

THE SIGNIFICANCE OF URINALYSIS IN PREGNANCY,
WITH ESPECIAL REFERENCE TO ECLAMPSIA.

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OPINIONS are so various at the present time with regard to the significance of urinary conditions during pregnancy, and especially with regard to the presence or absence of glucose or albumin, that a few pertinent cases in the experience of the writer have led him to briefly discuss the following questions:

1. What are the customary findings of urinalysis during a (clinically) normal pregnancy?
2. What variations from the normal may be noted, and what is their significance?
3. What dependence can be placed upon urinalysis as a warning of impending eclampsia?

The first question is by no means the most easily answered of the three, if one bases his reply upon the statements gathered from the current discussion of the subject by those who do purely obstetrical work. There seems to be as much diversity of opinion as to whether albumin or glucose may be found in the urine of a strictly normal pregnancy as there is with regard to the origin of these substances. One author states that a trace of either albumin or glucose has no significance, while another assures the student that the appearance of either renders the prognosis grave for the mother and child.

It may be stated as a general working rule, none the less, that the urinary picture which is normal for the ordinary conditions of

life is also indicative of normal conditions in pregnancy. Just how far this principle will maintain itself will be discussed at a later point.

Question 1 then narrows itself down to the subquery: Can there be variations from the ordinary normal urinary picture which will still admit of a clinically normal labor?

The answer must be a prompt one in the affirmative. Not only do parturient women sometimes give normal birth to healthy children in spite of urinary conditions indicative of possible misfortune; but sometimes the urine in such cases appears of such a character chemically and under the microscope as to promise a rapid fatality if the labor be not at once terminated.

The specific gravity may be constantly depressed, the quantity of urine may be large or small, the excretion of urea may be diminished or increased; or there may be albumin, glucose, or both, present in large or in small quantities; and still the labor may be an easy one, and clinically normal for mother and child in every other respect.

A more frequent picture is that of a pregnancy during which (especially when the gravid womb is occupying considerable space in the abdominal cavity) a so-called trace of glucose or of serum albumin is detected by the ordinary tests. Still more frequent, and such a common occurrence as to cause no surprise when noted, is the presence of delicate quantities of serum albumin, detected only by careful methods and confirmed by control tests.

In a series of nearly 1800 urinalyses, made by the writer during the past two years, a considerable number of the examinations were in the cases of women in the later stages of pregnancy. Of the entire number of specimens of urine obtained from parturient women, only a comparatively small percentage (22 per cent.) were entirely free from albumin and sugar, while in no case in which glucose was noted was albumin absent. In nearly 60 per cent. at least a trace of albumin could be detected. In many of the cases the albuminuria began to manifest itself about the fifth month. In some it was not present until the last days before delivery. In a few it became evident directly before the appearance of active labor pains, its presence being discovered at times only by accident, if the term may be fairly employed.

When glucose appeared in the urine of a subject known to have not previously shown glycosuria, the occurrence, as a rule, took place at some time between the beginning and end of the last month of pregnancy. Occasionally there was a trace of glucose present throughout the pregnancy, often disappearing completely after the birth of the child. In no case in which, in the absence of other indications of acute or permanent renal change, small quantities of either serum albumin or glucose (not evident previously) were found present during pregnancy did the urine fail to regain its normal

character shortly after the birth of the child except in the few cases in which fatal eclampsia supervened.

In the majority of cases the urea elimination was that of the normal woman under ordinary circumstances other than those of child-bearing. Its excretion varied with the individual, and especially in relation to the diet and exercise. Occasionally the quantity excreted appeared persistently high, and just as often exceedingly low; but with no evident bearing upon the otherwise normal outcome of the case.

When the microscopic sediment indicated positive renal change the beginning of this change almost invariably appeared to have antedated the pregnancy, and, as a rule, continued after the puerperium as a permanent condition. Exceptions were noted even to this rule, however, and the following case furnished rather a striking example of the kind:

Mrs. W. E. T., aged twenty-one years, was seen by the writer in her seventh month of pregnancy on March 19, 1901. Her father had died of trauma, and the condition of his kidneys was unknown. Her mother had chronic nephritis, and died from acute meningitis.

