

## THE PHLORIDZIN TEST.

WITH SPECIAL REFERENCE TO THE INFLUENCE EXERTED  
BY A DISEASED KIDNEY ON THE EXCRETORY  
WORK OF THE SECOND ORGAN.\*

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I shall limit myself to the report of seven selected cases,<sup>1</sup> which I believe demonstrate that a diseased kidney may so affect the excretory activity of the second kidney as to mislead all who rely too much on our present functional tests. I shall not deal with those disturbances of the second kidney that we see in acute obstructive conditions of the diseased side and which have been produced experimentally by Götzl. These lead to oliguria or to complete, though usually only temporary, anuria, and are best explained on a nervous basis as instances of reflex inhibition. I shall confine myself to the more chronic conditions in which excretory functional tests are possible. Moreover, I shall not discuss the degenerative changes in the second kidney, so-called sympathetic or toxic nephritis induced by disease of the impaired kidney. These changes evidenced by albumin and casts in the secretion of the second kidney are well recognized and known to all of us.

In the voluminous literature of functional kidney tests surprisingly little attention has been paid to the facts that I wish to present, and this is all the more surprising, as it is evident that if a diseased kidney can seriously affect the excretory work of the second organ all functional tests must be unreliable. This phenomenon really marks the crux of the whole question of functional tests, and with its demonstration, it seems to me, all attempts at a really accurate estimation of kidney capacity must fall to the ground.

In the following cases I have made special use of phloridzin, which in normal cases leads to a glycosuria. As the percentage estimation of glucose recommended by Casper and Richter is liable to be influenced by incidental polyuria or oliguria, and as the estimation of the total amount of glucose excreted by each kidney is impossible because urine frequently leaks by the catheters into the bladder, and these can not regularly be left in the ureters until the glycosuria ceases, I have employed the simpler modification of Kapsammer. This method takes cognizance of the time of appearance of sugar in the two separated urines. Normally glucose appears in the first thirty minutes after hypodermic injection of a warm solution. I used from 10 to 20 minims of an alcoholic solution in which phloridzin is readily held, warming it always before subcutaneous injection with an alcohol-washed syringe. The urine was tested at frequent intervals for glucose with Fehling's reagent. In 1904 Kapsammer announced his modification of the phloridzin test, and recently he has published a large work<sup>2</sup> on kidney diagnosis and surgery which energetically pushes his earlier views.

CASE 1.—K. G., 22 years, housewife.

*Diagnosis.*—Tuberculosis of kidney.

*Nephrotomy of Left Kidney.*—Oct. 23, 1906, for perinephritic and nephritic abscesses (pus sterile in smear and culture).

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1. The majority of these cases were studied in the German Hospital in the surgical services of Drs. Kammerer, Kiliani and Meyer. Many of the careful urine analyses were made by Dr. O. Hensel of the Pathological Department, to whom I am much indebted.

2. Nierendiagnostik und Nierenchirurgie, Vienna, 1907

*Cystoscopy and Bilateral Ureteral Catheterization.*—Nov. 16, 1906, bladder and ureteral ostia normal.

*Left Kidney (Tuberculosis). Right Kidney.*

Moderate, watery discharge.	Copious, amber colored.
Acid.	Acid.
Specific gravity, 1005.	Specific gravity, 1020.
No albumin. No sugar.	Trace of albumin. No sugar.
Urea, 3.5 per mille.	Urea, 13.0 per mille.
Chlorides, 1.0 per mille.	Chlorides, 3.0 per mille.

*Microscopically.*

Moderate number of pus cells.	Calcium oxalate crystals.
Calcium oxalate crystals.	No tubercle bacilli.
No tubercle bacilli.	No gonococci.
No gonococci.	Few red blood cells.
Few red blood cells.	

*Phloridzin Test.*—Ten minims of a 1 per cent. solution in alcohol (33 per cent.). Left kidney absolutely negative in the fifty minutes following injection. Right kidney showed slight reduction of Fehling's solution at twenty minutes, but up to fifty minutes there was no sugar reaction.

