

Original Articles.

PYELONEPHRITIS OF PREGNANCY AND THE PUERPERIUM.

(WITH A REPORT OF CASES.)

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PYELONEPHRITIS is an inflammatory condition of the pelvis of the kidney with extension into the renal tissue, and is, according to Councilman¹, invariably due to a suppurative lesion caused by pyogenic bacteria. Although the infection occurs primarily in the pelvis, invasion of the adjacent structures is not long delayed. Nor is this to be considered remarkable when one remembers the relation of the calices and the pyramids, and the rich lymphatic circulation of the entire organ. Simple pyelitis, therefore, as an independent clinical entity, may be disregarded.

The disease, as a complication of pregnancy, was either unrecognized or confounded with cystitis until Kruse² of Wurzburg, in 1889, first brought it to the attention of obstetricians. In 1892 Reblaud³ published a monograph upon the subject and reported five cases. The condition was further described by Vinay⁴ of Paris in 1899. It remained, however, for Craigin⁵ in 1904, to publish the first important article upon the subject in English, the writer's discussion having been based upon his experience with a series of ten cases.

Before entering further into a consideration of this disease, it seems wise at this juncture to review briefly the normal anatomy of the kidneys. The right, in addition to being the smaller—weighing 5 to 8 grams less than the left—is usually nearer the middle line and 1 to 2 centimeters lower than its fellow. It is also subject to greater variations of position, and when very low, its pelvis presents on the anterior surface with a sharp angle in the ureter where it emerges from its insertion behind the renal vessels. To the lower pole of this kidney, too, one is apt to find a wandering artery causing flattening of the ureter at the point of contact with it.

All of these factors conspire to render the right kidney the organ of election for obstructive process and the subsequent infection of the distended pelvis. Still another important anatomical consideration is the course and character of the ureter. Making a sharp angle as it leaves the pelvis, it passes downward, inward and for-

ward, the right making a long curve, and enters the true pelvis at the sacro-iliac junction. At this point it crosses the external iliac artery near the bifurcation of the common trunk. Here, too, the fatal predisposition of the right half of the urinary tract continues; for the external iliac vessels overlap more prominently on the right than the left, and the right ureter is correspondingly more exposed to pressure at the pelvic brim than its fellow. Within the pelvis both lie within two centimeters of the body of the uterus.

The normal calibre of the ureters at the widest point is about that of a goose-quill, and, according to Ludwig, the urine is excreted through them at a pressure about equal to 10 millimeters of mercury. Normally they contract in rhythmic peristalsis every fifteen seconds. Lucas⁶ found in experiments upon dogs that contractions in the middle portion, which is supplied chiefly by the spermatic and inferior hypogastric plexuses and is deficient in nerve cells, were inhibited by pressure on the distal portion, similar to that which might be caused by the pregnant uterus upon it as it rests upon the pelvic brim.

The frequency of this disease is much underestimated, yet from a review of the literature it appears to be of comparatively rare occurrence. Vinay in 1894 had seen but two cases and during the next five years had only increased his acquaintance to nine. Recently he is accredited with estimating that but one case a year occurred at his clinic in Paris. Craigin saw ten cases from 1900 to 1904. Kendirdjif⁷ collected from the literature 62 cases in 1904, Opitz⁸ 84 cases in 1905, Cumston⁹ 10 cases in 1906, Swift¹⁰ 40 cases in 1907, Mirabeau¹¹ 10 cases in 1907, and French¹² 20 cases in 1908. It is not unlikely that the same cases were reported in more than one series.

The disease occurs most frequently in poorly nourished women between the ages of 20 and 45 years. Much difference of opinion is met in regard to the influence of the number of pregnancies upon its occurrence. The writer agrees with Craigin that the greater the tone of the abdominal muscles, the greater the predisposition. Over 60% of the cases in the present series occurred in the first or second pregnancy. The favorite time seems to be in the last two months, though cases beginning at the fourth month have been recorded. It is generally admitted that the right kidney is the more commonly affected. When both kidneys are involved, the primary lesion is invariably found on the right. Vineburg¹³ estimates that about 15% of the cases have bilateral pyelonephritis. Twynam¹⁴ considers the likelihood of pyelitis in the right kidney sufficiently great as to cause him to advise against pregnancy in patients who have had the other removed.