The patient had always been strong and well except for two attacks of pneumonia, followed on both occasions by a complete recovery. Since then she had always been active. Menses regular; no leucorrhœa. She had been married one year, her last menstrual flow having occurred seven months before. No headaches or dizziness; no swelling of the face, feet, or hands. On physical examination she was found well nourished, her skin healthy, no jaundice or œdema. Chest absolutely negative; heart sounds all clear and regular; arteries soft. The abdomen was that of advanced pregnancy. On examination the gravid uterus was found to contain a living fetus in the L. O. A. position. The pelvic measurements were all ample and normal.

The *urinalysis* on March 21st resulted as follows: 1011, acid, pale straw in color, slightly turbid, sediment scanty, white, and flocculent; albumin none, sugar none; microscopically, full of squamous and cylindrical cells, no casts, few leukocytes, no mucus, no crystals.

A request was made during the following week that another specimen be sent, for the reasons that the specific gravity was so low and because there was doubt in the writer's mind as to the estimated time of the pregnancy.

On March 26th the *urinalysis* was 1013, acid, pale straw in color, albumin a decided trace, sugar none; microscopically, much squamous and cylindrical epithelium, many leukocytes, no casts, much mucus, no crystals.

An *examination* the following day (March 27th) showed 1027, albumin none, sugar none, heavy phosphatic clouding with heat; microscopically, full of uric acid crystals; no casts, much squamous epithelium, few leukocytes, considerable mucus.

The patient felt at this time strong and well. Fetal movements distinct. During the next month the urine remained negative except for a very high specific gravity, a urea output of 2.8 to 3.6 gm. per 100 c.c., occasional showers of uric acid crystals in the freshly voided urine, and once a heavy sediment of calcium oxalate crystals. No albumin; no casts. On April 15th the patient's feet began to swell. Although requested, the urine was not obtained until ten days later, when the urinalysis showed 1030, albumin, 6.6 gm. per litre; sugar none; urea, 2.51 gm. per 100 c.c. Microscopically, full of small hyaline and hyalogramular casts, many leukocytes, no renal epithelium, no crystals.

On the following day the albumin still measured over 6 gm. per litre, and there were present many granular casts and much renal epithelium, although the patient had been in bed and on a liquid diet for two days. Periodical pains began to be evident during the early evening of this day, gradually increasing, and after a labor of twelve hours the head of the child was on the perineum, and was delivered naturally, with a slight laceration. The latter was repaired at once, and both mother and child advanced through a normal puerperium and adolescence.

At no time in this case was there a suspicion of renal involvement up to the time of the single appearance of albumin in quantity, one month before term, and followed by its complete disappearance. Its reappearance at some time during the last ten days before the birth of the child; its presence in large quantities, and above all the indication by the microscopic sediment of serious renal change, all made labor a dangerous prospect and raised the question as to the best course to pursue. The event proved that sometimes Providence allows us to rush on in safety, when in a different mood we would counsel prompt artificial termination of the dangerous condition.

This will be recognized as a case in which every feature of the urinalysis indicated danger of the much-dreaded eclampsia, and as one which, none the less, passed on to a normal labor and delivery. The urine one month later was nearly free from albumin (faintest trace) and casts, but unfortunately the patient has moved away from this vicinity and has disappeared from view.

It may be briefly stated that cases have been noted in which the urine has contained as much as 4 per cent. or 5 per cent. of glucose during pregnancy, and yet the woman has gone safely through to term and a successful delivery. The same must be said of such instances as of the case just cited, that the probabilities are all against a favorable outcome. We are, however, more intimately concerned with the subject of albuminuric eclampsia, and will pass over other considerations for the present. It will be sufficient to say that cases are constantly being noted in which albumin is present throughout the course of the pregnancy; others in which it appears

early or late in its course; and in one or both, or neither, there may be casts and renal epithelium in abundance; and still there may be no departure from the normal in the labor.