Nov. 21, 1906: Nephrectomy. Left kidney showed a large caseous abscess in upper pole which did not communicate with the pelvis. Smaller tubercular foci were scattered through the kidney and the mucosa of the pelvis was thickened and inflamed.

January, 1907. Seven weeks after the nephrectomy another phloridzin test was made and the right kidney showed a copious sugar reaction at twenty minutes and this sugar excretion persisted for more than three hours (last examination). The patient's urine subsequent to the nephrectomy continued to show a faint trace of albumin and corresponded with the above analysis of the urine obtained from the right kidney minus red blood cells.

Here is a case in which the diseased organ so influenced the work of the second organ that the latter failed to excrete sugar (within fifty minutes) while the diseased organ was in the body. When the diseased kidney was removed the remaining organ responded promptly to the phloridzin test. If the first phloridzin test had been followed the patient would have remained an invalid, whereas now she is cured and well. Both the percentage estimates of Casper and Richter and the time of appearance of the sugar, according to Kapsammer, would have led us astray in determining subsequent therapy.

CASE 2.—I. S., 37 years, housewife.

*Diagnosis.*—Tuberculosis of kidney.

*Cystoscopy and Bilateral Ureteral Catheterization.*—Jan. 5, 1907. Bladder normal. Left ureteral ostium negative. Right ureteral ostium at first normal in appearance, but during the examination it became plugged with a mass of brown, soft tissue which projected into bladder and could not be displaced. The right ureter was obstructed at three inches from the bladder and on removing the catheter from this ureter without obtaining a specimen, the above plug followed it down and blocked the meatus of the ureter. To make sure that this ureter was blocked I made use of the indigo carmine test, whose value in such cases I can not overestimate,<sup>3</sup> and obtained absolutely no discharge from the right kidney, and copious discharge of blue urine from the left kidney at twelve minutes after the injection. The left kidney rapidly secreted yellow, slightly turbid urine, acid, specific gravity 1018, distinct trace of albumin, no sugar, urea 1.1 per cent., chlorides 1.2 per cent.

*Microscopic Examination.*—Flat epithelial cells, caudate cells, few epithelial casts, red blood cells, no tubercle bacilli.

*Phloridzin Test.*—Ten minims, was negative. Slightest reduction at twenty-seven minutes, but no sugar reaction.

*Phloridzin Test (second).*—Jan. 6, 1907. Twenty minims injected. At twenty-five minutes slight reduction. No sugar reaction up to thirty-five minutes after injection.

*Cystoscopy and Ureteral Catheterization (second).*—Jan. 12, 1907. Same condition as examination of seven days earlier. Right ureter is still plugged and no urine is excreted from this kidney.

3. Ann. Surg., October, 1906.

*Phloridzin Test (third).*—Fifteen minims injected. At twenty-seven minutes slightest reduction, but no sugar reaction. Left kidney secretes pale, clear, neutral urine, specific gravity 1007, phosphates 0.03 per cent., chlorids 0.15 per cent., urea 0.2 per cent., albumin, indican, acetone, sugar and diazo negative. Microscopically, few epithelial cells, few leucocytes.

*Phloridzin Test (fourth).* Jan. 13, 1907. Fifteen minims injected and again at twenty-five minutes slight reduction, but no sugar reaction within the first half hour.

*Nephrectomy.*—Jan. 14, 1907. Right kidney was enlarged and showed multiple abscesses connecting with the dilated pelvis which contained pus and albuminous masses (pseudostones), such as patient had passed and similar to the one that protruded into the bladder and blocked the ureteral meatus.

*Phloridzin Test (fifth).* Feb. 28, 1907. Fifteen minims injected and at twenty minutes a copious very marked sugar reaction was present.

