

DILATATION OF THE URETER AND KIDNEY PELVIS DURING PREGNANCY

A PYELOGRAPHIC STUDY*

HERMAN L. KRETSCHMER, M.D.
AND
N. SPROAT HEANEY, M.D.
CHICAGO

The severest case of acute pyelitis of pregnancy that ever came under our observation was one in which the patient was in the fifth month of her first pregnancy. She was taken seriously ill, with a temperature of 103.4 F. The urine from the right kidney showed 2,560,000 pus cells and from the left kidney, 2,880 pus cells per cubic millimeter, and the cultures showed *B. coli*. There was marked prostration, icterus, and acute dilatation of the heart. The ureteropyelograms showed enormous dilatation of both kidney pelvis and ureters, with extreme torsion and kinking, and marked outward displacement of both ureters.

GROUP 1. ACUTE PYELITIS

In a study of eleven subsequent cases of acute pyelitis, there was marked dilatation of both ureters and kidney pelvises in six cases. In two cases only one side was injected, in both of which cases the injected side was

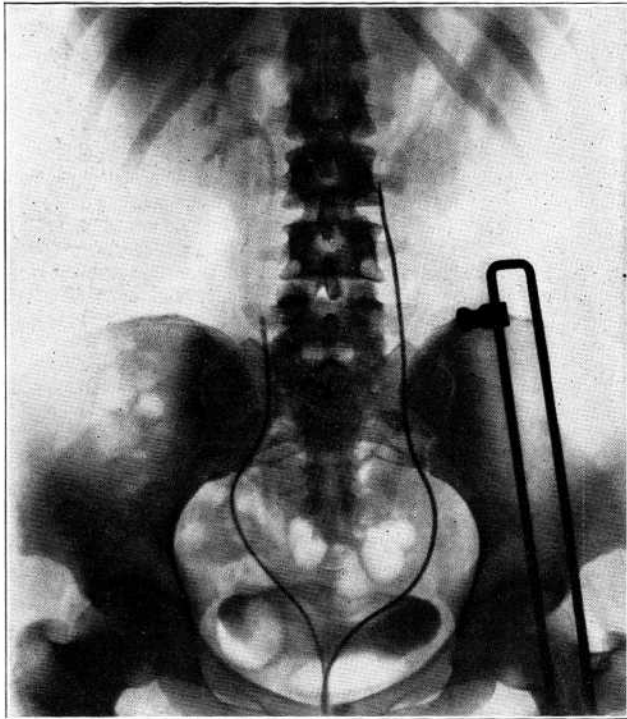


Fig. 2.—Primipara: Aug. 21, 1924; normal pelvis and ureter in early weeks of pregnancy; to be compared with Figure 3.

found dilated. In three cases in which both ureters were injected, the right ureter and kidney pelvis showed

enormous dilatation in two cases and only marked dilatation in the other, while the left ureter and pelvis were normal in all three cases.

These findings correspond to the general impression held regarding the presence of dilatation of the kidney pelvis and ureter in pyelitis of pregnancy.

Since dilatation of the ureters and of the kidney pelvises was so uniformly found, the question arose as

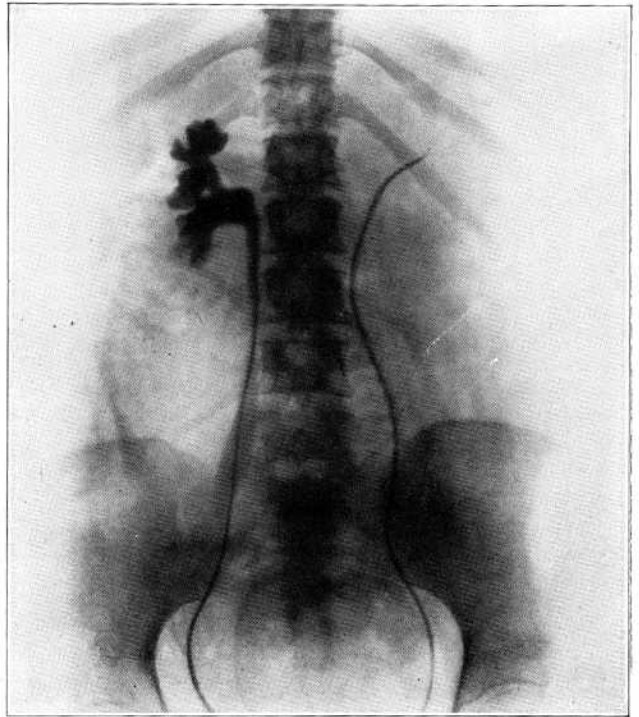


Fig. 3 (Mrs. M.).—Primipara: late pregnancy, Feb. 26, 1925; spindle-shaped dilatation of right ureter; dilated pelvis and calices; to be compared with Figure 2.

to whether this dilatation occurs only in such patients as develop pyelitis, or whether it occurs commonly in pregnancy and is, in consequence, a predisposing factor in pyelitis.

