

THE RENAL FUNCTION TESTS IN RELATION TO IMMEDIATE

PROGNOSIS.

THESIS
SUBMITTED FOR THE
M.D. DEGREE.
BY

JOHN ADAM.
M.B., Ch.B., Glasgow, 1924.

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For many years, the question of giving an accurate, immediate prognosis in nephritis and cases of suspected Renal involvement, has proved insurmountable, because the methods of examination clinical, urinary and of the blood, although providing much information, have not been able to show definitely the extent of kidney damage, or reveal early evidence of disease. To overcome these difficulties certain tests were introduced, which are now grouped under the heading of Renal Function Tests. Many were devised, but the claims of all the investigators have not been substantiated; so that although more of the function of the kidney is now known, the problem still remains; can an accurate, immediate prognosis be given in Renal lesions, when clinical, urinary and functional examinations are performed?

The methods of examination are of three kinds:-
URINARY.

In 1827, Dr. Bright drew attention to the connection between albumen and kidney disease, with the result, that up to the present time, all persons with albuminuria have been looked on with grave suspicion. Lately, it has been clearly demonstrated, that conditions such as Functional Albuminuria do exist, and MacLean¹ has shown that during the war, 5%

*albumin
in the urine*

long ago!

of all the men had Albuminuria. In many cases these soldiers had not been subjected to the rigors of a campaign. The quantity of albumen was at one time thought to be an indication of the severity of the lesion; but fortunately this view has now been entirely discarded. The same importance was attached to the presence of casts in the urine, and G. Stewart² says:- "Tube casts are of undoubted value in establishing the existence of Bright's disease." Even this has been discredited by MacLean's³ recent work, which has proved that casts epithelial and hyaline are present in the urine of normal, healthy adults. The solids of the urine have also received attention and G. Stewart⁴ in 1871 noted that in certain stages of the Inflammatory form of Nephritis, Chlorides, Sulphates, Phosphates and Uric Acid were diminished. Modern methods have been applied to these results, so that now the estimation of Urea and Chloride is easily and accurately carried out and employed in Renal Function Tests. Similarly the variation of the Sp. Gravity was noted, and is now used in what is known as the Two Hour Test.

BLOOD.

Blood changes were recorded in 1829 and 1839 by Dr. Christison,⁵ who found that there was a marked retention of urea in the blood in the waxy form of

nephritis. He comments on the fact that the amount of urea remained high, although large quantities of urea are being excreted.

With the rapid improvement in technique, blood analysis has become a comparatively easy matter, and it has been shown that in Renal lesions, certain substances are retained in the blood, such as Urea, Chlorides, Cholesterol and Phosphates. The estimation of these is now employed as a test for Renal function, and forms the basis of important statements regarding diagnosis and prognosis. Much of this work is at present in its infancy, but already it has been shown that certain of the blood tests are specially referable to the type of lesion present, e.g. Blood Urea in Urine Obstruction and Chronic Interstitial Nephritis; Blood Chloride and Cholesterol in Parenchymatous Nephritis.

DYE.

Many tests have been brought forward under this heading, but the basis of all is the same, namely:- the introduction of a dye and the subsequent estimation as to how rapidly and completely it is excreted by the kidney.

The Phenolsulphonephthalein Test introduced by Rowntree and Geraghty in 1910 has found the greatest favour among observers.

The object of these tests may be summarised as follows:-

(1) To discover if Renal disease is present and to indicate the cause, i.e., to assist in diagnosis.

The real difficulty occurs most often when slight albumen is present accompanied by a decidedly high blood pressure, and such cases are often diagnosed Primary Interstitial Nephritis with secondary Cardiovascular changes. By the application of Renal Function Tests, it can be clearly demonstrated that the kidney is working efficiently and therefore, the condition is not due to renal involvement. This is only one of many examples that can be quoted, but it serves to show the value of the tests in diagnosis.

(2) To determine the extent of Renal damage, and so aid in an accurate prognosis.

This is by far the most difficult feature of all renal disease, and the problem is probably best discussed under the following headings:-

A. Surgical

Many surgical failures in the past would have been avoided if these tests had been available, because it is now well understood that successful operation is largely dependent upon renal efficiency. As an instance of this, the removal of an enlarged prostate may be quoted. In this condition the free passage

of urine has been hindered over a long period, with the result that back pressure has often seriously impaired the function of the kidneys. By suprapubic cystotomy performed prior to prostatectomy, it is possible to improve the renal function, and so make it safe to proceed at a later date with the major operation. It may be said that no surgical measures should be undertaken in any case where back pressure has been present, or where residual urine exists in any quantity, unless renal function tests are carried out.

As a guide, Beaumont and Dodds⁶ state that a Blood Urea over 50 mgms. per 100 cc. is a contraindication to operation. Regarding localised lesions of the kidney, the surgeon himself usually employs the Indigo Carmine Test for direct observation on the ureters.

B. Obstetrical Case.

Albuminuria is one of the serious complications which may arise at any time during pregnancy, and presents many difficulties in relation to prognosis. It has to be decided if the condition is due to pregnancy or superimposed on old standing renal disease, because the treatment is entirely different in each. Many of these, due only to pregnancy will settle down under appropriate treatment, but when

chronic nephritis has been present prior to foetation then it is known that if the patient is allowed to go to full term, the renal condition will be much worse after delivery. The problem of determining the cases in which Eclampsia may supervene is one that also required serious consideration, and as an aid, Beaumont and Dodds⁷ state that when the blood urea and non protein nitrogen contents are above 40 mgms. per 100 cc., pregnancy should be terminated.

C. Medical Case.

In the past, prognosis of this type has been based on the clinical examination, particularly the Cardio-Vascular system, the blood pressure and fundal changes:- Boyd,⁸ showed the blood pressure unfortunately furnishes no evidence as to the state of renal function. The importance of the careful study of the various organs cannot be over estimated, but they can be misleading as is occasionally seen in patients whose general condition is improving, and who suddenly die from Uraemia.

For surgical and obstetrical cases it is sufficient to know that the function of the kidney is impaired to such an extent as to preclude the possibility of operation, or render the termination of pregnancy essential.