In this case we have a patient who previous to the removal of the diseased kidney was living on her left kidney, as the right ureter was blocked. Apparently this organ was adequate, as she showed no signs of kidney insufficiency. Despite this adequacy on four successive phloridzin tests this kidney failed to excrete sugar within thirty or thirty-five minutes after the injection, but when the malevolent influence of the diseased organ was withdrawn by nephrectomy this left kidney promptly excretes sugar within twenty minutes. Though it was self-evident that this left kidney was adequate, as it alone was doing the excretory work of the patient, still the negative phloridzin tests bade us pause. Had we relied on these we would have made a serious mistake, as the patient recovered completely after the nephrectomy. The same criticism applies to any undue reliance on the low percentage of urea. Whereas high percentage speaks for concentrative power of the kidney, and perhaps high efficiency, low percentage as seen in this case, just like negative phloridzin results, appears very misleading.

CASE 3.—M. P., 56 years; housewife.

*Diagnosis.*—Pyonephrosis.

*Cystoscopy and Bilateral Ureteral Catheterization.*—Dec. 27, 1907. Bladder negative. Both ureteral ostia negative. There is no play at the left meatus, no efflux, and though three catheters were introduced (Nos. 4, 5 and 7, French scale), no specimen was obtainable. Right kidney secreted well; urine was acid, specific gravity 1020, very faint trace albumin, few pus cells, few erythrocytes.

*Phloridzin Test.*—Fifteen minims injected and there was no sugar excreted within fifty-two minutes.

*Nephrectomy.*—Dec. 30, 1907. Kidney enlarged, pelvis and ureter dilated and full of purulent fluid.

*Diagnosis.*—Pyonephrosis with obstructed ureter.

*Phloridzin Test.*—Jan. 27, 1907, after an uneventful recovery. At fifteen minutes there was reduction and at twenty-two minutes a copious sugar reaction. The postoperative urine analyses corresponded with the above analysis of the specimen obtained by ureteral catheterization.

Here again we see the influence of the diseased kidney on the second organ. Here again when the diseased kidney is removed the second organ responds to the phloridzin test as a normal kidney does. Here again the slight significance of a negative phloridzin result is emphasized. If the teachings of Casper and Richter, or of Kapsammer, had been adhered to, nephrectomy would not have been performed and our patient instead of being cured would be in her same suffering condition.

CASE 4.—F., 25 years; married.

*Diagnosis.*—Nephroptosis and tuberculosis of kidney.

*Cystoscopy and Bilateral Ureteral Catheterization.*—Feb. 19, 1908. Bladder was normal in appearance. Ureteral ostia were

negative. The right ostium seemed drawn a little to the right. The right kidney specimen showed a very faint trace of albumin, some pus cells, some large epithelia. The left kidney specimen showed a trace of albumin, very few pus cells, many large epithelia.

*Phloridzin Test.*—Fifteen minims were absolutely negative on both sides at 20, 25, 30 and 35 minutes. Urine showed no tubercle bacilli.

*Nephropexy.*—This was performed Feb. 29, 1908, to relieve the repeated attacks of right renal pains, and during this operation a small diseased area was excised. This proved to be a tubercular lesion.

March 11. Bladder urine showed tubercle bacilli.

March 12. Bladder urine showed many tubercle bacilli.

*Cystoscopy and Ureteral Catheterization.*—March 14. The bladder picture was completely changed. The left half of the trigone was injected and looked diffusely red, as if washed in blood. The left ureter was easily catheterized. I could not introduce a catheter into the swollen right ureteral ostium.

*Uranalysis.*—The specimen from the left kidney was acid, straw colored, clear, no sediment, specific gravity 1015, very faint trace of albumin, sugar (phloridzin) present, acetone negative, diacetic negative, indican negative, urea 0.8 per cent., chlorids 0.8 per cent.

*Microscopically.*—Few white corpuscles, few round epithelial cells, occasional red blood cells, no casts, no tubercle bacilli.