GROUP 2. NORMAL CASES

We therefore studied nineteen cases of normal pregnancy, selecting only such patients as were free of the usual symptoms and signs ordinarily considered as indicative of infection in the urinary tract, with the following results:

In the nineteen cases in this series, bilateral dilatation was found in nine cases (47.36 per cent.). In seven cases the kidney pelvis and ureter were dilated on only one side (36.84 per cent.). (In three of the seven cases only one side was injected.) In three cases no dilatation was found (15.8 per cent.). In one of the latter three cases the pelvises were normal but the ureters were not filled with the bromid solution.

The three cases showing no dilatation were as follows: quadripara, at term; primipara, at 32 weeks; primipara, at 25 weeks.

The nine cases showing bilateral dilatation were as follows: primipara, at 6 months, two cases; primipara, at 7 months, one case; secundipara, at 8 months, two cases; primipara, at term, three cases; quadripara, at term, one case.

The seven cases showing dilatation of only one side were as follows: primipara, at 6 months, one case; secundipara, at 3 months, one case; secundipara, at 5

* From the A. D. Thompson Medical Fund for Genito-Urinary Surgery and the Presbyterian Hospital.

* Read before the Section on Obstetrics, Gynecology and Abdominal Surgery at the Seventy-Sixth Annual Session of the American Medical Association, Atlantic City, N. J., May, 1925.

* Because of lack of space, this article is abbreviated in THE JOURNAL by the omission of several illustrations. The complete article appears in the Transactions of the Section and in the authors' reprints. A copy of the latter will be sent by the authors on receipt of a stamped addressed envelop.

DR. A. J. CARLSON, Chicago: This work is both new and important. I have followed it with great interest. But I am disturbed by Allen's finding that the substance is present in organs other than the ovary; namely, in the placenta, in the fetus, and also in the corpus luteum of pregnancy in the human female. That raises the question whether he has the normal hormone complex in the follicular fluid; whether there are various lipid soluble substances present or whether there is a splitting of the substance in the methods of preparation and preservation. That latter possibility is suggested by the fact that so far the hormone appears to be strictly only lipid soluble. It seems quite clear that, if this hormone passes from the follicle into the blood to be distributed from the uterus and vagina and other parts of the body, it must be soluble in the blood; that is, in salt solution. Dr. Allen stressed the fact that so far no effect has been produced by this hormone administered by mouth. It must be given hypodermically. Assuming that the substance is really a normal ovarian hormone, does that not bring a lesson to those who have employed ovarian therapy by mouth? Does it not suggest that most of the ovarian preparations on the market are to be avoided, since the lipid soluble materials have in most cases been taken out, and even if the hormone is in the material, it fails to act by mouth? I wonder whether Dr. Novak did not partly misunderstand Allen's position. As I understood this report, Allen has done no work injecting this material in either spayed or normal women to see its effect. He has obtained material from human sources and used this on his animals.

DR. ROBERT L. DICKINSON, New York: The question has been raised whether any of this work is applicable to the woman. Stockard and Papanicolaou showed, in 1917, that just as there is a cycle in the mucous membrane of the uterus which can be recognized in its stages of development and retrogression, so in the vaginal mucous membrane there is a cycle which can be demonstrated in lower animals by so simple a method as taking a smear from the vagina, whereby ovulation is accurately gaged. At Woods Hole last summer I asked how the test could be applied to women, whereupon the Committee on Maternal Health arranged for the test and supplied half the funds for work at the Woman's Hospital in New York. These daily vaginal smears of a long series of women for months will show whether we can determine when ovulation occurs. If it works,

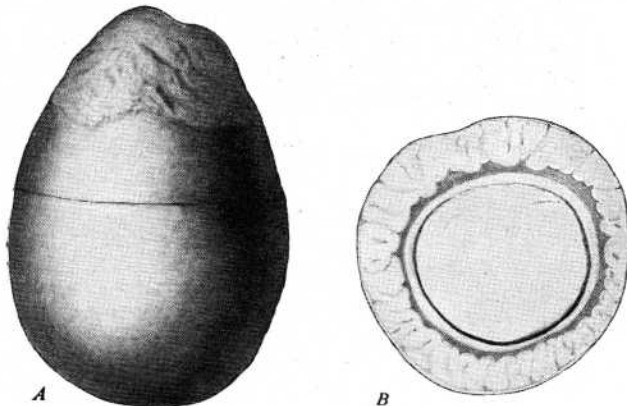


Fig. 11.—Corpus removed during the third month of pregnancy: A, full view; B, cross section.

it will tell us whether or not a given ovary is at work; whether in pregnancy cessation of ovulation has occurred; what is the "safe period" for a given woman, and it also shows whether a given ovarian or other extract used in women does or does not affect ovulation. The female sex hormone, says Robert Frank, who first, I understand, collected it from the ovarian follicle, is in three forms: He uses the follicular fluid and lipid extracts from the later stages of the corpus luteum, and from the placenta and gets positive results by all three methods. In white rats, using the device introduced into this type of research by Allen and Doisy, all three produce results. There is another test which Frank has developed, that of studying contraction of the uterus after the method of Blair. A rapid rate of contraction is negative; a slow rate is positive.