In the medical case it is necessary to know much more, especially the extent of damage done to the kidney, and it is here that the value of the

tests of renal function are a help in prognosis. Various forms of nephritis give different readings when Blood Analysis is carried out and as an example hydraemic nephritis may be quoted, showing low urea retention. This variation increases the difficulty but fortunately other Bio-Chemical tests can be applied, which assist in the elucidation of the problem.

The use of these tests is by no means confined to renal lesions but can be of great help in other conditions, where recovery depends on a sound kidney, as Pneumonia, Cardiac diseases etc. Thus it will be seen that any knowledge of a case, when supplemented by the results of these tests, widens the whole field and allows a more definite prognosis to be given.

I have taken fifteen cases which have occurred in my practice, where it seemed that further information regarding prognosis could only be obtained by use of the Renal Efficiency Tests.

How often the physician is asked by the patient, "What is my outlook?" and in an attempt to answer this I have carried out the following tests, during a period of from two to three days, attempting to make the conditions under which the tests were performed, the same; special attention being given to the influence of diet on the results.

These tests have been performed once each, for

reasons which I will try to substantiate later. One knows well the value of repeating these tests at intervals, but the patient, in many cases, will not wait, he wants results at once; and the tests were carried out with that point definitely in view.

The following, I have used with a view as to seeing which gave the most help, and were suitable for use in general practice.

- (1) Blood Urea.
- (2) Urea Concentration.
- (3) Phenolsulphonephthalein.

As well as this, I have made a brief survey of each case, noting the general features, including the Blood Pressure, amount of Albumen, Sp. Gr. and weight.

Before proceeding to discuss these cases it is necessary to give a brief account of the various tests used in estimating renal efficiency. The methods at present employed are:-

- (1) Estimation of Blood Urea.
- (2) Urea Concentration Test.
- (3) Phenolsulphonephthalein Test.
- (4) Diastatic Test.
- (5) Less used methods:-
 - (a) Sodium Benzoate Test.
 - (b) Two hour test.

1. ESTIMATION OF BLOOD UREA.

This is performed by the method suggested by Marshall and Van Slyke, but modified by Maclean and de Wesselow. The principle is that Soya Bean contains an enzyme Urease, which converts Urea into Ammonium Carbonate but has no effect on the other nitrogenous constituents.

In the presence of Alkali the Ammonia is liberated from the Ammonium carbonate and by the help of a current of air, is passed through a standard solution of acid. The amount of acid neutralised indicates the amount of Ammonia present, and from this the urea can be calculated.

Technique.

3 cc. of blood are mixed with .3 grms. of Soya Bean Meal in a tube and placed in a water bath for

15 minutes. It is then connected with another tube containing N/100 H_2SO_4 and what ammonia is present is sucked through by means of a pump. After two minutes the blood tube is opened and 4 cc. of saturated Potassium carbonate solution along with 3 grms of solid anhydrous potassium carbonate added quickly. The tube is then closed and suction resumed for 30 minutes. The acid tube is then titrated with N/100 NaOH, and the difference between the 25 cc. of acid originally taken and cc. of alkali used gives the number of cc., neutralised by ammonia. Each cubic centimetre of acid neutralised equals 10 mgrs. Urea per 100 cc. of blood.

This is one of the most valuable of renal efficiency tests, but there are certain fallacies which must be avoided. It is generally understood that on an average diet in healthy people the amount of Urea in the blood varies between 20 to 40 mgrs. per 100 cc. blood. In the aged however, it is not uncommon to find blood Urea of 60 mgrs. or even more, when the kidneys are apparently fairly normal for that period of life.

Diet is also of importance. The blood should be obtained from the patient either in the morning before he has partaken of food, or at least six hours after a meal. Maclean⁹ has shown that other diseases

such as Pneumonia, Cardiac disease, Intestinal Obstruction etc. can cause a rise in the blood urea.

Day¹⁰ says that blood urea may be normal and still renal inefficiency, as hypertension, diminished protein intake and polyuria will keep it low.

Agnew;¹¹ "Three fifths of the kidney surface must be destroyed before the blood urea is raised, and therefore with such a wide margin of safety slight changes in the kidneys are not indicated by the test."

Agnew;¹² "A raised blood urea means bilateral kidney disease, and it is thus of great value to the Surgeon in 'Surgical Kidney.'"

2. UREA CONCENTRATION TEST.

This test was introduced by Maclean and de Wesselow, and has proved highly satisfactory in estimating renal efficiency. It depends on the fact that patients with defective kidneys are incapable of secreting urine with a high concentration of urea.

Technique.

From 7 p.m. the patient takes no food, and if possible no fluid. Then, at 7 a.m. the bladder is emptied and he is given 15 grms. of urea in 100 cc. of water by the mouth. At 8, 9 and 10 a.m. the bladder is emptied and the specimens collected in separate bottles.

As urea may cause a marked diuresis it is best

to use the second hour specimen but should this exceed 120 cc. then the third should be used. Various methods are in use for the estimation of urea, and I have used that of Doremus. The apparatus is filled with a freshly prepared solution of Sodium hypobromite made by mixing 2 cc. of Bromine in 18 cc. of 35% NaOH. Then for accuracy the urine is diluted to 50% and one cc. of this introduced through the bulb into the long limb by means of a pipette. After effervescence has ceased the reading is obtained directly on the side of the tube and multiplied by 2.

It is now definitely accepted that a healthy kidney will concentrate urea from 2% upwards, and anything below this figure shows renal deficiency in proportion. Maclean¹³ considers that this test is unnecessary in a case where the blood urea is high, as the patient has already a large enough "Head of Urea," and the urea estimation can be carried out at once from a specimen of the urine.

Various points arise in the test such as the restriction of fluid, and Maclean¹⁴ states that the value of the test is enhanced 50% if little or no fluid is given for 18 to 24 hours beforehand, and only a light meal three hours before carrying out the estimation. It will also indicate slighter lesions than blood urea, and in acute nephritis long after blood urea has returned to normal, still show evidence of renal inefficiency.

Coope and Jones¹⁵ state that the test for immediate prognosis is of no great help, as some cases where it was low, lived, and others with fairly high, died. They say that under 1% marked renal deficiency; 1 - 1.5% strong presumption of renal deficiency; and 1.5 - 2% possibility, and summing up that it must be checked along with the blood urea.

