcus.

<sup>2</sup> One case, streptococcus, and gonococcus in each class.

<sup>3</sup> One case colon and gonococcus.

<sup>4</sup> One case (streptococcus and gonococcus) admitted on sixth day; fever lasted until death, five days.

One case (streptococcus and gonococcus) admitted on eighth day; fever lasted one day.

one case the infection was very severe, but in the majority this was not so, and temperature curves corresponding to the so-called "sapræmic" or septic absorption temperature were more frequently found, the temperature suddenly rising and returning to normal in three or four days.

In addition, three patients with mixed infection had a temperature above  $100^{\circ}$ . In one, colon and gonococcus infection, the temperature rose on the sixth day, lasted six days, and reached  $102^{\circ}$  three times. This patient showed moderately severe constitutional symptoms. Two cases of streptococcus and gonococcus infection had widely varied courses. One, admitted on the eighth day, with a history of fever and chills following an operative labor, had a mild course, and fever lasted only one day; the other, admitted on the sixth day, with a history of a seven months' abortion and fever, had a high temperature, a severe course, and general peritonitis followed by death.

In 5 of the 17 women, the temperature never rose to  $100^{\circ}$ , although there were, in 2, slight abdominal pain and rigidity.

#### PARITY.

All of the 17 cases reported were primiparæ; one, however, had had two previous abortions at the third month. The majority of the patients delivered in the hospital are primiparæ, for, with a large outdoor service, it is planned that multiparæ be attended in their own homes, and they themselves do not desire admittance. It is, however, surprising that not one multipara should have been included in our series.

#### ABDOMINAL SYMPTOMS

Pain was present in 9 of the 17 cases; in 3 it was described as severe, in 2 as moderate, and in 4 as slight. It was usually referred to the lower abdomen, and several times was spoken of as "cramps." It was often referred to one or the other side.

Rigidity occurred 7 times, and was marked in 3, moderate in 3, and slight in 1. It was also usually referred to one or the other side, when moderate, but when marked, to both sides.

#### INTERRUPTION OF PREGNANCY

Premature labor occurred in three patients,

at periods varying from six and one half to seven months. In one case there was streptococcus and gonococcus infection, suppurative salpingitis, and general peritonitis. Operation was done immediately after the general infection of the peritoneum, but was without avail. This was the only death in the series. Another had a vulvovaginal abscess, which was opened the day previous to admission. The patient was admitted in labor, and had moderately severe constitutional symptoms in the puerperium. Pain and rigidity were marked; temperature rose to  $102^{\circ}$ , and there was, on one occasion, vomiting. The third case was uneventful and made a good recovery. These three abortions were the only late abortions occurring in 172 lying-in patients. In view of this fact, it seems that the gonococcus may be a cause of late abortions, which has not been given proper consideration, and that in all cases of unexplained late abortion this infection should be considered. No cases of early abortion were examined, save, at the time, when uterine exploration and removal of placental remains were being effected, and at this time the quantity of blood so obscured the field that it was impossible to make a proper search for the organism microscopically.

#### LOCHIA

The character of the lochia in the early part of the puerperium was unchanged, but after the fifth day it became more and more purulent, terminating in a number of cases in a profuse yellow discharge. The more pus-cells found in the lochia, the greater was the ease of recognition of the gonococcus, and it was found that the best site from which to take smears was within the cervix. Bacterioscopic examination of the uterine discharges was found to be of great value in the diagnosis of the infecting organism in other cases than gonococcus infection, although at the same time intra-uterine cultures were usually taken. The examination of smears from the uterus often permitted the immediate recognition of the streptococcus instead of waiting 24 hours for cultures to grow out.

#### SUMMARY OF INFANTS

Fourteen full-term babies and three premature labors were the result of the seventeen

pregnancies. Thirteen babies were under observation an average time of thirteen days, and one, which was admitted on the eighth day, has been excluded from the summary. All of these thirteen mothers were infected with the gonococcus, and from one, in addition, the colon bacillus was found by intra-uterine culture.

#### BABIES' MAXIMUM TEMPERATURE

	Cases
Maximum temperature 100-100.8° in . . . . .	4
Maximum temperature 101-101.8° in . . . . .	1
Maximum temperature 102-102.8° in . . . . .	1
Maximum temperature 103-103.8° in . . . . .	3
Irregular temperature to 99.8° in . . . . .	3
Normal temperature in . . . . .	1

While it is more or less common to have a rise of temperature during the first two or three days of infant life, these temperatures were, as a rule, too marked to be explained by "starvation temperature," and usually occurred later. The temperatures of babies is much more easily disturbed than that of adults, and it is even said that a fit of crying will cause a rise. Several hundred observations in normal babies were made before and after crying, and the conclusion was that they are not affected when normal. These rises of temperature cannot be thus explained.