*Phloridzin Test.*—Fifteen minims showed a positive reaction between twenty and twenty-five minutes.

In this case I had a movable kidney, which at the same time was tubercular. Before the kidney was anchored the second organ failed to respond to the phloridzin test, but after the nephropexy, despite advancing tubercular disease, the second organ responded to the phloridzin test.

In the following cases the same peculiar functional disturbance of the second kidney is demonstrated with almost the same clearness, as in these cases the patients were living on only one kidney, and though that was adequate as far as allowing the patient to live, according to the phloridzin test the patients were living on an inadequate organ and should have been suffering from renal insufficiency.

CASE 5.—K., 36 years; housewife.

*Diagnosis.*—Ureteral calculus.

*Cystoscopy and Bilateral Ureteral Catheterization.*—May 20, 1907. Bladder shows some thickening of the mucosa. The right ureteral ostium is negative, whereas the left projects like a cervix and its lips are moderately everted. There is an obstruction in this side 1.5 cm. from the bladder which can not be pushed aside or passed with small or large catheters. No specimen could be obtained from left side due to occlusion, whereas from right side normal urine was obtained.

*Phloridzin Test.*—Negative during the first half hour.

The x-ray showed a calculus in lower end of left ureter.

*Cystoscopy.*—May 23, 1907. The left ureter was sounded with bougies. Injection of adrenalin and sterile liquid petrolatum into lower end of left ureter, which was still occluded. Stone could not be loosened.

Here again the failure to excrete sugar after the phloridzin injection can not be interpreted as due to any real and permanent disturbance, as the patient was living in absolute comfort and showed no signs of renal insufficiency. Evidently this is another of the instances of the malevolent influence of a disease of one side (ureter alone?), affecting the functional activity of the adequate organ, which is being subjected to the best test of its adequacy by the closure of the opposite ureter. If we could in this way imitate Nature and close one

ureter temporarily, we would approach much more closely to the solution of the problem of the adequacy of a doubtful kidney than we have done heretofore.

CASE 6.—A. S., 46 years; weaver.

*Diagnosis.*—Nephrolithiasis and carcinoma of the kidney.

*Cystoscopy and Bilateral Ureteral Catheterization.*—Oct. 27, 1907. Bladder was normal except for injection about right ureteral ostium. The right ureter was blocked close to the pelvis and left kidney secreted normally.

*Uranalysis.*—Specimen was acid, yellow, slightly turbid, specific gravity 1018, faint trace of albumin, no sugar, indican, bile, acetone or diacetic acid, urea 1.6 per cent., chlorids 0.5 per cent.

*Microscopically.*—Very few hyaline casts, few pus cells or epithelial cells, few crystals of calcium oxalate, no tumor cells, tubercle bacilli or gonococci.

*Phloridzin Test.*—Fifteen minims caused no result within first hour; then slight reduction.

The x-ray showed large calculus in the right kidney and pelvis.

*Nephrotomy.*—Oct. 28, 1907. An enlarged kidney with dilated pelvis contained large calculus was found. Following the operation the bladder urine remained unchanged, showing that the ureter was plugged or compressed (autopsy showed a carcinoma of the lower pole of the kidney occluding the ureter by pressure). The patient's condition rapidly became feebler and the repeated hemorrhages from the opened kidney led to his death.

*Autopsy.*—A carcinoma was found as mentioned above. The second kidney on microscopic examination showed practically no changes of moment. It was anemic and normal.

This case again illustrates the influence of a diseased organ on its fellow's activity. Here the second organ was microscopically normal; still this kidney failed to excrete sugar as a normal organ does, because of the peculiar influence exerted by its diseased mate. Here also the patient was living on his left kidney, as the ureter of the right side was closed. Nature's test of the adequacy of the left kidney was again at variance with the phloridzin test.

CASE 7.—M. C., 58 years; housewife.

*Diagnosis.*—Closed hydronephrosis.