DR. GEORGE GRAY WARD, New York: I wish to correct one statement Dr. Dickinson made, which was that the funds for this research work at the Woman's Hospital were being provided by the Committee on Maternal Health. One half of the funds have been provided by the committee and the other half by the board of governors of the Woman's Hospital. I make this statement only because I feel that the board of governors would like to have that known. I wish to say, in addition to what Dr. Dickinson has said, that this work of Stockard and Papanicolaou will be valuable in another direction. They have been able to tell when conception has occurred by examination of vaginal smears long before any physical signs can be determined. So far as we have gone in the work

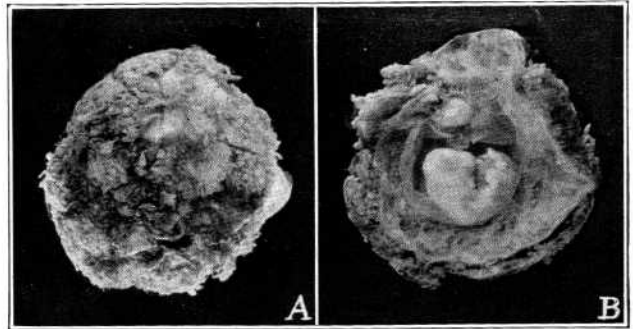


Fig. 12.—A, chorionic vesicle found free in a blood clot in the peritoneal cavity; B, vesicle opened showing 12.5 mm. embryo with the amnion and the yolk sac (just above the head).

at the Woman's Hospital in the prenatal clinic, this point has been confirmed in the human being as well. They have also been able to tell when conception has terminated by death of the ovum as, for instance, in an ectopic gestation or abortion.

DR. EDGAR ALLEN, Columbia, Mo.: To discuss briefly one of the points brought out by Dr. Novak, that of the differences between the lower mammals and man: We think that the continuation of the secretion of this hormone in considerable amounts by the human corpus luteum may possibly prove to be one of the important causal factors contributing to the difference between the human menstrual cycle and the estrous cycle in the lower mammals. Our quantitative analyses so far show less active material in the human corpus than in the follicular fluid, seeming to indicate that the hormonal function of the human corpus in the absence of pregnancy is waning from a maximum attained by the follicle before ovulation. Dr. Carlson has stressed the various human tissues that contain this active substance. It is, indeed, an interesting puzzle as to why the placenta (in women and cows) should contain this material. But since the follicular hormone may be extracted from the ovary of the hen, which species has neither corpus luteum nor placenta, the phylogenetic origin of this female sex hormone must in the ultimate analysis be referred to the follicle or even to the ovum itself. Dr. Dickinson's reference to his work with Dr. Papanicolaou on vaginal smears as an aid to the diagnosis of ovarian conditions in women is interesting. We have also made similar tests, in collaboration with Dr. Q. U. Newell, on vaginal smears from patients in the gynecologic clinic. Although we found a decided variation in the numbers of leukocytes and epithelial cells at different times in the cycle, results were not nearly so clear-cut as in rats, because normally no cornification occurs in the vaginal epithelium of women. Furthermore, the smear test is of greatest value in animals, in which sexual changes are not clearly marked externally. In the primates, menstruation furnishes such a prominent milestone that vaginal smears seem of secondary importance for diagnosis.

Laboratory Work in State.—Either state or local laboratory facilities should be provided to aid in the diagnosis of communicable diseases and to control water and milk supplies. It is especially desirable to have a laboratory in connection with the county health department when state laboratory facilities are not located so as to be available for prompt service.—Parran, Thomas, Jr. 40:988 (May 15) 1925.

months, one case; secundipara, at term, one case; tertipara, at term, one case; quintipara, at 8 months, one case; one patient in whom the parity was unknown, at 8 months, one case. In these seven cases the dilatation occurred on the right side six times and on the left side only once.

The assertion has often been made that primiparas are more commonly predisposed to pyelitis of pregnancy than are multiparas, because the tense abdominal walls increase the pressure of the pregnant uterus against the ureter; in view of this it is interesting to note the relationship between parity and the presence of dilatation in the normal cases described above. Of the three patients showing no dilatation, two were primiparas. Of the nine patients showing bilateral dilatation, five were primiparas and four were multiparas. Of the seven patients showing dilatation of only one side, one was a primipara.

The frequency with which the right ureter is affected in pyelitis of pregnancy has been by some brought into relationship with the frequency with which engagement occurs in the right oblique diameter of the pelvis; i. e., that pressure of the presenting head is the responsible factor. It will be noted in the foregoing seven cases that in three the pregnancy was so early that presentation could not come into consideration. In the single case with dilatation of the left ureter, the pyelogram was made the day before delivery and the head was

but were free from urinary symptoms and were negative on physical examination at the time that they presented themselves for obstetric attention.