The possibility of a pre-existing movable kidney in some of the cases is worthy of consideration in view of Glenard's¹⁵ estimate that this condition occurs in 22% of all adult females. In

statistics which he reviewed, Jones¹⁶ found that 90% of the cases of movable kidney occurred in women and 80% were right-sided, as were 55% of his own cases of hydronephrosis. These, together with the anatomical factors to which attention has already been called, and upon which they no doubt depend, play an important role in the infection of the right kidney.

Still another mechanical influence worthy of notice is the position of the fetus and the character of the presentation. About 90% of all presentations are vertex. Of these, in a great majority the fetus lies in the right oblique uterine diameter, which causes the hard head to exert greater pressure on the right ureter, already flattened by dextro-torsion of the uterus, than upon the left. The artificial hydronephrosis which results makes the right kidney a prey to subsequent infection. The engorgement or passive congestion which has resulted from pressure on the inferior vena cava, and, in the later months of pregnancy upon the renal veins, has already rendered the organ vulnerable. The stagnant pool of the renal pelvis then becomes a hatchery for vagrant bacteria.

Their mode of entrance is uncertain. Four avenues are possible,—the blood-stream, the lymphatics, extension upward from the bladder and direct transmission from the colon. Infection by the pyogenic cocci, with the exception of the gonococcus, and by the tubercle bacillus may come through either of the first two channels. Why the kidneys should be marked for the sacrifice, and especially the right kidney, is not altogether clear, as the other organs are certainly apt to be in a reduced state as well as the kidney. During an acute infection Rolly¹⁷ found bacteria vastly more numerous in the blood than in the urine, so it would seem likely that another avenue was selected. Infection by extension from the bladder is rare, and is then invariably gonococci.

Direct transmission through the colon into the kidney was demonstrated experimentally by Mirabeau. He ligated the right ureter in rabbits and then fed the animals pure colon cultures. Death resulted from pyemia or septiemia, and the right kidney showed the characteristic lesions of pyelonephritis. Similar investigations have shown that the presence of the colon bacillus in the blood-stream is not essential to the production of this condition. Kastner¹⁸ in his studies of coli-pyelitis in children found the majority of cases in females. Briscoe¹⁹ in the *Lancet* has called attention to the greater frequency of the infections of the kidneys in women than in men, and believes that the organisms find entrance through the intestinal coats. By far the greater number of cases show the colon bacillus in culture. In infections of the urinary tract Dodge²⁰ found it in 49 out of 61 cases, Craigin in 3 out of 7; Swift in 17 out of 17, Vinay in 8 out of 9, Brown²¹ in 7 out of 20, and Rovsing²² in 285 cases of pyelonephritis found the colon bacillus in 180.

The predominance of this organism may be readily accounted for by the tendency to constipation in pregnant women; the accessibility it has to the kidney, especially the right, a third of whose peritoneal covering is denied it by the overlapping of the ascending colon; and the omnipresence of the bacillus in the large intestine.

The pathological changes in the kidney in pyelonephritis are striking.

The organ is large, congested and opaque, with occasional ecchymoses on its surface. Small yellowish areas appear in and beneath the capsule, representing necrosis with invasion of leucocytes. On section the cortical and sub-cortical zones are studded with miliary abscesses due to bacillary emboli. Infection by the staphylococcus is characterized by abscesses in the pyramids alone, while in infection by the colon bacillus, the lesions are found universally distributed.

The pelvis is generally greatly dilated and contains pus, colloid material and decomposed urine. It is usually dilated downward, forward and inward—following the line of least resistance. In one of Jones' cases its capacity was found to be five ounces. The ureter is invariably dilated as far as the brim of the pelvis, and may be as large as the small intestine. Stadfield²³ found dilatation of the ureter in 9 out of 12 autopsies performed upon pregnant women. Olhausen²⁴ observed 14 cases of dilatation of the right ureter in a series of 16 cases, and Lohlein²⁵ estimates that 25% of all kidney complications show dilated ureters at autopsy. Where the pelvis has long been distended, a valve-like fold may sometimes be found at the proximal ureteral orifice, which no doubt plays an important part in causing subsequent attacks. Occasionally strictures occur. Stoeckel²⁶ has found a point 10 to 13 cm. from the bladder where the ureteral catheter passes with difficulty.