Beaumont and Dodds¹⁶ point out that the test has one disadvantage, in that it depends not only on the excretory power of the kidney, but also upon the emptying power of the stomach, since urea is only absorbed by the intestines.

3. PHENOLSULPHONEPHTHALEIN TEST.

The principle of this test is based on the fact that in cases of renal deficiency, the elimination of this dye is delayed.

Technique.

The patient is given 300 cc. of water to drink, and twenty minutes after the bladder is emptied and 1 cc. of the solution (1 cc. contains 6 mgms. of the dye) rendered non-irritating by a few drops of NaOH. injected into the lumbar muscles. Ten minutes are allowed for excretion to begin and specimens are collected at the end of the first and second hour.

The result is obtained (1) By a Colorimeter
(2) By Comparison. I have used the second method.
A standard solution is prepared by taking 1 cc. of

the dye, adding a few drops of NaOH. and making the whole up to a litre with water. Two similar 100 cc. graduated jars are required. To the first 20 cc. of the standard solution are added and made up to 100 cc. The quantity of urine passed is measured, one tenth of it placed in the second jar, a few drops of NaOH. added and then diluted to match the standard. The calculation is easily worked out. It is often necessary to filter the urine before proceeding with the estimation.

Various opinions are at present expressed as regards the value of the test. Maclean,¹⁷ "Although apparently simple, it is really difficult to carry out, as an error of from 20 - 30% is possible. One of the main points is that the standard is made with water and the other with urine, which contains pigment which masks the end point.

Day¹⁸ is of the opinion that half hour periods are better, as it is the proportion of the dye passed in the first half hour in relation to that of the second, that matters. Agnew,¹⁹ Bieter and Hirschfelder showed that Phenolsulphonephthalein is excreted only by the glomeruli and therefore delay is an indication of their involvement. E. Clay Shaw²⁰ shows that over half the amount of dye which would be eliminated in the first two hours was passed during the first 15 minutes, and therefore by plotting a fifteen minute graph, a curve is obtained, and it is

the position of the peak on this that matters. If the peak is delayed then renal inefficiency is present, as in some cases the total quantity of dye passed during the first two hours was the same even when improvement had taken place, but the peak was earlier, showing renal improvement. It is now accepted that about 40 to 60% of the dye is excreted by the first, and 60 to 85% by the second hour.

4. DIASTATIC TEST.

This test depends upon the presence of diastase in the urine. Normally there is a definite amount of diastase in the blood, and if the kidneys are efficient a fairly constant amount is present in the urine. When defective it is diminished.

Technique.

Solutions required:-

- (a) 1% solution of soluble starch in distilled water.
- (b) 9% Sodium chloride.
- (c) Solution of Iodine, about 1/10th normal.

The diastatic activity of any specimen of urine is estimated in terms of the amount of starch which a definite volume of urine will change in a given time. The disappearance of starch is indicated by the failure of starch and urine to give the blue reaction.

The average value for healthy adults varies between 6 and 20 units, whereas in renal inefficiency

results are obtained in proportion to the severity of the disease. This test is only of value when considered along with other results, but by itself it is too erratic to be of much use. As Maclean says:²¹
"Personally, I attach very slight importance to the test."

Lesser Used Methods.

1. THE SODIUM BENZOATE TEST.

This test depends upon the formation of Hippuric acid by the conjugation of Benzoic acid and its salts with Glycocoll, and that this synthesis of Hippuric acid is absent or diminished in affections of the kidney.

Technique.

24 grms. of Sodium benzoate are given in 100 cc. of water after the bladder has been emptied, and then the tumbler is rinsed and another 200 cc. given. An hour later a further 200 cc. is given. Specimens are collected at the end of the 2nd and 3rd hours and analysed for Hippuric acid. Fruit must be restricted from the diet for 24 hours before. Bryan:²² "Very useful in determining renal function. 70% excreted in two hours, and 85-90% in three; although the question of getting Glycocoll when the liver was deranged would upset the test." This test is too complicated for general use.

2. TWO HOUR TEST.

2. TWO HOUR TEST.

This test depends upon the variation of the specific gravity of the urine, before and after food, the quantity of urine passed and the relation of the S. gravity and quantity of night urine to that of the day.

Technique.

The patient is instructed to eat ordinary meals at 8.30 a.m., 12.30 p.m., 6.30 p.m. and to drink freely at these times only. The bladder is emptied at 9 a.m. and specimens are collected every two hours till 9 p.m. All the night urine from 9 p.m. to 9 a.m. is collected.

The interpretation of this test is at first difficult, as many points have to be considered. Normally, the samples following meals will be larger in quantity and lower in specific gravity than those before. Also, there will be a variation in the specific gravity of night specimens. If there is a narrowing of the range of the specific gravity functional impairment is present and fixation at low levels indicates severe damage. The night urine will show low specific gravity and large increase in amount. This method is unfortunately not greatly used in this country.

These tests by themselves are valuable, but their

real use is when they are taken in conjunction with the clinical manifestations of the patient, so as to assist in the question of prognosis.

In the following 15 cases I have endeavoured to give:-

- (a) A short history of each patient's illness.
- (b) Family history, if any.
- (c) Brief clinical conditions on examination.
- (d) Patient's complaint.
- (e) Charts:-
 - (1) Blood urea.
 - (2) Phenolsulphonephthalein.
 - (3) Urea C. Test.
 - (4) Amount of urine in 24 hours.
 - (5) Amount of albumen.
 - (6) Blood Pressure.
 - (7) Weight.

I have analysed these tests and pointed out their importance in immediate prognosis.

No.1. 24/11/27.

Age 17 years. Female. Clerk. Single.

History.

Family history good. In July 1924, she had some swelling of the neck and face but this was attributed to her age. Two months later her urine became red, and on examination contained albumen and blood. Swelling of the legs and chest developed confirming the diagnosis of acute nephritis. She remained under treatment for a period of nine months.

Clinical Examination.

Tall, thin, good colour, no oedema, no retinal changes, albumen present in the urine.