In this group there were six cases, as follows: Bilateral dilatation, two cases, 33 $\frac{1}{3}$ per cent.: primipara at 5th month and secundipara at 3rd month. Unilateral dilatation, three cases, 50 per cent.: secundipara at 6th month, right side dilated; quadripara at 8th month,

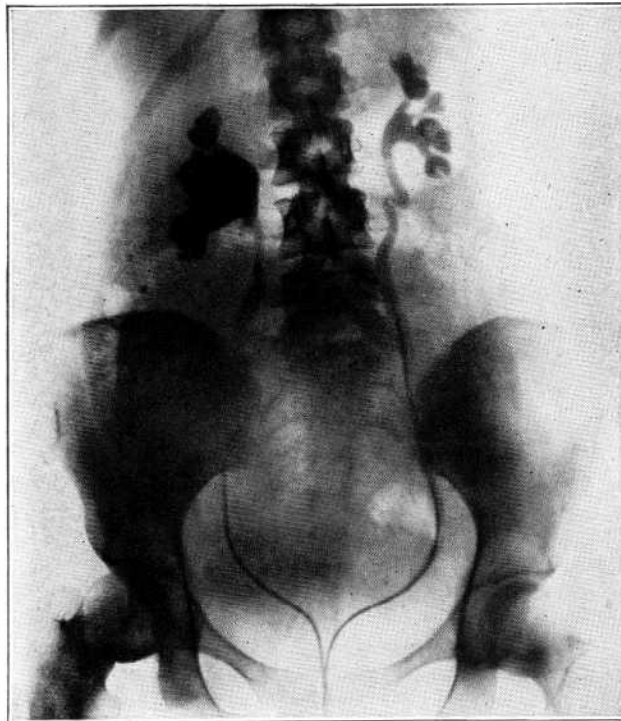


Fig. 5.—Primipara: sixth month; normal urine; pain in right side of abdomen; dilatation of right pelvis; slight dilatation of right ureter; left pelvis normal; slight clubbing of calices.

engaged in the right oblique (left occipito-anterior), in which oblique, compression of the left ureter from the fetal head could not have occurred.

GROUP 3. PATIENTS GIVING A HISTORY OF PYELITIS BEFORE COMING UNDER OUR OBSERVATION BUT AT PRESENT WITHOUT SYMPTOMS

These patients gave a history of a previous pyelitis either before marriage or during a previous pregnancy,

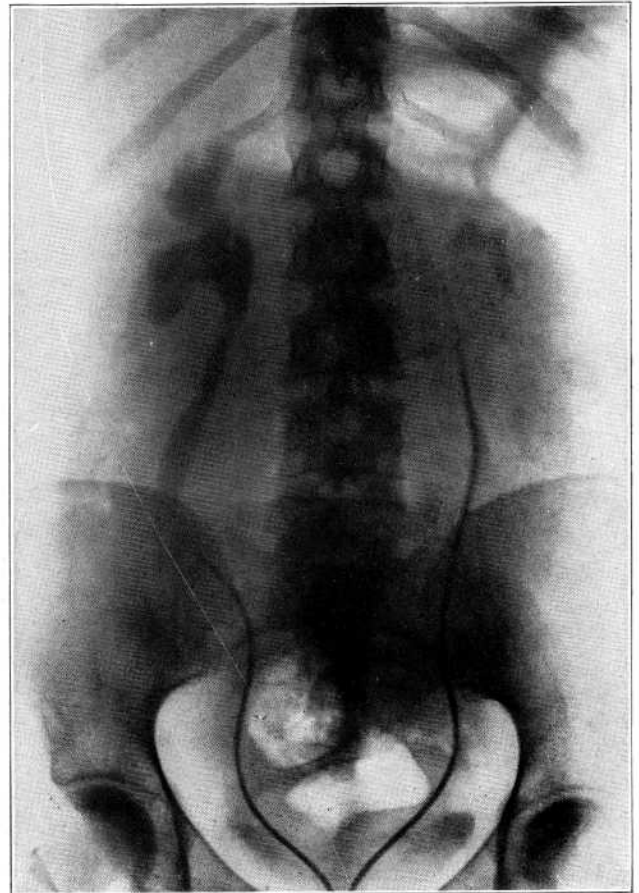


Fig. 9.—Dilatation of right ureter and calices; urine normal; history of pyelitis before marriage; urine sterile.

right side dilated; octipara at 5th month, right side dilated. No dilatation, one case, 16 $\frac{2}{3}$ per cent.: primipara at 35th week.

It will be noted that, by comparing the percentages found in Group 3 with those given under Group 2, bilateral dilatation, unilateral dilatation and absence of dilatation occurred in relatively the same ratio in the two groups, so that, at least in the small number of cases that we have examined, the history of a previous pyelitis did not increase the number of dilatations above the ratio that we found when examining a group of normal women.