The symptoms are subject to a wide range of variation in number and intensity. Usually they develop insidiously and without attracting the patient's attention, suddenly fulminating in a stormy onset. Flatulence, constipation or diarrhea with malodorous stools may precede the attack.

Irritability of the bladder with frequent smarting urination is an early sign. In the acute cases this is followed quickly by pain in the loin, radiating around to the front of the abdomen and down into the pelvis. Chills, headache, fever and profuse perspiration occur in most of the cases. Intermittent pyuria is a constant symptom. Nausea and even severe vomiting may be present. A dry cough, increased frequency of respiration and voluntary dyspnoea with subcrepitant rales at the base of the lung for the affected side are observed in the more severe cases.

The patient's general condition depends upon the amount of absorption and the virulence of the infection. A terminal state resembling ty-

phoid occurs in the fatal cases. The temperature varies from normal to 104.5 and follows an irregular curve. It usually attains its greatest height synchronous with the attacks of pain.

Great variation of the pulse is noted, its rate ranging from 96 to 160. Reed²⁷ and others have observed that it does not always follow the temperature. Elevation of the blood pressure may occur in suppurative processes limited to a single kidney. As shown by the observations of Kato²⁸, it may reach 150 millimeters, at which point it remains until tension on the kidney is relieved, being higher and more persistent than the transient type described by Prentiss²⁹ occurring in normal pregnancy. The leucocytosis seldom exceeds 18,000, but may be as high as 30,000. A differential count of the white cells shows an excess of polymorphonuclears.

The urine is turbid, pungent and generally high colored. Pus, in a moderately severe attack, may constitute one per cent. to five per cent. of the entire volume. The reaction is invariably acid. Pilcher,³⁰ however, from catheterization of the ureter, concludes that it may be alkaline in the pelvis if there has been long retention. The 24 hour amount varies greatly from day to day, being diminished as much as 30% during an acute attack. The specific gravity is rarely in excess of 1.016. Elimination of urea, which according to Matthews³¹ is usually lower than normal in the late months of pregnancy, is probably but slightly influenced. An excess of indican is usually found. Albuminuria occurs in practically every case, and may be caused by pressure on the ureter alone. The degree seems to be independent of the severity of the lesion. Chute³² has found as little as 1-40 of 1% estimated by Esbach's method in a case of pyelonephritis of considerable severity. Examination of the sediment usually shows the presence of pus, transitional epithelium, candate cells from the pelvis of the kidney, and, in the more severe cases, granular casts and blood.

On physical examination the abdomen is generally found to be distended and tympanitic. Tenderness is most marked in the loin, and just above McBurney's point. It may be elicited, too, at the costo-vertebral angle by bi-manual pressure. Enlargement of the kidney is found in about 20% of the cases, and is to be suspected when ballottement can be elicited even in the absence of a palpable mass. In a small number of cases the ureter may be felt by vaginal examination, where it crosses the pelvic brim, as a thick, tender cord of the calibre of a lead pencil.

Edema of the extremities or dependent parts is infrequent.

The diagnosis is not difficult in the majority of cases. Wherever there is a history of frequent voiding of turbid albuminous urine, purulent at intervals, accompanied by chills, fever, malaise and pain in the loin, pyelonephritis is to be suspected. Tenderness over the kidney and at the costo-vertebral angle, reflex flexion of the thigh and spasm of the recti and lumbar mus-

cles, and the presence of a palpable or ballotable kidney affords confirmatory evidence. It may be confused at the onset with pleurisy, pneumonia or influenza, or with lumbago; in the later stages with typhoid fever, with salpingitis and with uterine sepsis, with appendicitis, with cholecystitis, and with simple cystitis. The development of respiratory signs is usually sufficient to eliminate the first group. The leucocytosis is always higher than in typhoid and usually lower than in the acute surgical diseases of the other abdominal viscera.