Heart. Apex beat in fifth interspace heaving in character, left side of the heart just outside nipple; first sound at apex heaving and slow, second sound accentuated in Aortic Area.

| <u>Blood Urea</u> mgrs. per 100 c.c. | <u>Phenol-Sulph</u> <u>Test.</u> | <u>Urea</u> <u>Conc.</u> <u>Test.</u> | <u>Amount of</u> <u>Urine in</u> <u>24 hrs.</u> | <u>Albumen</u> <u>Esbach</u> | <u>Blood</u> <u>Pressure</u> <u>Systolic</u> | <u>Night</u> <u>Urine</u> <u>Sp. Gr.</u> |
|--|-------------------------------------|---|---|---------------------------------|--|--|
| 39 | 75% | 2.8% | 44 ozs. | 1.2% | 110 mms. | 1026. |

Weight.

9 st. 12 lbs.

Prognosis.

I consider her immediate outlook good. The renal function tests are all within normal limits, although her blood urea is rather high for her age and

the Cardiac changes are not marked.

Progress.

This patient has gained a stone in weight during the past year, and is able to do a moderate day's work without undue fatigue.

As the headache continued her eyes were examined, and glasses prescribed which relieved the condition.

No.2. 30/5/27.

Age 43 years. Female. Housewife. Married.

Complaint.

Severe headache, failing vision, shortness of breath, loss of weight, passing of urine in the night.

History.

Mother died of stroke, two cousins with diabetes and another with Bright's disease. Fourteen years ago had swelling under the eyes with severe headache, and urine revealed albumen. Since then she has been under medical supervision.

Clinical Examination.

Thin, pale, no oedema, albuminuric retinitis and hardening of brachial arteries present. Albumen present in urine.

Heart. Apex beat diffuse over sixth interspace, left side of heart $\frac{3}{4}$ of an inch outside nipple line, marked accentuated second sound in Aortic area.

Systolic murmur heard at apex.

| <u>Blood Urea mgrs. per 100 cc.</u> | <u>Phenol-Sulph Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine in 24 hours.</u> | <u>Albumen Esbach</u> | <u>Blood Pressure systolic</u> | <u>Night Urine Sp.Gr.</u> |
|-------------------------------------|---------------------------|-------------------------|-------------------------------------|-----------------------|--------------------------------|---------------------------|
| 140 | 5.7% | 1.8% | 35 ozs. | 4% | 210 mms. | 1015. |

Weight.

7 st. 2 lbs.

Prognosis.

Prognosis.

I consider her immediate outlook very bad. The renal function tests reveal marked insufficiency of the kidneys, especially the high blood urea and low dye excretion. Heart changes are present along with high blood pressure and Albuminuric Retinitis.

Progress.

This patient died seven months later from Uraemia.

? if tests were done

No.3. 4/3/27.

Age 16. Female. Packer. Single.

Complaint

Headache, pain over the heart, pain in eyes, easily tired, poor vision.

History.

Family history good. In June 1922 had an attack of Influenza and was in bed a fortnight. Six months later complained of feeling tired in the mornings, severe headache and albumen found in large quantity in the urine. She remained in bed for two months with some swelling of the face, and since that date has been off and on under treatment.

Clinical Examination.

Thick set, white bloated face, no oedema, diminished vision, albumen in urine.

Heart. Apex beat diffuse over fifth and sixth interspaces, left border of the heart extends just outside the nipple line. First sound at apex, slow and heaving, second sound is accentuated in Aortic area, Systolic murmur present in Pulmonary area.

| <u>Blood Urea</u> <u>mgrs. per</u> <u>100 cc.</u> | <u>Phenol-Sulph</u> <u>Test.</u> | <u>Urea Conc.</u> <u>Test.</u> | <u>Amount of</u> <u>Urine in</u> <u>24 hours.</u> | <u>Albumen</u> <u>Esbach</u> | <u>Blood</u> <u>Pressure</u> <u>systolic</u> | <u>Night</u> <u>Urine</u> <u>Sp. Gr.</u> |
|---|-------------------------------------|-----------------------------------|---|---------------------------------|--|--|
| 25 | 50% | 4% | 40 ozs. | Trace. | 126. | 1017. |

Weight.

10 st.

Prognosis.

I consider her immediate outlook good. The renal function tests are satisfactory except the Phenolsulphonethalein, which may possibly indicate more damage to the Glomeruli than the rest of the kidney. The Cardiac changes are not marked.

Progress.

This patient has had two attacks of Influenza during the past eighteen months and is fairly well at present. Her eyes have been examined and a moderate degree of astigmatism found, which has been corrected by glasses. Her weight is increasing.

No.4. 17/6/27.

Age 64 years. Female. Housewife. Married.

Complaint.

Severe headache, pain in the chest, shortness of breath, dizziness, failing eyesight.

History.

Family history good. About a year ago felt shaky, nervous and unfit to do her housework. She is a farmer's wife and has always led a strenuous, active life.

Clinical Examination.

Well built, good colour, fine tremor in the hands, no oedema, hard brachial arteries, blood vessels very prominent in retina, trace of albumen in the urine.

Heart. Apex beat in sixth interspace, left border of the heart half an inch outside nipple line, accentuated second sound in Aortic area. Heart rapid, 96 per minute, with extra systoles present.

| <u>Blood Urea.</u> | <u>Phenol-Sulph Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine.</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|---------------------------|-------------------------|-------------------------|----------------|-----------------------|---------------------------|------------------|
| 34 m. | 75% | 3.2% | 50 oz. | Trace. | 230 mgs. | 1013 | 11 st. 2 lbs. |

Prognosis.

I consider her immediate outlook bad. The renal function tests are extremely satisfactory, but

the high blood pressure, retinal changes, cardiac distress all point to a possible haemorrhage.

Progress.

This patient is losing weight and although her blood pressure fell to 170 mms. under treatment with rest in bed, it rose again.

? value 170.

No.5. 2/6/27.

Age 17 years. Female. Invalid. Single.

Complaint.

Severe headache, great prostration, attacks of sickness.

History.

Family history good. From birth she has been weakly and ten years ago albumen was found in the urine. Since that date she has been ill periodically, and is now permanently confined to bed, following an attack of Uraemia.

Clinical Examination.

Very pale, translucent skin, undersized, no evidence of rickets, no oedema, hands moist, optic neuritis present, albumen in urine.