GROUP 4. PERSISTENCE OF PYURIA AND URINARY SYMPTOMS AFTER DELIVERY

Several patients came under our observation because of pus in the urine, which had failed to disappear after delivery. It is well known that during pregnancy patients may have pus and colon bacilli in the urine without clinical manifestations, and that the urine may rapidly become normal after delivery. Even acute pyelitis tends to a rapid convalescence as soon as the uterus is emptied.

Some of the patients came because of backache or other urinary symptoms, after delivery. In this group of cases we found, without exception, definite evidence of dilatation of the ureter, a picture very plainly dem-

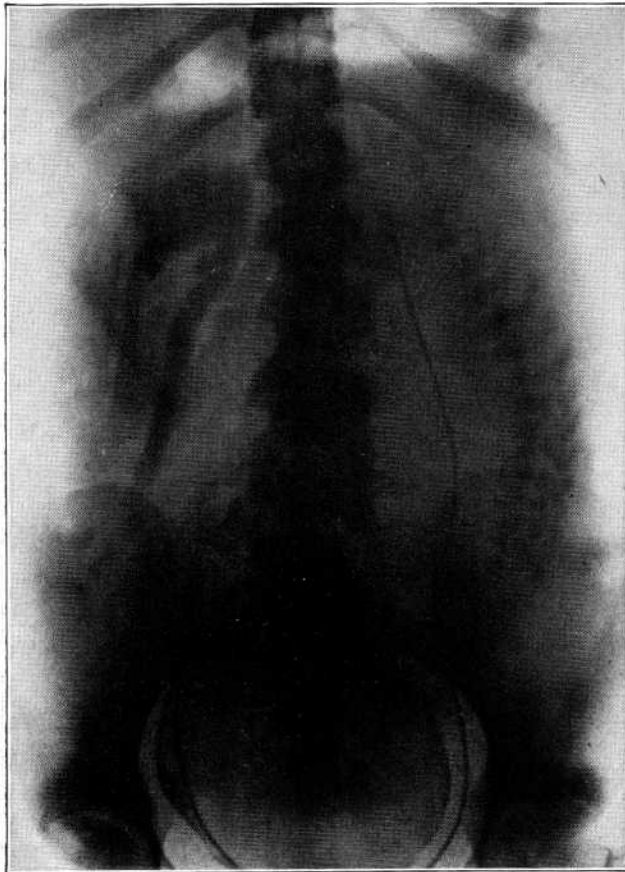


Fig. 10 (Mrs. W.).—Aug. 28, 1924; extensive dilatation of right ureter and right kidney pelvis, with lateral displacement of right ureter.

onstrated by ureteropyelograms. It is therefore clearly indicated to submit all patients who present residual urinary symptoms after pregnancy to complete urologic study.

Repeated pyelography during the course of pregnancy shows the progress of pathologic changes in a given case. In several instances in which the patients were subjected to examination early in pregnancy, a certain amount of dilatation was present in the higher urinary tract. This in some cases was associated with a low lying kidney. Pyelograms several weeks later showed the kidney to be lying at its normal level and that the dilatation had, at least temporarily, disappeared.

In other cases a reversal of conditions was noticed. The dilatation present early in the pregnancy had increased, and as the pregnancy advanced, the hydronephrosis became more marked.

In some of the cases there was a definite displacement of both ureters away from the median line, so that the distance between the two ureters was very markedly increased. This was particularly noticed in the cases in which the dilatation of the ureters was extensive.

In some of the cases the dilatation extended all the way up the ureter from the bladder to the kidney pelvis and was extreme. In others, the dilatation seemed to come to a very abrupt stop at about the brim of the pelvis, below which point the ureters either were slightly

dilated or normal. This was particularly marked in cases showing lateral displacement of the ureter.

ABDOMINAL PAIN

Several patients during pregnancy complained of obscure, indefinite and atypical abdominal pain. In two instances a diagnosis had been made of a possible appendicitis. There was no elevation of temperature and there were no urinary findings. These patients were subjected to pyelography. Dilated and kinked ureters were found, as well as hydronephroses.

Our experience leads us to believe that during pregnancy dilated ureters and kidney pelvis often provoke pains in the sides and upper abdomen when the urinary tract is not suspected as being the cause of the pain, since the patient is free from fever and has no pus in the urine.

KINKS IN THE URETER

In several cases the ureteropyelogram showed the presence of kinks in the ureter. These were found only when the ureters were moderately or extensively dilated. It is our impression that these kinks are the result and not the cause of the dilatation, since, when pyelograms were made again after delivery, the kinks had disappeared.