The similarity of its course to that of uterine sepsis may be misleading, as can be seen from the experience of Esselbruegge,³³ who reports a fatal case in which pyelonephritis was found at autopsy. Acute cases resemble appendicitis so closely that the diagnosis is beset with difficulty. A moderately high white count, purulent urine, remittent pyrexia and transient pain, relatively infrequency of spasm of the rectus, and tenderness at the costo-vertebral angle, which is rare even in retrocecal appendicitis, serves to favor the diagnosis of pyelonephritis. A mild attack may simulate cystitis. The presence of caudate cells in the urinary sediment should help to differentiate them, although Cabot³⁴ believes their source cannot be identified with any degree of certainty. In cystitis the turbidity of the urine usually clears on standing by precipitation, while in pyelitis it persists as a hazy milkiness.

Bransford Lewis³⁵ and Chute recommend catheterization of the ureters as an aid to diagnosis, while Hoffman³⁶ advises against it.

The common complication is abortion, and this occurs only in a small percentage of the cases. Fetal death in utero is rare. The writer has seen it but once—the victim being one of twins.

Pyemia and septicemia have occurred only in the fatal cases. In one of the writer's cases definite signs of meningitis were noted 48 hours after spontaneous labor.

Surgical kidney is also a common complication. Cumston has collected from the literature 11 cases, Swift reports 5, and Le Wald,³⁷ Craigin and the writer 1 each.

Hydronephrosis from continued pressure on the ureter with valve-formation at the renal pelvis is considered by Sir Frederick Treves³⁸ as a possible permanent injury. Recurrence of the disease in the same and subsequent pregnancies is fairly common. The morbidity in the infants of mothers who have had several attacks is considerable. Poynton³⁹ reports a case of pyelonephritis of a new born infant whose mother had several attacks of the same disease during pregnancy.

The treatment must be for the most part symptomatic, and should be continued for some time after the attack appears to have ceased. Absolute rest in bed is essential. Posture is believed to hasten recovery. Elevation of the affected kidney, either by placing the patient in the latero-prone or semi-recumbent position, favors drainage. The writer has used a small firm

pillow such as is used in operations on the kidney by the lumbar route, placed beneath the loin on the sound side to further increase the freedom of the process.

The pain should be controlled by morphine or codeine,—given subcutaneously if there be much vomiting. An ice-cap to the loin often gives relief. Thorough catharsis should be established early, preferably by the use of calomel and salines. Fluids,—especially cream of tartar water,—should be forced to the extent of three or four litres a day. Sweating should be promoted to lessen the burden of the unaffected kidney. The diet should be extremely simple, consisting of milk, which should be skimmed if there be much digestive disturbance. Lactone buttermilk ought to prove useful.

Urinary antiseptics have been used with universal satisfaction. Hexamethylenamin or one of its equivalents, cystogen and urotropin, given in 5 grain doses at three or four hour intervals with a glass of water is the most valuable. In the writer's experience it acts more effectively when combined with an equal amount of lithium citrate. Helmitol, a derivative, is also strongly recommended. Churchman⁴⁰ believes that these substances simply inhibit the growth of bacteria in the urine without killing them. Kastner recommends that potassium citrate up to 40 grains a day be used in conjunction with urotropin, and Hicks⁴¹ advises the use of potassium iodide. Reed and Rovsing have used salol with good results. Many of the cases in this series have been treated by a method suggested by Dr. Newell with remarkably prompt results. They were given urotropin and lithium citrate in 10 grain doses at four hour intervals for 48 hours. Sodium benzoate in 10 grain doses at two hour intervals is then substituted and continued until the patient complains of a burning sensation in the region of the kidneys; the first combination is then at once resumed.

The change in the degree of acidity of the urine brought about by this medication renders it an uncongenial medium for the growth of bacteria, especially the colon bacillus, and the infection quickly subsides.

Drainage of the kidney by retained catheter is advocated by Rovsing in severe cases. Pilcher has instilled 1 dram 25% argyrol into the pelvis in six cases with good results, but advises this treatment only in cases persisting more than ten days.

The use of autogenous vaccines in colon bacillus infections has met with some success. Williams, Craigin and Newell⁴² conclude that their use may result in temporary cure of the symptoms, but not of the bacteruria, and that their value is much limited. Hicks,⁴³ Dodge, Kastner, Briscoe and Routh⁴⁴ report cases in which relief of the symptoms follow the injections. An initial dose of 30 to 50 millions is given and repeated once a week, the increase in the dosage being governed by the severity of the symptoms.

Obstetrical interference is seldom necessary.