In concluding his comment on this question, and partly by way of discussing Question 2 (What variations from the normal may be noted, and what is their significance?), the writer would simply say that most cases of pregnancy present minute traces of serum albumin in the urine, and that these can be detected if sufficient care be devoted to the search. Probably these traces are the result of pressure by the gravid uterus and of the consequent congested state of the kidneys. Sometimes there seems to be actual renal disease, and the ultimate cause may never become evident. Such cases must be placed in the category with those other problems that are too deep for our understanding; and when they go on to normal labor we should be thankful for the occurrence and content to accept the gift of Providence. Too often the urinary indications of renal involvement are verified by the dreaded onset of eclampsia, and too often, also, in such cases the opportunity is afforded on the autopsy-table to ascertain the extent of renal damage.

Much stress has been laid by some writers upon a diminution in the elimination of urea in certain cases of pregnancy, both as an indication of impaired renal activity and of the danger of eclampsia. Certain it is that in most pregnant women the specific gravity of the urine is high (1025 and upward), and the urea output correspondingly large; or, to state the sequence of affairs more accurately, the urea is excreted in abundant quantities, and the specific gravity is correspondingly high. The true significance of the variations in the elimination of urea must be estimated as in all other conditions—viz., when the kidneys are doing their proper share of work they will excrete a normal amount of urea; when hampered or diseased, their urea output is diminished and sometimes becomes exceedingly scanty. The doubtful claim that a decided fall in the amount of excreted urea is ever a dependable indication of oncoming eclampsia will be referred to again in connection with the cases cited under Question 3. The highest importance must always be attached to the presence of renal epithelium in quantity; also to tube casts, especially when in large numbers, and when of the granular, blood, or epithelial varieties. Normal urine always contains a few hyaline casts, which may be found if looked for with care. No normal urine contains many of the latter, however, and normal kidneys are never responsible for casts of the granular or epithelial types. The microscopic sediment in the majority of instances furnishes our most accurate guide as to the condition of the renal apparatus, and its critical study should never be omitted from the urinary examination.

It remains to recall the fact that sugar (glucose, lactose, etc.) may often appear in small quantities, and that when confined to such

inconsiderable amounts it has little or no practical significance, at least in the light of our present knowledge. When glucose is present in pathological or in permanent form it is interesting to note that there is present also, with few exceptions, some indication of renal change. We have yet to discover the real cause of the appearance of glucose, even in diabetes, but we have learned clinically that diabetic glycosuria is usually accompanied by renal sclerosis, and that its urine contains a renal sediment; and we have learned that the association is such a close one as to be valuable clinically for diagnostic purposes. The rule holds equally well in the pregnant woman and the non-pregnant diabetic. The presence of glucose, as already stated, is in itself by no means a grave sign, and in small quantities unattended by signs of renal incompetency can usually be ignored as far as concerns the outcome of the pregnancy. When it represents a diabetic condition, however, it assumes a new importance, furnishing the picture of a subject of a cachexia undergoing the greatest strain imposed by nature upon woman's vitality. Pregnancy under such conditions becomes a dangerous and questionable duty, instead of woman's trying but precious privilege.

In conclusion, Question 3 (What dependence can be placed upon urinalysis as a warning against impending eclampsia?) raises again an all-important and much-mooted discussion. The writer has already cited a case in which the urinary condition indicated serious renal change, and yet in which labor was carried on with entire exemption from eclampsia. He remembers with vividness a second case in the hands of a prominent obstetrician in which the urine had always been found normal prior to the pregnancy. Unfortunately, the urinalysis was omitted during the course of the pregnancy owing to confidence in the integrity of the renal function; and this case died in eclamptic convulsions. A third case is still under the care of the writer, and is interesting in that it presents the picture of a urine absolutely normal on the evening prior to the beginning of labor, a total absence of a history of nephritis, and yet a series of convulsions beginning while the fetal head was on the pelvic floor and continuing into the post-partum stage after an instrumental delivery. The following presents merely an outline of the case:

Mrs. J. F. E., aged twenty-six years; family history negative. One child living and well; forceps delivery after a long but otherwise uneventful labor. Seen for the first time by the writer on March 14, 1903, at which time the patient considered herself six months pregnant. The abdomen was very large, but the patient stated that this was also true of the first pregnancy. The right leg was swollen, also the right labium, the veins of which and of the right vaginal wall were swollen and tortuous. This condition was greatly relieved in the recumbent posture, and was evidently due to pressure in the abdominal cavity. The vertex was distinctly felt on vaginal exam-

ination, approximately in the L. O. A. position. Pelvic measurements were all normal.