Heart. Rapid action, 100 p.m., apex beat in fifth interspace, no enlargement, accentuation of second sound in Aortic area.

| <u>Blood</u> <u>Urea.</u> | <u>Phenol-Sulph</u> <u>Test.</u> | <u>Urea</u> <u>Conc</u> <u>Test</u> | <u>Amount</u> <u>of</u> <u>Urine.</u> | <u>Albumen</u> | <u>Blood</u> <u>Pressure</u> | <u>Night</u> <u>Urine</u> <u>Sp.Gr.</u> | <u>Weight</u> |
|------------------------------|-------------------------------------|---|---|----------------|---------------------------------|---|-----------------|
| 212 m. | Refused | .7% | 35 oz. | .2% | 120 mms. | 1009 | 5 st. 6 lbs. |

Prognosis.

I consider her immediate outlook very bad. The renal function tests reveal great insufficiency and the past history of Uraemia all point to an early termination.

Progress.

This patient died in March 1928 from Uraemia and I attribute the length of her life in part to the fact that her diet consisted of only fruit juice and a little milk. A diagnosis of Renal Dwarf was considered, but in view of the absence of rickets, was discarded.

No.6. 10/9/27.

Age 73 years. Male. Retired clerk. Widower.

Complaint.

Shortness of breath, indigestion, headache in the morning, failing vision, irritating cough.

History.

Father died, aged 69 from Cerebral Haemorrhage. Patient never had a day's illness in his life until 1925, when albumen was found in the urine.

Clinical Examination.

Thin, sallow complexion, oedema over tibiae, liver half an inch below costal margin, wasted, brachial arteries hard, albumen present in urine.

Heart. Apex beat in sixth interspace, left border half an inch outside nipple line, rapid action with "tic tac" rhythm, systolic murmur at apex conducted into Axilla, accentuated second sound in Aortic area.

| <u>Blood Urea.</u> | <u>Phenol-Sulph Test.</u> | <u>Urea Conc. of Test.</u> | <u>Amount of Urine.</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|---------------------------|----------------------------|-------------------------|----------------|-----------------------|---------------------------|---------------|
| 50 m. | 43% | 2.2% | 45 oz. | .05% | 170mms. | 1024 | 8 st. |

Prognosis.

I consider his outlook fair. The blood urea is slightly raised, but is possibly due to his age. The phenolsulphonephthalein shows some degree of

insufficiency, while the urea conc. test is within normal limits. Viewed from the Renal Function test his outlook would be good, but there is definite evidence of myocardial degeneration.

Progress.

This patient had a severe break down in August, 1928, with great oedema of legs, thighs, scrotum and of the face. Ascites was present and he made an excellent recovery.

No.7. 30/5/27.

Age 73 years. Male. Gentleman. Married.

Complaint.

Pain in left groin, difficulty in starting flow of water, has to get out of bed to micturate.

History.

Family history good. Eight years ago had to be catheterised for retention, but this cleared up after three weeks treatment. An enlarged prostate was the diagnosis. He has noticed that worry causes a relapse, and in 1925 he had a recurrence, which was accompanied by profuse bleeding.

Clinical Examination.

Tall, well built, looks ten years younger, enlarged prostate, easily felt per rectum.

Heart. Apex beat in sixth interspace, left border just outside nipple line, no other abnormality.

| <u>Blood Urea.</u> | <u>Phenol-Sulph Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|---------------------------|-------------------------|------------------------|----------------|-----------------------|---------------------------|------------------|
| 34 m. | 36% | 1.8% | 45 oz. | Trace. | 160 | 1020 | 11 st. 2 lbs. |

Prognosis.

I consider his immediate outlook good. The blood urea is normal. The Phenol-sulph and Urea Conc. results indicate some degree of renal insufficiency,

but this is counterbalanced to some extent by the blood pressure and cardiac changes being slight.

Progress.

This patient is in good health and has had no further attacks. He is a suitable case for operation but as he is well, will not consider it.

THIS PATIENT DIED IN MARCH 1929, FROM URAEMIA.

*Seems to me from such a case as
this to be wrong to lay all stress on
uremia.*

No.8. 17/6/27.

Age 23 years. Male. Clerk. Single.

Complaint.

None. Medical examination prior to entering training college, discovered albumen in the urine.

History.

Family history good. This patient has had no serious illness.

Clinical Examination.

Pale, well built, urine on rising contained albumen, while that passed during the day contained little or none.

Heart. Normal.

| <u>Blood Urea.</u> | <u>Phenol-Sulph Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|---------------------------|-------------------------|------------------------|----------------|-----------------------|---------------------------|------------------|
| 32 m. | 70% | 2.5% | 48 oz. | | 124 | 1020 | 10 st. 2 lbs. |

Prognosis.

I consider his outlook excellent. The renal function tests reveal no deficiency and there are no Cardiac changes.

Progress.

This patient is in good health, thus confirming the diagnosis of Functional Albuminuria.

Handwritten note: 100% albumen in urine.

No.9. 22/9/27.

Age 56 years. Female. Housewife. Widow.

Complaint.

Pain over the sternum, feeling of blood rushing into the head, severe headache, dizziness, shortness of breath.

History.

Family history good. Rheumatic fever in 1899, then had water in the legs following confinement about 24 years ago. Albumen was found in the urine, and she was treated in hospital for kidney trouble.

Clinical Examination.

Tall, well nourished, slight oedema over tibiae due to varicosity, no retinal changes.

Heart. Apex beat in sixth interspace, left border just outside nipple line, sounds faint at apex due to thickness of chest wall, accentuated second sound in Aortic area.

| <u>Blood Urea.</u> | <u>Phenol-Sulph Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|---------------------------|-------------------------|------------------------|----------------|-----------------------|---------------------------|------------------|
| 26 m. | 70% | 3% | 50 oz. | nil. | 190 | 1022 | 13 st. 7 lbs. |

Prognosis.

I consider her immediate outlook good. The Renal Function tests are all within normal limits, the

cardiac changes are slight and there are no eye changes.

Progress.

The blood pressure has fallen to 164 mms. under treatment, and she is able to perform her house duties without undue fatigue.

has this case of hepatitis?

No.10. 18/10/27.

Age 58 years. Female. Housewife. Married.

Complaint.

Attacks of severe pain in left side.

History.

Family history good. During the past twenty years at intervals she has had numerous attacks of colic-like pains in the left side. Six weeks ago during one of these, she had profuse haematuria.