Persistent cases late in pregnancy should be delivered. Markoe⁴⁵ changed the presentation of the fetus from the vertex to breech by external bi-polar version in two cases, the method being successful in but one.

When definite signs of a surgical kidney are present, nephrotomy for drainage of the organ should be performed. The danger of delay in operating is considerable, the septic process becoming general unless drainage is promptly established. In the opinion of the writer whenever the attack persists without remission for 72 hours or more, especially in the presence of a high pulse rate, the kidney should be drained by the lumbar route in the majority of cases. Roswell Park⁴⁶, Balloch⁴⁷ and others advise decapsulation in every case where it is necessary to drain the organ, and this procedure ought to contribute much to the conservation of its function. The mortality following nephrotomy is much less than after nephrectomy, Pousson⁴⁸ finding 21% of deaths in 600 cases of the latter operation. Kelly⁴⁹ has reported 3 nephrectomies with recovery in infections due to the colon bacillus.

The prognosis in pyelonephritis is good for recovery in most of the cases treated promptly. Cases developing in the early months of pregnancy have a tendency to recur and are likely to abort. Meek⁵⁰ has reported several cases that showed recurrence in succeeding pregnancies.

Careful attention to prophylaxis, special emphasis being laid upon the regulation of the excretory functions of the skin, the kidneys and particularly the intestine, will do much to prevent the occurrence or recurrence of the disease. Austin Flint's⁵¹ suggestion that the urine be examined weekly during the last six weeks of pregnancy should be followed in every case.

The duration varies in all types from a few days to weeks. Mixed infections generally run a protracted course. The outlook is unfavorable in cases that continue without remissions for more than three or four days. A tuberculous lesion of the kidney may not interfere with pregnancy as shown by Sondern's⁵² cases and one in the present series where only one kidney was present. The maternal morbidity is considerable, especially in long drawn out cases. Vineburg and Hicks regard the prognosis for the child poor, and when one considers the likelihood of premature labor and the degree of fetal intoxication which is present in severe infections, their conclusion seems amply justified.

From the study of the cases in this series and a review of the literature, these conclusions may be drawn:

1. Infection of the pelvis of the kidney invariably involves the parenchyma.
2. Owing to its anatomical relations the right kidney is the more vulnerable.
3. The disease is much more frequent than supposed; the writer estimates that it occurs once in every 3000 cases.
4. Malnutrition, constipation, and tonicities of the abdominal muscles, are predisposing factors;

tendency to renal abnormalities on the right, dextro-torsion of the uterus and predominance of positions in the right oblique diameter favor the infection of the right kidney.

5. Infection by the colon bacillus is the most common type, direct transmission through the intestinal walls being the probable mode of entrance.

6. The pathological picture shows the pelvis and ureter dilated with pus and miliary abscesses in and beneath the cortex.

7. The cardinal symptoms are smarting micturition, chills, fever, nausea and vomiting, pain in the loin and elevation of pulse. The urine is turbid, purulent and albuminous.

8. Tenderness in the region of the kidney is always present. Enlargement of the organ can be demonstrated in about one-fifth of the cases.

9. Abortion and surgical kidney are the most common complications.

10. The diagnosis can generally be made on physical signs and urine analysis, the differentiation from appendicitis presenting the greatest difficulty.

11. Prognosis is usually good for the mother and less favorable for the child.

12. Treatment by rest, sedation, catharsis and urinary antisepsis has met with success. The use of vaccines and pelvic lavage, if of any real value at all, entails dangerous delays and, being extremely technical, is beyond the scope of the rank and file of the profession. Early operation in cases that assume a surgical aspect is to be strongly recommended.

REPORT OF CASES.

In reporting these cases detailed accounts of their courses, urinalyses and treatment has been avoided. In all but two of the cases the urine was constantly acid, albuminous and purulent. Except where operative interference was necessary, the same line of medical treatment has been followed throughout.