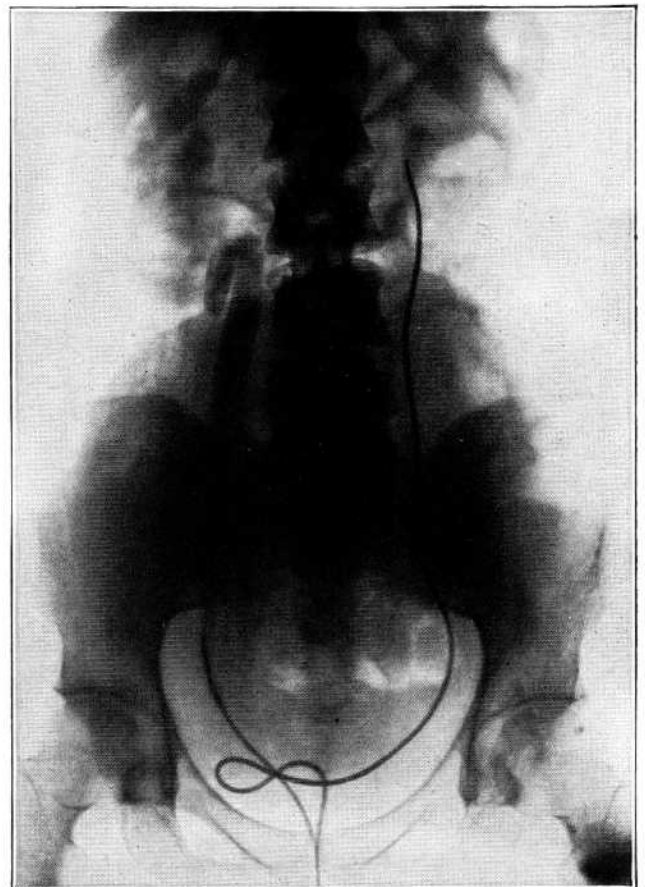


Fig. 15 (Mrs. H.).—Dec. 19, 1924; extreme dilatation of right ureter; urine sterile; free of pus.

That dilatation of the kidney pelvis and ureter occurs during pregnancy was known to the older clinicians, who made their observations at necropsy on patients who died from obstetric complications. It is generally not known that dilatation of the upper urinary tract during

pregnancy is as common as our figures demonstrate, particularly that varying degrees of dilatation occur in approximately 80 per cent. of cases of normal pregnancy.

122 South Michigan Avenue.

ABSTRACT OF DISCUSSION

DR. L. R. WHARTON, Baltimore: This paper opens up the question of the etiology of pyelitis and dilatation of the ureter. I have specimens of the urinary tract of seven patients in whom such conditions had been diagnosed clinically. Not all of these patients were women who had been pregnant. In general, we found four distinct types of lesions of the ureter: (1) congenital obstruction of the ureters; (2) obstruction due to pressure of the surrounding tissues, such as scar tissue in the pelvis and broad ligament; (3) obstruction due to trauma of operation; (4) the genuine ureteral infections associated also with infections of the whole urinary tract, the bladder and the kidneys. In pregnant women there is, in addition, hyperemia of the pelvis and of all structures around the ureter plus the abdominal "tumor." I have also been doing some work on women who have been pregnant and had pyelitis during pregnancy. It is my impression that, once a hydronephrosis is formed in these cases, the condition is likely to persist. The question of etiology cannot be settled until we have pathologic studies of the cases that Dr. Kretschmer has been discussing. The difficulty clinically is that the symptoms in these conditions are obscure. Recently I saw a woman who never had any symptoms referable to the bladder. The only pain had been in the left kidney region during menstruation. She carried the baby to term and was delivered normally. She was sent to me a year later because of persistent pain in the left kidney region during the menstrual period—exactly the same pain she had before the baby was born. Going over her history, I found that she had an exacerbation of this pain during the puerperium with a fever of 103 F., but with clear urine. I was surprised to find, on cystoscopic examination, that the left kidney was entirely destroyed and that its capacity was 300 c.c. We interpreted the atrophic kidney as a congenital lesion, because she had exactly the same symptoms throughout her whole menstrual life and because there was never any evidence of infection.

DR. N. SPROAT HEANEY, Chicago: We examined eleven cases of acute pyelitis of pregnancy, and dilatation of the ureter and of the kidney pelvis was present in every case. Frequently it was bilateral, with torsion of the ureter, kinks and lateral displacements. This picture was so unusual that we wondered whether the patient had some difficulty in the way of kink or torsion of the ureter previous to the pregnancy, if the women who have acute pyelitis of pregnancy are those in whom the history reveals a previous pathologic condition. We, therefore, examined nineteen apparently normal pregnant women who had had no previous operations and no history of previous pain or difficulty with the urinary tract, women who had no history of cystitis or anything that could be interpreted as a previous difficulty, women with normal urine at the time they were examined. These nineteen women were studied cystoscopically and by ureteral pyelograms. Four out of every five showed an easily ascertainable dilatation of the ureter and of the kidney pelvis or of the kidney pelvis alone, showing that the picture we found in the acute pyelitis was not due to any congenital difficulty, to any previous stricture of the ureter, but that with practical uniformity in pregnancy there is a dilatation of the ureter and of the kidney pelvis. If we become familiar with this dilatation we, shall find that in some of those patients who have had obscure pain in the abdomen, which we thought was due to the ovary or the uterus or to spasm of the intestine or to a previously undiagnosed gallbladder lesion, the amount of pain is in accordance with the degree of dilatation of the ureter. We are inclined to believe that a good many of the obscure abdominal pains that patients have during pregnancy are attributable to dilatations of the urinary tract.