*Cystoscopy and Bilateral Ureteral Catheterization.*—June 4, 1907. Bladder was negative except for cystocele. Left kidney secreted rapidly.

*Uranalysis.*—This specimen was yellow and clear, acid, specific gravity 1014, faint trace of albumin, urea 0.9 per cent., chlorids 0.48 per cent.

*Microscopically.*—Red blood cells, epithelial cells, few cylinders, no casts, tubercle bacilli or gonococci.

Right ureter was occluded close to the pelvis about eight inches from the bladder, and the indigo carmine test showed no discharge from this kidney, whereas the left discharged blue urine. This test, plus the inability to pass three different catheters beyond the obstruction, made it evident that this kidney was not doing any of the patient's excretory work.

*Phloridzin Test.*—Fifteen minims proved negative during the thirty minutes following the injection.

*Phloridzin Test (second).*—June 6, 1907. Fifteen minims again negative.

*Phloridzin Test (third).*—June 7, 1907. Fifteen minims again negative in first forty minutes following injection.

*Cystoscopy and Ureteral Catheterization (second).*—Same condition as on June 4, 1907.

*Nephrectomy for Closed Hydronephrosis.*—June 10, 1907.

Patient died June 18, 1907.

On one last day she passed some 700 c.c. of urine. Urine after operation showed considerable albumin (1 pro M.) hyaline and coarsely granular casts, red blood cells and leucocytes. At autopsy the left kidney shows some areas of an old nephritis and well-marked epithelial degeneration and many casts in the tubules.

Here again was a patient living in comfort with a closed ureter on one side, the other organ doing all the

necessary work. It was more than likely that this condition of affairs had existed some time prior to the first cystoscopy and up to the time of nephrectomy. Still the repeated phloridzin tests pointed to the conclusion that the only organ that was functioning was inadequate, which was not borne out by the observations before and after operation. If reliance had been placed on the percentage of urea it would have been almost as misleading as the phloridzin test.

A point of great interest in this case is the post-operative disease of the second kidney after the removal of the enormous adherent hydronephrotic sac. The absorption from this huge area was sufficient to produce a marked degeneration of the second kidney, as evidenced by the postoperative urine and microscopic examination of this organ, despite the fact that Nature's test of its function by forcing it to do all the legitimate work after closing the right ureter had pointed to its adequacy.

These cases seem to permit of but one conclusion, i. e., that a diseased kidney may so influence the second organ as to cause the latter to appear gravely diseased. This same conclusion was forced on me several years ago in considering the value of cryoscopy of the blood.<sup>4</sup> Disturbed function of an adequate organ may lead to molecular retention and concentration of the blood (low, freezing point), misleading us just as phloridzin did in the above series of cases. In looking over these cases they naturally fall into two series, four cases belonging to one, and three to the other. The first four are particularly important, as I was able to make a phloridzin test subsequent to the operation. Of such cases there are very few instances in the literature, and these are just the most enlightening of all clinical data bearing on the question of functional kidney tests. Even cases similar to the last three have not been reported in any number.

Turning to the literature of this subject we find that Rovsing has reported one experience similar to those detailed above. In a case of pyonephrosis he found after nephrectomy an early response to phloridzin, whereas before the operation there had been none, and also a rapid increase in the amount of urea excreted, which had been minimal prior to operation.<sup>5</sup>

In a similar case Kapsammer reports<sup>6</sup> similar behavior after using phloridzin, though his case is less striking than those mentioned above. Rovsing believes that the diseased kidney frequently disturbs the work of the second organ, and though his data are not published in a conclusive form, he states that this influence is observed in the following conditions, arranged in order of frequency: malignant tumors, tubercular pyonephrosis, nephrolithiasis, uratic nephritis and perinephritis. Kapsammer, ardent advocate as he is of the modified phloridzin test, admits that he has seen almost regularly a functional improvement in the second organ after the condition in the diseased organ has been attended to.