CASE I. H. K. II Para. Admitted to Boston City Hospital May 24, 1904, in fourth month of pregnancy with pain in right flank, burning micturition and fever of one week's duration. The right kidney was tender and easily palpated and the urine was typical. She was delivered by breech extraction at term at the Boston Lying-in Hospital. In 1906 she had a trachelorrhaphy and a ventrofixation at the Massachusetts General Hospital. She entered the City Hospital Dec., 1908, seven months pregnant, with retention of urine and symptoms as before, and was discharged relieved in two weeks. She was readmitted in Feb., 1909, with recurrence. While in the hospital she started in labor and a Caesarian section was done on account of the condition of the cervix and lower uterine segment. Her renal symptoms cleared up during convalescence.

CASE II. M. M. Age 24. III Para. Admitted to hospital Jan. 30, 1906, in fifth month of pregnancy with fever, frequent chills, vomiting and burning micturition of five days' duration. W. C. 13,000, dullness and tenderness throughout right

flank. As symptoms increased in severity, an exploratory laparotomy was done and a distended gall-bladder was drained without relief of symptoms, which later became localized in the right kidney. The patient was discharged well four weeks after admission.

CASE III. M. K. Age 34. VIII Para. Admitted to hospital March 22, 1906, in the seventh month of pregnancy, having had intermittent pain in the right loin, with chill, fever and vomiting for one week. The right kidney was tender on palpation and the urine characteristic. As the symptoms failed to improve under treatment manual dilatation and delivery was performed March 14. W. C. 26,800. Patient made an uninterrupted recovery.

CASE IV. A. K. Age 24. II Para. Admitted to hospital Sept. 23, 1906, one month after normal delivery. During the third week of the puerperium she began to have pain in the right flank, chills and intermittent fever,—the symptoms steadily increasing. There was marked tenderness in the region of the right kidney, and the urine was characteristic. She was discharged relieved after one week of treatment.

CASE V. T. D. Age 22. I Para. Admitted to hospital March 26, 1907, one week after a miscarriage at four and one-half months. Chills, fever, vomiting and burning micturition for two weeks. Right kidney tender; W. C. 14,000, considerable pus in the urine. Patient practically well one week after admission. Patient died suddenly April 6, with symptoms of acute cardiac dilatation.

CASE VI. A. R. Age 28. II Para. Admitted to hospital Sept. 30, 1907, in sixth month of pregnancy. She had had severe pain in right flank, with fever, chills, vomiting, frequent painful micturition for four days before admission. Spasm and tenderness in the right flank and at the costo-vertebral angle, W. C. 14,000. Discharged well on Oct. 12.

CASE VII. C. M. III Para. Admitted to hospital March 6, 1908, at full term. An abdominal Caesarian section was performed for complete placenta praevia in which the patient made an uninterrupted recovery. Two weeks after discharge from hospital she was readmitted with symptoms of pyelonephritis in the left kidney. The right had previously, in 1906, been removed for tuberculosis. Frequent microscopic examinations of a very purulent urine failed to reveal the tubercle bacillus. The patient was discharged relieved in two weeks.

CASE VIII. M. G. Age 20, I Para. Admitted to hospital March 30, 1908, in sixth month of pregnancy for pain in right loin, chills, fever, vomiting and burning micturition of six days' duration. There was tenderness over right kidney and at costo-vertebral angle. W. C. 32,000, urine scanty during attacks of pain, rising to 40 ounces during remissions. Patient was discharged relieved April 22d.

CASE IX. I. W. Age 20. II Para. Admitted to hospital May 13, 1908, with pain in left lower quadrant, fever and frequent painful micturition. Tenderness in left loin and marked spasm and tenderness in right loin and at costo-vertebral angle.

There was considerable pus in the urine. Patient was discharged relieved May 23, but had similar attacks at intervals until delivery at term. During the next succeeding pregnancy she had several attacks in the last two months, and symptoms referable to the right kidney, until delivered at term by internal podalic version for prolapsed cord. She also gave a history of pyelonephritis during her first pregnancy which terminated in premature labor at seven months.

CASE X. H. L. Age 21. I Para. Admitted to hospital July 20, 1908, having had pain in right flank, chills, fever and vomiting for five days before entrance. Tenderness and spasm just above McBurney's point, W. C. 12,200, uterus enlarged to size of seven months pregnancy. Suspecting appendicitis a laparotomy was performed and the appendix, gall-bladder and pelvic viscera were found to be normal. Symptoms disappeared three days after delivery. Patient was discharged well Aug. 23, the urine still containing a small amount of pus.