The average weight at birth of the thirteen babies was 3,107 grammes, and the average weight when they passed from observation by death or discharge, after an average time of thirteen days, was 2,705 grammes. The average weight-loss at thirteen days was thus 402 grammes. When it is considered that the preliminary weight-loss of normal well-nourished babies is usually recovered in from seven to nine days, this weight-loss will be seen to be unusual at a time when a gain should be shown. Only one infant showed a gain (200 grammes) and two others recovered the preliminary loss, and were discharged weighing the same as at birth. The greatest losses were 1,075 and 900 grammes.

Gonococcus conjunctivitis occurred in three infants. The discharge from the eyes began on the third, sixth, and ninth days, and lasted in two cases two days, and in one case three days. No infant at birth showed any signs of inflamed eyes, and all had Crede's nitrate-of-

silver treatment for prevention of the infection. In addition, during this time, as before referred to, two infants of healthy mothers had gonococcus conjunctivitis. Two full-term infants died, and one was taken away moribund, with temperature of 96° and after a weight-loss of 900 grammes. If all the infants be considered, including the case which came late under observation, and which recovered, this gives a mortality of three in fourteen babies (21.4 per cent), and if the three cases of premature labor from six and one-half to seven months be also added, there is a loss of six infants in seventeen pregnancies (35.3 per cent).

Autopsy reports of the two babies which died in the hospital are as follows: One, ileocolitis and marasmus; one, bronchopneumonia, acute fibrinopurulent pleurisy, suppurative meningitis, and suppurative hypogastric arteritis.

The majority of the thirteen infants, all breast-fed, showed evidences of disturbed nutrition and intestinal disturbance. This was shown by green stools, distinct from the passage of meconium, and by a progressive loss of weight. The marked difference between the nutrition of these babies and of those nursed by non-infected women was a most striking fact in the study of this series of cases. A transference in two instances to the breasts of non-infected women was followed by a rapid improvement. Our efforts to satisfactorily explain these facts were unsuccessful. In the light, however, of the recent work relative to the existence of gonococcus toxins, these observations may find some reasonable explanation.

Stone has noted, in his service at the Vanderbilt clinic, that of the patients with evidences of gonorrhœa, very few have been able to nurse their children for any length of time, and that the infantile mortality among those who have nursed is considerably higher than can be accounted for by the ordinary causes.

#### CONCLUSIONS

The results of this study showed that gonococcus infection was present in a much larger proportion of patients of the obstetrical clinic than was previously supposed by the writers. This is explained by lack of knowledge of dis-

covery of the organism. The difficulty of cultivation of the gonococcus is one factor in this failure of isolation. Intra-uterine or other cultures in cases of mixed infection may show the accompanying organisms, while the gonococcus fails to grow out. The failure to discover the gonococcus by means of smears is explained by the fact that such smears are usually taken early in the puerperium, at the time when fever or other morbid symptoms appear, and are obscured by blood. The positive diagnosis of the gonococcus is difficult in the absence of pus-cells, and these do not, as a rule, appear until later in the puerperium. The spread of the gonorrhœal infection also increases the ease of recognition of the organism as the puerperium advances. These facts explain the varying results of other investigators.

The temperature curves of those patients having fever were so varied, and differed so much one from another, that no reliance could be placed upon this as an aid to diagnosis. One patient had a temperature-chart similar to that of acute streptococcus infection, and others showed varying grades of height and duration of temperature. However, the most common type seemed to be that of a sudden rise followed by return to the normal in three or four days, simulating sapræmia.

The puerperal state has a direct influence upon the course of the disease. Gonorrhœa, which has been latent before labor, commonly spreads upward with rapidity during the puerperium. This was shown, in our series, by the presence of abdominal pain and rigidity in patients not previously thus afflicted. The presence of these symptoms, when accompanied by fever, is considered to indicate the extension of the disease beyond the confines of the uterus. Thus may be explained many of those cases of salpingitis following labor, which are supposed to be the result of puerperal infection.

All patients in this series were primiparæ, although a certain number of multiparæ were delivered in the clinic. The tendency of gonorrhœal disease to spread upward and involve the tubes is believed to account for this disproportion. One-child sterility is thus caused by gonorrhœal disease.

Gonorrhœal infection is a frequent cause of

abortion, and in all cases of late abortion this should be considered. Thus if adnexal disease follows an abortion, it should not be ascribed to the abortion, as gonorrhœal infection may have been the cause of both.

The writers would not draw any positive conclusions, because of the limited number of observations, as to the relation of this infection to nutritional or other disturbances in the children, except for the well-known frequency of ophthalmia.

The morbidity and the mortality, however, are relatively so marked in this series of cases that a relation between the disease in the mother and nutritional disturbances in the child is probable.

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