The urine at that time was examined and showed, A. M.: 1010; albumin, faint trace; sugar, none; urea, 1.22 gm. per 100 c.c.; microscopically, full of squamous cells, no renal sediment, few leukocytes, no crystals; P. M.: 1020, acid, etc.; albumin, faint trace; sugar, none; urea, 2.80 gm.; no renal sediment, full of squamous cells.

From this time until May 18th, inclusive, the urine was examined weekly. On the latter date both the morning and evening specimens were examined. At no time during this period could albumin or sugar be detected. No casts and no renal epithelium were present. The urea averaged 2 gm. per 100 c.c., and on the last examination before labor began was 2.18 gm. On May 19 the writer was called because of colicky pains over the abdomen. There was some headache, and it was learned that the bowel had not been emptied for two days. At this time the patient was supposed to be about one month from term, but the abdomen appeared so large that oncoming labor was suspected, and the vaginal examination showed the cervix already dilating. After a long, slow labor of twelve hours the vertex was on the perineum. Convulsions suddenly supervened, following the second of which forceps delivery was carried out with the assistance of Dr. W. A. N. Dorland, and without injury to mother or child. The placenta was at once delivered with the hand in the uterus. An hour later a third convulsion took place, followed by a fourth, fifth, and sixth. The urine drawn by catheter showed the following: 1012, acid, etc., strong odor of decomposition; albumin, 1 gm. per litre; sugar, none; urea, 1.18 gm. per 100 c.c.; considerable number of hyaline and hyalogramular casts; no blood; considerable renal epithelium.

The patient was bled, and then transfused into a vein with normal salt solution. She was then kept in a steam bath almost continuously for six hours, when the kidneys again began to take up their share of the work. Consciousness was not fully regained for thirty-six hours, though no convulsions occurred after transfusion.

The urine rapidly cleared up, until at the present time it is perfectly normal, and the patient free from evident impairment of the renal functions, and with no recollection of the ordeal.

Dr. Dorland has informed the writer of a case of eclampsia, recently seen by him, in which the urine was examined immediately before labor, and found to be normal, but in which convulsions appeared and death ensued before morning.

We have studied cases, therefore, which have presented urinary pictures of seemingly grave import, but in which labor has followed a normal course; and, on the other hand, cases of dangerously obstinate, and even fatal eclampsia occurring in spite of kidneys in which, up to the moment of labor, were supposedly healthy. As a result of our study we are confronted with the question: Can

eclampsia be accurately foreseen and avoided by the careful attendant upon the case; and does albuminuria, or even a renal sediment, predict with any degree of accuracy parturient or puerperal eclampsia? By way of answer the following conclusions seem warranted at the present time:

1. Careful urinalyses should be carried out in all cases of pregnancy at frequent intervals, and with increased frequency as term is approached.

2. The most dependable indications of impaired renal function and of probable eclampsia have been shown by general experience to be the presence of decided quantities of serum albumin, the diminution of the eliminated urea, and the presence of a microscopic renal sediment (casts, renal epithelium, blood, etc.). The character of the latter, when accompanied by the well-known clinical signs of nephritis, always constitutes a working basis for an estimate of the probability of imminent danger.

3. Even if the urine appear perfectly normal the possibility of eclampsia must be considered, especially in young women. Eclampsia in such cases is of equal severity with that of cases in which the urine has given due warning of impaired renal functions.

4. When eclampsia supervenes upon labor in a subject with previously (apparently) healthy kidneys, the tendency subsequently is toward a return to normal renal functions if the patient survives. This circumstance would seem to indicate still more strongly that the kidneys may actually have been normal up to the time of a temporary embarrassment and suspension of function.

5. Until the nature and ultimate cause of uræmia and eclampsia are more thoroughly understood, it would appear that urinalysis, though not an unerring guide, is our most valuable index of the condition of the kidneys and our most trustworthy source of information as to danger from such forms of toxæmia.

6. The prognosis seems to be vastly improved if eclampsia be combated by generous bleeding, followed by venous transfusion with normal salt solution. These measures reduce and dilute the poison in the circulation, and relieve the cardiac distress. Free diaphoresis and purging are of course indicated.