CASE XI. C. B. Multipara. Admitted to hospital Aug. 10, 1908, on the twelfth day of the puerperium. For three days she had had pain in the right loin with fever and vomiting, marked tenderness over the right kidney, W. C. 26,000. The symptoms subsided on the fifth day, abruptly following the avoiding of a large quantity of purulent urine. Discharged well Aug. 24.

CASE XII. M. C. Age 30. II Para. Admitted to hospital Aug. 26, 1908, three weeks after normal delivery on account of chills, fever, vomiting, sharp pain in the left loin and painful micturition. The left kidney was readily palpable and the urine purulent. Discharged relieved Sept. 13.

CASE XIII. E. C. Age 32. I Para. Admitted to hospital Sept. 7, 1908, seven months pregnant. Pain in left flank, fever, vomiting and burning micturition for three days. Considerable tenderness, fullness and spasm over left kidney. Symptoms ceased five days after admission. Discharged well Sept. 15.

CASE XIV. H. F. Age 21. I Para. Admitted to hospital Sept. 29, 1908. Patient had had pain in right loin, chills, fever and burning micturition since a few days after instrumental delivery at term six weeks before admission. Tenderness and rigidity in both flanks, more marked on the right. Urine contained considerable pus. Patient discharged well Oct. 8th.

CASE XV. S. L. Age 26. Multipara. Admitted to hospital Oct., 1908, last month of pregnancy, on account of pain in right flank, chills, vomiting and painful micturition of three days' duration. Marked tenderness and spasm over right kidney. W. C. 12,000. As the patient's symptoms increased alarmingly, an internal podalic version was performed. Symptoms promptly cleared up after delivery. Patient was discharged well Nov. 9th.

CASE XVI. B. L. Age 31. VIII Para. Admitted to hospital Nov. 7, 1908, in fifth month of pregnancy, on account of pain in right flank, chills, fever, burning micturition of three weeks' duration. Right kidney tender. Symptoms subsided on the fourth day and the patient was discharged

well Nov. 17th, but returned with another attack one month later.

CASE XVII. E. F. Age 32. XIV Para. Admitted to hospital Nov. 25, 1908, five days after delivery of an eight-months' macerated foetus. For two days had had pain in right loin, fever and vomiting. Right kidney easily palpated. W. C. 25,000. Urine contained numerous granular casts and considerable pus. The kidney remained large for ten days, the mass suddenly disappearing simultaneously with the appearance of a large amount of pus in the urine. There was tenderness in the region of the left kidney throughout the attack. Patient discharged relieved Dec. 19th.

CASE XVIII. D. T. Age 33. III Para. Admitted to hospital Jan. 17, 1909, five months pregnant. For one week had had pain in back and right flank with chills, fever and painful micturition. Considerable spasm and tenderness over the right kidney. Patient remained in the hospital two months during which time she had frequent mild attacks of pain and pyuria. W. C. 15,000. Discharged well March 15. Entered the Lying-in Hospital with similar symptoms in April and was discharged well in a week. Was delivered normally May 9th. Had another attack of pyelonephritis May 10th, which lasted a week. Discharged well May 25th.

CASE XIX. C. T. Age 21. II Para. Admitted to hospital March 3, 1909, five months pregnant. Had an attack of pain in the right flank with scanty turbid urine, and burning micturition six weeks ago, the symptoms persisting for two weeks. Three days ago a similar attack began. Pulse 120. Temp. 103. W. C. 17,000. Marked tenderness and spasm over right kidney. Spontaneous labor began three days after entrance. Owing to the patient's condition dilatation and delivery was done under ether. There were twin fetuses, one occupying the left position being macerated for about a week. The patient's condition steadily grew worse, and she died of septicemia March 13th.

CASE XX. N. H. Age 27. VIII Para. Admitted to hospital March 4, 1909, in sixth month of pregnancy, having had pain in the right loin, chills, fever and vomiting at intervals for seven weeks. Painful micturition and cloudy urine during each attack. Marked tenderness in right flank. Patient had two attacks while in the hospital with sudden rise of temperature. Discharged relieved on March 17th.

CASE XXI. I. W. Age 25. II Para. Admitted to hospital March 13, 1909, seven months pregnant. Pain and tenderness in left flank, burning micturition and constipation for five days. Considerable tenderness in left loin. Urine markedly purulent. Symptoms subsided in 24 hours. Discharged against advice March 15th.