Albarran<sup>7</sup> calls attention to the influence exerted by hydronephrosis on the activity of the second organ, as well as the remarkable improvement which follows drainage of such hydronephrotic sacs. Koranyi published a case of pyonephrosis with blood freezing at 0.68° C. As soon as the pyonephrotic sac was removed the second kidney secreted better and the blood concen-

4. Present Status of Blood Cryoscopy in Determining the Functional Activity of the Kidneys. *Am. Jour. Med. Sci.*, February, 1906.

5. *Arch. f. Klin. Chir.*, lxxv, 1905.

6. *Id.*, i, 317.

7. *Exploration des fonctions renales*, 319.

tration dropped to 0.57° C. Wiebrecht also reported a similar case of kidney tumor in which after nephrectomy the second kidney excreted more fluids and more solids than both organs before operation.

From all the above it seems that there is a factor underlying functional tests that has not been emphasized sufficiently in the past. Until the factor can be estimated all functional tests of the excretory activity of a kidney are misleading. All negative results might be occasioned by this factor, this peculiar influence exerted by a diseased organ on its fellow, whereas all positive results may in turn be shorn of some of their importance by the above influence (stimulation or inhibition). Whereas it is comparatively easy to approach the negative results and elucidate their import, positive results, though they may be occasioned in part by some such influence as we are discussing, are much more difficult to analyze, for self-evident reasons.

Just the nature of this influence, whether it be toxic or reflex, or both combined, I do not wish to discuss in this particular paper, whose object is to emphasize and demonstrate the fact that the second kidney may be so influenced in its excretory activity as to appear functionally deficient, owing to the presence of a diseased kidney, and that as soon as this influence has been removed this apparently inadequate second kidney responds to our functional tests as a normal organ.

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## AN EPIDEMIC OF CEREBROSPINAL MENINGITIS

AND THE SUCCESSFUL USE OF FLEXNER'S ANTISERUM.

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PORTERVILLE, CAL.

Porterville is a town of about 2,000 inhabitants, in the San Joaquin Valley, at the foot of the Sierras. Here in 1896 occurred five cases of cerebrospinal meningitis, of which two recovered. One, now a boy of 16 years old, is a hopeless cripple; he has no use of arms or legs.

The following cases have occurred in the present outbreak, which began early in December, 1907. The first twelve cases are given briefly; antiserum was not used; only one recovered; thus the mortality in these twelve cases was 91.6 per cent.

CASE 1.—(Dr. O. C. Higgins, December, 1907.) Miss T., aged 21, was examined at 11 a. m. by the doctor in a tent-wagon. Had had a chill and convulsions a few hours before. When seen by the doctor there was external strabismus and the patient was unconscious. Died about 9 a. m. the next day, within twenty-four hours of onset.

CASE 2.—(Dr. O. C. Higgins, Dec. 21 and 22, 1907.) E. W., aged 14, complained of pain in the neck and between shoulders. Chill at 4 a. m.; vomited eight hours later for two and one-half hours. Ten hours after the chill had convulsions and delirium, followed by unconsciousness, which lasted till death. Choking spells from onset of unconsciousness until death. Head drawn back and marked opisthotonos. Length of illness, twenty-nine hours.

CASE 3.—(Drs. Barber and Miller, Dec. 20, 1907.) L. H., aged 21; had a chill at bedtime; said he felt as though he had the grip. In the morning was found in bed unconscious and never regained consciousness. Kernig's sign and retraction of head were present and there was great restlessness and vomiting. Lumbar puncture was performed within twenty-four hours of onset; the cerebrospinal fluid was cloudy and contained many gram-negative diplococci, intracellular and extracellular. Patient died at the end of four days.

CASE 4.—(Drs. Higgins and Barber, Dec. 21, 1907.) Mrs. N., aged 40, was taken sick at noon. When seen at 1 p. m., she had a chill; complained of vomiting, headache. Kernig's sign and external strabismus were present. Could be roused. Died before midnight. Sick less than twelve hours.