BERIBERI FROM A DIET OF RAW STARCH*

E. J. KEPLER, M.D.

PHILADELPHIA

Beriberi is seen so infrequently in the United States that its occurrence is worthy of mention. Cases of the disease do occur from time to time, but chiefly among the crews of vessels landing in our ports or among the Orientals. Vedder¹ has shown that the disease has been fairly common in our asylums and penal institutions, and since the publication of his work epidemics in prisons have been reported by both Travis² and Livengood.³ Sporadic cases occur from time to time, but they are exceedingly rare, especially in this part of the country. The probable reason for our fortunate freedom from the disease lies in the fact that even in our lowest social strata the standards of living are sufficiently high to prevent its occurrence.

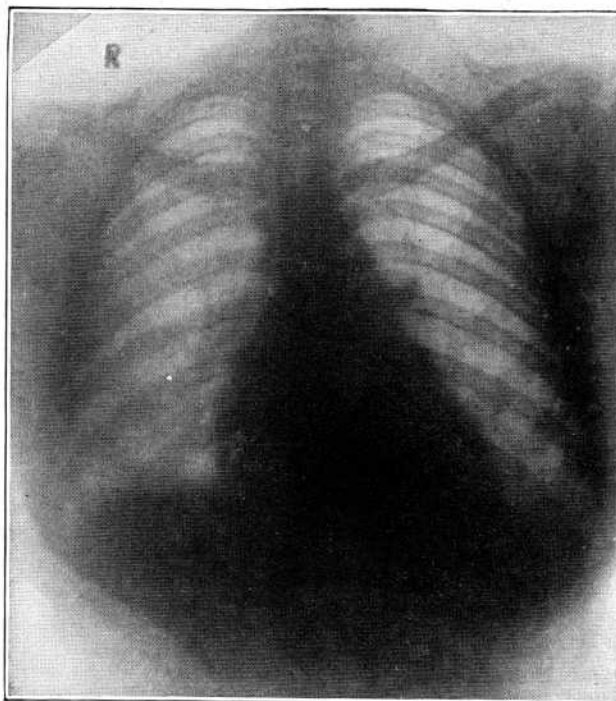


Fig. 1.—Dilatation of both sides of the heart on admission: arch, 5.4 cm.; distance from median line to farthest right border, 5.7 cm.; distance from median line to farthest left border, 9.2 cm.; oblique, 16.3 cm.

The etiology of beriberi is now generally accepted to be a deficiency in the diet of a specific vitamin known as water soluble B. In eastern Asia this deficiency is usually the result of the excessive use of polished rice. On board ship, as Holst⁴ has shown, vitamin deficiency results from the too exclusive use of canned foods and white bread. How the absence of the vitamin produces pathologic effects is not fully understood, but it seems likely that the vitamin is necessary for the proper metabolism of carbohydrates. Cooper and Braddon⁴ pointed out that in birds a quantitative relationship

* From the Neurologic Service of Dr. W. G. Spiller, Philadelphia General Hospital.

1. Vedder: Beriberi, New York, William Wood & Co., 1913.

2. Travis, F. M.: Beriberi or Endemic Multiple Neuritis, with Twenty-One Cases, Kentucky M. J. 15:476-482 (Oct.) 1917.

3. Livengood, H. R.: Beriberi in Union County Jail, J. M. Soc. New Jersey 13:395 (Aug.) 1916.

4. Quoted by Walshe: Nelson Loose Leaf Medicine, New York, Thomas Nelson and Sons 3, 1921.

exists between the amount of carbohydrates eaten and the amount of vitamin necessary to prevent the occurrence of polyneuritis; and Vedder⁴ and Clark⁴ have shown that if birds are fed on a total beriberi diet for only one week, characteristic microscopic changes appear in the peripheral nerves, whereas birds fed nothing but water live three or four weeks and at the end of that time show no microscopic evidence of neuritis. To make this point clearer, an analogy between beriberi and diabetes might be drawn. In diabetes, a definite amount of carbohydrates must be metabolized to prevent the development of acidosis. To prevent the development of beriberi, a carbohydrate diet must be supplemented with a definite amount of vitamin substance. In other words, the water soluble B vitamin is to carbohydrate metabolism what glucose is to fat metabolism. When the disproportion between the carbohydrate and the vitamin is not great, years may elapse before the onset of symptoms, which even then may be mild in character; but on a total beriberi diet pronounced symptoms occur after about ninety days.⁵

Because of the rarity of the condition, it might be well to review the chief features of the disease. In the fatal cases the pathologic findings are fairly constant and consist, first, in degenerative changes in the entire nervous system but with the greatest involvement of the peripheral nerves; secondly, in dilatation and hypertrophy of the heart with the microscopic evidence of degeneration, such as brown atrophy, edematous infiltration, vacuolation, fatty changes and sometimes even fragmentation and segmentation of muscle; finally, in a generalized tendency to edema and effusions into the serous cavities. The changes in the other organs are not characteristic.