CASE XXII. E. S. Age 31. VIII Para. Admitted to hospital Sept. 26, 1909, in eighth month of pregnancy. Pain and tenderness in right loin, chills, fever and vomiting for three days. Had a similar attack two weeks ago in the hospital. Marked tenderness in right flank. W. C. 18,300. Symptoms persisted for two weeks with a chill at mid-day, followed by pain and rising temperature. The membranes were ruptured accidentally Oct. 9,

during packing of the cervix to induce labor. Following this the patient had no further attacks of renal pain. She was delivered normally Oct. 11th, and discharged well Oct. 24th.

CASE XXIII. H. D. Age 20. I Para. Admitted to hospital Oct. 22, 1909, to the Medical Service. Was later transferred to the Surgical Service for acute appendicitis, and again to the Gynecological Service for pyelitis. She had had pain in the right lower quadrant, vomiting, fever, and burning micturition for three weeks. Uterus enlarged to size of six months pregnancy. Marked tenderness over right kidney. W. C. 30,000. Labor induced by cervical packing Oct. 26, and terminated by spontaneous delivery of a breech Oct. 27. Symptoms cleared up promptly after delivery. Discharged well Nov. 13th.

CASE XXIV. M. R. Age 16. I Para. Admitted to Lying-in Hospital Nov. 18, 1907. Delivered normally at term Nov. 19th. Four days later pain and tenderness in right loin, temperature 101, W. C. 6000, urine purulent. Right kidney tender on palpation. The attack subsided in five days.

CASE XXV. M. C. Age 19. I Para. Admitted to hospital March 29, 1908. One week after low forceps operation an attack of pain in right loin, and painful micturition, temperature 104, W. C. 8000. Marked tenderness over right kidney. Symptoms disappeared in five days.

CASE XXVI. C. R. Age 39, XI Para. Admitted to hospital March 29, 1909, from Massachusetts General Hospital. Pain and tenderness in right loin, fever, and burning micturition of three weeks' duration. Considerable tenderness over right kidney and at costo-vertebral angle. Patient seven and a half months pregnant. Labor induced March 30th on account of symptoms by means of a Vorhees bag, and high forceps delivery performed March 31st. Symptoms slowly abated. Patient discharged April 25th.

CASE XXVII. F. H. Age 21. I Para. Admitted to hospital Sept. 22, 1909. Diagnosis of hydranios. Pain in both flanks, especially the right, frequent burning micturition, scanty cloudy urine for three weeks before admission. Marked tenderness over the right kidney. As the patient was in labor dilatation of the cervix was promoted by the introduction of the Vorhees bag. Delivery was normal. There was no recurrence of symptoms until the fourth day of the puerperium, when the right kidney was palpable and tender, and the urine very purulent. Symptoms had disappeared Oct. 2, and patient was discharged Oct. 8th.

CASE XXVIII. B. W. Age 24. III Para. This patient had a resection of both ovaries and a ventro-suspension performed at the Boston City Hospital Oct. 16, 1908. Eleven days later she had an attack of right-sided pyelitis. She applied for treatment at the Out-patient Department of the Lying-in Hospital Aug., 1909, in the seventh month of pregnancy on account of pain of the right loin and smarting micturition. The kidney was tender and the urine contained pus. She responded

quickly to treatment, but had another attack during the puerperium from which she recovered in a few days.

CASE XXIX. E. P. Age 29. II Para. Admitted to hospital Oct. 10, 1909. Had had sharp pain in right flank for ten days. Had been in bed four days on account of malaise, fever and chills. Frequently passed purulent concentrated urine. Considerable tenderness over right kidney and at costo-vertebral angle. Six months pregnant. W. C. 11,000. Delivered by precipitate labor Oct. 11th. Renal symptoms with the exception of pyuria, had disappeared Oct. 20th. On that day patient showed marked confusion and excitability, and her condition closely resembled typhoid fever. Pulse 120 to 140, temp. 99 to 101, W. C. 7500. Widal reaction negative. Urine contained a large amount of pus and the culture showed a pure growth of colon bacillus. Patient grew steadily worse, and died with symptoms of meningitis Oct. 21st.

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