CASE 5.—(Drs. Miller and Higgins, Dec. 31, 1907.) Mrs. O., aged 23, was taken sick at 4 p. m., with chill and severe headache and vomitings. She was unconscious by night. Kernig's sign was present, but no convulsions. Died at 11 p. m.; duration of illness, seven hours.

CASE 6.—(Dr. Barber, Jan. 1, 1908.) Mr. C., aged 23. Malaise all day, followed at 5 p. m. with chill. Found later in the evening unconscious in bed. Had been vomiting. Head was retracted and Kernig's sign marked. Violent delirium during which he got up and went out of doors. Died in twenty-seven hours.

CASE 7.—(Dr. Barber, Jan. 28, 1908.) C. E. B., aged 22; the night of January 27 had chill and vomiting. Went to Dr. Barber's office next day at 9 a. m., with pain in right iliac region. Temperature, 102 F.; tongue coated; symptoms of appendicitis. Signs of meningitis soon were apparent. Complained of pain in right thigh, but there was nothing objective there. Kernig's sign was present, also opisthotonos. Died in wild delirium. Sick three days.

CASE 8.—(Drs. Miller and Barber, Feb. 15, 1908.) Eva W., aged 7. Illness began with chill, vomiting and fever. There was retraction of the head and she complained of "drawing feeling" under knees. Headache in vertex; frequent urination, somnolence and unconsciousness. Lumbar puncture showed a cloudy cerebrospinal fluid which contained a great many Gram-negative diplococci, both intracellular and extracellular. Lumbar puncture was repeated each day; about 5 c.c. of fluid being withdrawn and a like quantity of antistreptococcus serum injected. This treatment seemed to be of some slight benefit, but the symptoms progressed in severity until death at the end of four days.

CASE 9.—(Drs. Barber and Miller, Feb. 23, 1908.) S. W., aged 4. The onset was typical, with chill, vomiting, retraction of head and somnolence. Kernig's sign and strabismus were present. Died at end of three days.

CASE 10.—(History told Dr. Higgins by child's mother.) Miss B., aged 13; onset with chill, vomiting, fever, unconsciousness. Death in twenty-four hours.

CASE 11.—(Dr. Barber, March 2, 1908.) S., aged 8. Onset with chill and vomiting; stupor. Marked Kernig's sign and retraction of head and strabismus. Was never unconscious; took nourishment throughout illness. His mother refused to have lumbar puncture done or to have the antiserum injected. Child recovered in one week.

CASE 12.—(Dr. Barber, March 15, 1908.) K., aged 6. The girl went to bed well; at midnight had a chill and vomited. When seen by doctor there was marked Kernig's sign, delirium, opisthotonos and petechial eruption. Died in eight hours.

The following four cases had the benefit of Flexner's antiserum; three were marked by recovery, giving a mortality of 25 per cent. The one patient who died would probably have been saved if our supply of serum had lasted.

CASE 13.—(Drs. Barber and Miller, March 12, 1908.) F. H., aged 14 months. At 8 a. m., March 11, he had a chill and vomited. Vomiting continued through the day and once in the night, at 1 a. m. Was seen by Dr. Barber at 5 p. m., March 11; temperature, 103 F.; pulse, 125. The child was very restless; Kernig's sign marked in both legs. By 7:30 p. m. there was external strabismus in both eyes and stupor. At the first visit the mother refused use of serum, saying, "I don't want any experiments tried on my baby."

March 12, 8 a. m.: Temperature, 102 F.; pulse, 140; respirations, 45. Child brighter and better. Kernig's sign not present in right leg, but slightly in left. Eyes straight. Nursed breast at 7 p. m. yesterday (first time since chill), and once last night. 9:30 a. m.: Temperature, 101 F.; pulse, 152; respirations, 48. Kernig's sign absent in right leg, slightly marked in left; eyes straight; expression fairly good. Blood examination showed leucocytes, 21,000. Parents consented to