The symptoms are determined by the pathologic findings outlined above. In the mild cases the onset is insidious, with weakness, pains, paresthesias and finally paralysis of the extremities. Generally the legs are first affected. Along with the neuritic symptoms, the evidence of myocardial injury becomes apparent and the patient complains of palpitation, dyspnea, and precordial and substernal pain. Slight edema of the feet and ankles may appear. In this stage the disease may remain chronic for many years with slight remissions and exacerbations, but it may become acute at any time with collapse, general anasarca and death. Other cases go on to a chronic neuritis and flaccid paralysis without any edema. An acute form in persons apparently well occurs in which edema and cardiac failure predominate. In these cases death may occur in a few hours, or, if immediate recovery ensues, the disease may go on to the chronic atrophic type indistinguishable from these cases in which the onset has not been so spectacular.

The physical findings are those of a multiple neuritis, with or without edema, and cardiac failure. The heart findings vary greatly. Pulsations in the neck and epigastrium are common. There is practically always an enlargement of the heart to the right and sometimes to the left. The rate is accelerated, and there may be marked arrhythmias. The blood pressure is usually

described as being low, but in the twenty-one cases reported by Travis,² the systolic readings were uniformly high and the diastolic readings unusually low, the average pulse pressure being 105.

Eye changes occur frequently, as shown by Fernando⁶ and others. These include dimness of vision, disturbance of color sense, inconstant hyperemia, blurring of the optic disk and a slight neuroretinitis.

There are no constant laboratory findings. The blood usually shows a secondary anemia and variable changes in the differential picture. The urine is usually diminished in amount, and only occasionally contains albumin. Casts are rare. Few studies in the chemistry of the blood have been made. Arima,⁷ in 1917, reported a moderate increase in the nonprotein nitrogen of the blood comparable to that occurring in chronic parenchymatous nephritis.

The prognosis, except in the acute cases in which death is the rule, is generally good. In some epidemics the mortality rate has been above 50 per cent. and in others as low as 3 per cent. Conservative estimates place the average mortality at 5 per cent.¹

REPORT OF CASE

History.—M. R., a colored woman, aged 28, married seven years, had one child, aged 5 years, and had had two subsequent miscarriages. She was admitted to the Philadelphia General Hospital, Oct. 18, 1924, and assigned to the neurologic service of Dr. Spiller, to whose courtesy I am indebted for the privilege of reporting this case.

Before the onset of the present illness, her health had been good except for influenza in 1918, and occasional mild attacks of tonsillitis. In August, 1918, she had a miscarriage followed by severe vaginal bleeding. One of her friends recommended raw starch as a therapeutic measure.

Acting on this advice and later influenced by a superstition among negroes that raw starch has cosmetic value and tends to make the skin white, she gradually acquired a fondness for this type of food, and would eat it from the box, piece by piece, as one would eat candy. At the end of two years this habit had increased to such an extent that she was consuming one of the popular brands of gloss starch in amounts ranging from 1 to 2 pounds (0.5 to 0.9 kg.) daily—approximately from 1,600 to 3,200 calories. Her husband ate only one of his daily meals at home, and rather than cook for herself, she obtained most of her nourishment from the uncooked starch. The cooked meal at night consisted of the usual staple articles of diet found on a working man's table. Under this regimen she lost her appetite, and as a result she practically subsisted on laundry starch, which, so far as its vitamin content is concerned, is certainly the equivalent of decorticated rice. The hold which this habit had obtained on her can be realized from the fact that on several occasions after her admission to the hospital, she asked the nurses to smuggle starch to her. No other peculiarities or excesses in her habits could be discovered. Alcohol was ruled out by repeatedly questioning the patient, her husband and her neighbors.

In spite of her starch diet from August, 1921, she remained in fairly good health until May, 1924, when she began to notice unusual sensations in her hands and feet. She felt as

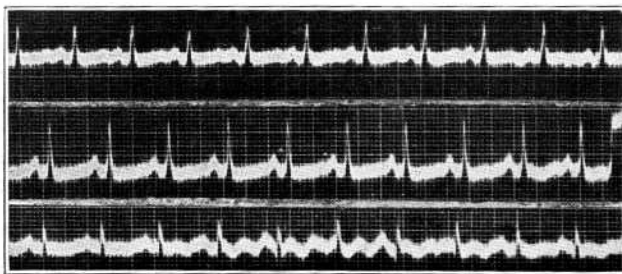


Fig. 2.—Normal conduction time and normal ventricular complexes at time patient was admitted.

6. Fernando, S.: The Eye in Beriberi, *Am. J. Ophth.* **6**: 385-389 (May) 1923.

7. Arima, E.: Observations on the Nonprotein Nitrogen Blood Content in Beriberi, *China M. J.* **31**: 336 (July) 1917.