Clinical Examination.

Pale, well built woman.

12/9/27. Bacteriological report revealed pus with epithelial cells, and B. Coli communis in moderate quantities. X-ray of the urinary tract, negative.

22/9/27. Chromo-Cystoscopy, right ureter normal, left much swollen, oedematous, slight bleeding. Ureter bougie passed up quite easily.

4/10/27. Left kidney excised. Pathological report states thickening of pelvic epithelium with intense congestion and a number of small abcesses in the underlying tissues. The vessels are much sclerosed and many of the glomeruli are completely obliterated.

18/10/27.

| <u>Blood</u> | <u>Phenol</u> | <u>Urea</u> | <u>Amount</u> | <u>Albumen</u> | <u>Blood</u> | <u>Night</u> | <u>Weight</u> |
|--------------|---------------|--------------|---------------|----------------|-----------------|---------------|------------------------|
| <u>Urea.</u> | <u>Sulph</u> | <u>Conc.</u> | <u>of</u> | | <u>Pressure</u> | <u>Urine</u> | |
| | <u>Test.</u> | <u>Test.</u> | <u>Urine.</u> | | | <u>Sp.Gr.</u> | |
| 34 m. | 24% | 2.8% | 40 oz. | TRACE | 156 | 1018. | Not avai- lable. |

Prognosis.

I consider her immediate outlook good. The renal function tests are satisfactory, except the Phenolsulphonaphthalein, which may indicate that the glomeruli have been more damaged than the rest of the kidney.

Progress.

This patient is in good health, has gained weight and is able to perform her house duties.

The Surgical Notes regarding the Case were kindly supplied by Mr. C. D. Lochrane and Mr. J. C. Grieve of the Women's Hospital, Derby.

No.11. 29/3/28.

Age 15 years. Female. Clerk. Single.

Complaint. Headache, easily tired feels run down.

History. Family history good. In Dec., 1927 she had an attack of acute nephritis following tonsillitis, albumen and blood were both present in the urine. After six weeks in bed she recovered fully, except for a slight trace of Albuminuria.

Clinical Examination. Pale, well-built, no oedema, no retinal changes, trace of albumen in the urine.

Heart. Apex beat in fifth interspace, left border at the nipple line, soft, systolic murmur at apex and pulmonary area, second sound slightly accentuated in Aortic area.

S/A

| <u>Blood Urea.</u> | <u>Phenol-Sulph. Test.</u> | <u>Urea Conc. of Urine.</u> | <u>Amount of Urine.</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|----------------------------|-----------------------------|-------------------------|----------------|-----------------------|---------------------------|------------------|
| 24 m. | 75% | 3.4% | 45 oz. | Trace. | 120 | 1022 | 7 st. 11 lbs. |

Prognosis. I consider her immediate outlook good. The renal function tests are all extremely satisfactory, but there is evidence of early Cardiac changes.

Progress. This patient is in good health, the headache was relieved by glasses and she has gained over four pounds in weight. SHE HAS UNFORTUNATELY

IN APRIL 1929 DEVELOPED ANOTHER ATTACK OF ACUTE NEPHRITIS, AND IS SERIOUSLY ILL.

She has completely failed to respond to the treatment given. It is probable that she will have to be treated in hospital.

No.12. 3/11/27.

Age 59 yrs. Male. Retired Publican. Married.

Complaint. Severe headache, paralysis of right side of body, failing vision.

History. Family history good. This patient had a right sided hemiplegia in November 1926, and has partially regained the use of the affected limbs.

Clinical Examination. Tall, stout, ruddy complexion, bull-necked, paresis of right arm, leg and face, no oedema, arterio sclerosis of retinal vessels.

Heart. Apex beat diffuse in fifth and sixth inter-spaces, left border half an inch outside nipple line, sounds are faint, owing to thickness of the chest wall.

| <u>Blood Urea.</u> | <u>Phenol-Sulph. Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine.</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|----------------------------|-------------------------|-------------------------|----------------|-----------------------|---------------------------|------------------|
| 44 m. | 55% | 3.8% | 60 oz. | nil. | 160 | 1020. | 15 st. 7 lbs. |

Prognosis. I consider his immediate outlook fair. The renal function tests do not reveal any marked insufficiency, and there is nothing in the heart to cause immediate anxiety. The risk of another haemorrhage cannot, of course, be overlooked.

Progress. The headache persists in spite of treatment, his sight is not improving and he is disinclined to curtail his diet.

Handwritten notes:
Blood urea test...
done on 3/11/27

No.13. 21/12/27.

Age 38 yrs. Female. House duties. Single.

Complaint.

Dragging pain in the left side, clots and blood in water.

History.

This patient had myxoedema in 1917 and early in 1924 had a right sided pleural effusion which was tapped, a sequestrum was removed from the seventh rib some months later, leaving a sinus. Two years ago sudden pain in the right lumbar region, which lasted for half an hour, and in the past year she has noticed some "matter" in the urine. During the last three months at intervals, there has been blood in the urine with clots, and this has been associated with pain in the left side.

Clinical Examination. Stout, pale, small scar, not healed over left seventh to eighth ribs, in front kidneys not palpable.

11/7/27. Bacteriological Examination. A few Tubercle bacilli and pus cells present. X-Ray of Urinary Tract negative.

12/7/27. Chromo-Cystoscopy. Right Ureter normal, left ureter considerably displaced upwards and the opening drawn up. No Indigo-Carmine was observed flowing from this orifice.

13/7/27. Cystoscopy. Ureteric bougie passed into left ureter, but obstructed after four inches.

25/10/27. Kidney excised and ureter divided at pelvic brim.

Pathology.

Kidney slightly enlarged, capsule adhesive, a multisacculated pyonephrosis present, Ureter thickened, hard and finely nodulated.

21/12/27.

| <u>Blood Urea.</u> | <u>Phenol-Sulph. Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|----------------------------|-------------------------|------------------------|----------------|-----------------------|---------------------------|------------------|
| 30 m. | 21% | 2.3% | 45 oz. | Trace. | 130. | 1010 | 10 st. 2 lbs. |

Prognosis.

I consider her immediate outlook good. The renal function tests are satisfactory, except the Phenolsulphonephthalein, which may indicate that the right kidney has not altogether escaped.

Is there not thin white material of casts?

Progress.

This patient has made an excellent recovery. There is no pus or blood in the urine, and no frequency of micturition. She is gaining weight.

The Surgical Notes regarding the Case were supplied by Mr. C. D. Lochrane and Mr. J. C. Grieve of the Women's Hospital, Derby.

No.14. 31/7/28.

Age 68. Male. Heating Engineer. Married.

Complaint. Difficulty in starting flow of urine, getting out of bed at night to pass water.

History. Family history good. This patient never had a day's illness that he remembers.

Clinical Examination. Fairly well built, ruddy complexion, brachial arteries hard, no oedema, enlarged prostate, easily detected per rectum.

Heart. Apex beat in fifth interspace, left border just outside nipple line, second sound accentuated in Aortic area.

| <u>Blood Urea.</u> | <u>Phenol-Sulph. Test.</u> | <u>Urea Conc. Test.</u> | <u>Amount of Urine.</u> | <u>Albumen</u> | <u>Blood Pressure</u> | <u>Night Urine Sp.Gr.</u> | <u>Weight</u> |
|--------------------|----------------------------|-------------------------|-------------------------|----------------|-----------------------|---------------------------|-------------------|
| 180 m | 20% | 1.2% | 35 oz. | Trace. | 170 | 1016 | 10 st. 12 lbs. |

Prognosis. I consider his immediate outlook bad.

The renal function tests all reveal marked deficiency especially the blood urea. The question of operation is difficult, because Supra Pubic Cystotomy with drainage may fail to relieve the kidneys sufficiently to allow of Prostatectomy, and he would be left with a permanent fistula.

Progress. This patient is slowly losing weight but his symptoms have somewhat abated at present.

HE DIED IN MARCH 1929 FROM URAEMIA

No.15. 11/7/27.

Age 34 years. Male. Clerk. Married.

Complaint.

Attacks of severe pain in the right lumbar region, radiating into the testicle.

History.

Family history good. Operation nine years ago for stone in the kidney, again the following year for stone in the left ureter. Two and a half years ago had severe pain in the right kidney, and X-Rays showed two stones present.

Cystoscopy revealed that the left kidney was not functioning properly and the surgeon refused to operate. Twelve months later he passed a small stone but still has attacks of pain.

Clinical Examination.

Medium height, thin sallow complexion. Scars of previous operation.

Heart. Apex beat in fifth interspace, left border at nipple line, sounds normal.

| <u>Blood</u> <u>Urea.</u> | <u>Phenol-Sulph.</u> <u>Test.</u> | <u>Urea</u> <u>Conc.</u> <u>Test.</u> | <u>Amount</u> <u>of</u> <u>Urine.</u> | <u>Albumen</u> | <u>Blood</u> <u>Pressure.</u> | <u>Night</u> <u>Urine</u> <u>Sp.Gr.</u> | <u>Weight</u> |
|------------------------------|--------------------------------------|---|---|----------------|----------------------------------|---|------------------|
| 46.m. | 52% | 3.2% | 42 oz. | Nil. | 130 | 1020 | 9 st. 10 lbs. |

Prognosis.

I consider his immediate outlook good. The blood urea is slightly raised and the dye excretion is reduced, thus revealing some small degree of renal insufficiency. In view of the history it is likely that he may pass the other stone. Operation, I think is not called for in this case.

Progress.

During the past year he has had no attacks of pain, and has recovered completely from a severe attack of Influenza.

No.1.

In order to analyse the Blood Urea Estimations

I have grouped them in three classes:-

(a) 100 mgrs. per 100 c.c. and over.

(b) 40-100 mgrs. per 100 c.c.

(c) under 40 mgrs. per 100 c.c.

(a) There are three cases in this group.

| | No.2 B.U.140 m. | No.5 B.U.212m. | No.14 B.U.180 |
|--------------------------------|------------------------|-----------------------|--------------------|
| Disease. | Chr.Nephritis. | Chr.Nephritis. | Enlarged Prostate. |
| Length of life after the test. | 7 months. | 9 months. | Still alive. |
| Uraemia. | No indication | Present for 9 months. | None. |
| Eye changes. | Albuminuric Retinitis. | Optic Neuritis. | None. |
| Cardiac changes | Very marked. | None. | Slight. |
| Blood Pressure | 210 | 120 | 170. |
| Sp.Gr. night urine. | 1015. | 1009. | 1016. |
| Immediate Prognosis. | Very bad | Very bad. | Bad. |

Conclusion:-

(a) A high blood urea indicates an extremely bad prognosis.

(b) Does not, for immediate prognosis, draw a fine enough dividing line between the cases.

(c) The eye and Cardiac changes with the Blood urea give the most information for immediate prognosis.

(d) The blood urea does not give warning of Uraemia.

(e) The outlood of high blood urea with nephritis seems to be more serious, than with back pressure due enlarged prostate.

(f) High Blood urea with high blood pressure seems to indicate grave immediate danger.

10/11
to/1

No.2.

(b) There are three cases in this group.

| Case. | No.6 B.U.50m. | NO.12.B.U. / m. | No.15 B.U.46m. |
|-------------------------|--------------------|----------------------------|----------------|
| Disease. | Cardio-Renal | Cerebral Hae- morrhage. | Renal Calculus |
| Eye changes | Nil. | Arterio-Scle- rosis | Nil. |
| Cardiac changes. | Myocarditis. | Moderate. | Nil. |
| Blood pressure. | 170 | 160 | 130. |
| Sp. Gr. night urine. | 1024. | 1020. | 1020. |
| Immediate prognosis. | Fair. | Fair. | Good. |
| Special features. | Tic-Tac Rhythm. | Sight fail- ing. | — |

44/1

Conclusion.-

(a) The rise of the Blood Urea is small and by itself does not indicate the immediate outlook. In Nos.6 and 12 it might be explained by the age.

(b) High Blood Pressure with increased Blood Urea seems to be of more prognostic value.

(c) The clinical signs are of more importance in regard to prognosis, as the small variations above normal of the blood urea do not give the clue to seriousness of the condition, e.g. in No.6.

No.3.

(c) There are nine cases in this group.

| Case. | No.1. | No.3. | No.4. |
|---------------------------|------------------|----------------|--------------------------|
| Blood Urea in 100 c.c. | 39 mgrs. | 25 mgrs. | 34 mgrs. |
| Disease. | Chr.Nephritis. | Chr.Nephritis. | Arterio-Scler- rosis. |
| Eye changes | Nil. | Nil. | Arterio-Scler- rosis. |
| Cardiac changes. | Slight. | Slight. | Moderate. |
| Blood pressure. | 110 | 126 | 230. |
| Sp. Gr. night urine. | 1026. | 1017. | 1013. |
| Immediate prognosis. | Good. | Good. | Bad. |
| Special features. | 1.2% Albumen. | — | Hard Arteries. |

*with hard as
leads.*

| Case. | No.7. | No.8. | No.9. |
|------------------------|--------------------|--------------|--------------------|
| Blood Urea in 100 c.c. | 34 mgrs. | 32 mgrs. | 26 mgrs. |
| Disease. | Enlarged Prostate. | Albuminuria. | Arterio-Sclerosis. |
| Eye changes. | Nil. | Nil. | Nil. |
| Cardiac changes. | Slight. | Nil. | Slight. |
| Blood Pressure. | 160 | 124 | 190 |
| Sp.Gr. night Urine. | 1020 | 1020 | 1022. |
| Immediate Prognosis | Good. | Excellent. | Good. |
| Special Features. | — | Functional. | — |

| Case. | No.10 | No.11. | No.13. |
|------------------------|-----------------|------------------------|-----------------|
| Blood Urea in 100 c.c. | 34 mgrs. | 24 mgrs. | 30 mgrs. |
| Disease. | Pyo-Nephrosis. | Nephritis. | T.B. Kidney. |
| Eye changes | Nil. | Nil. | Nil. |
| Cardiac changes. | Nil. | Slight | Nil. |
| Blood Pressure. | 156 | 120 | 130. |
| Sp.Gr. night Urine. | 1018 | 1022 | 1010. |
| Immediate Prognosis. | Good | Good. | Good. |
| Special Features. | Kidney excised. | After acute nephritis. | Kidney excised. |

Conclusion.

(a) When the Blood Urea estimations fall within normal limits they assist prognosis rather in a negative manner, e.g. in Nos.4 and 9 it enables a diagnosis of pure arterio-sclerosis to be given, thus ruling out Chr. Nephritis.

(b) The Blood Urea when normal assists the prognosis directly when there are no Cardiac, Eye or Blood pressure changes, e.g. in cases No.9, 10 and 13.

(c) The Blood Urea fails to reveal evidence of early Chr. Nephritis, e.g. in cases 1, 3 and 2.

The Estimations of the Blood Urea were carried out for me by the Clinical Dept. of the Charing Cross Hospital.

No.1. Urea Concentration Test.

(a) For purposes of analysis I have classified the results of the Urea Concentration Test as follows-

(a) 1.5% and under.

(b) 2% to 1.5%.

(c) Over 2%.

(a) There are two cases in this group.

| Case. | No.5. | No.14. |
|----------------------------|-----------------|-------------------|
| Urea Concentration Test. | .7% | 1.2%. |
| Disease. | Chr. Nephritis. | Enlarged Prostate |
| Length of life after test. | nine months. | Still alive. |
| Uraemia. | Present | _____ |
| Eye Changes. | Optic neuritis. | None. |
| Cardiac Changes | None. | Slight. |
| Blood Pressure. | 120. | 170. |
| Sp.Gr. Night urine. | 1009. | 1016. |
| Prognosis Immediate. | Verv bad. | Bad. |

Conclusion. (a) Very low concentration seems to indicate a very bad ultimate prognosis, but is indefinite for immediate purposes.

(b) Low Urea Concentration in Chr. Nephritis seems to be of more prognostic value than in back pressure due to enlarged prostate.

(c) Low Urea Concentration estimated with the clinical signs and symptoms enable an accurate immediate prognosis to be given.

No.2. (b) There are two cases in this group.

| Case. | No.2. | No.7. |
|----------------------------|------------------------|-------------------|
| Urea Concentration Test. | 1.8%. | 1.8%. |
| Disease. | Chr. Nephritis. | Enlarged Prostate |
| Length of life after test. | 7 months. | Still alive. |
| Eye changes. | Albuminuric Retinitis. | Nil. |
| Cardiac changes. | Marked. | Slight. |
| Blood Pressure. | 210 | 160 |
| Sp.Gr. Night urine. | 1015. | 1020. |
| Prognosis Immediate | Very bad. | Good. |
| Special Feature. | Died from Uraemia. | _____ |

Conclusions. (a) A moderate urea concentration does not seem to assist immediate prognosis.

(b) High Blood Pressure with moderate Urea Concentration renders the outlook bad.

(c) A moderate Urea Concentration does not give warning of Uraemia.

(d) Eye changes and Cardiac changes assist immediate prognosis more than a moderate Urea Concentration.

(e) A moderate Urea Concentration in Chr. Nephritis seems to be of more prognostic value than in back pressure due to prostate enlargement.

No.3. (c) There are eleven cases in this group.

| | | | |
|---------------------|-----------------|--------------------|--------------------|
| Case. | No.1. | No.3. | No.4. |
| Urea Conc. | 2.8% | 4% | 3.2% |
| Disease. | Chr.Nephritis. | Chr.Nephritis. | Arterio Sclerosis. |
| Eye changes | Nil. | Nil. | Arterio Sclerosis. |
| Cardiac changes. | Slight. | Slight. | Moderate. |
| Blood Pressure | 110 | 126. | 230 |
| Sp.Gr. night urine. | 1026. | 1017. | 1013. |
| Immediate Prognosis | Good. | Good. | Bad. |
| Special Feature. | — | — | Arterio Sclerosis. |
| Case. | No.6. | No.9. | No.8. |
| Urea Conc. | 2.2% | 3%. | 2.5%. |
| Disease. | Cardio-renal. | Arterio Sclerosis. | Albuminuria. |
| Eye changes. | Nil. | Nil. | Nil. |
| Cardiac changes. | Myocarditis. | Slight | Nil. |
| Blood Pressure. | 170 | 190 | 124. |
| Sp.Gr. night urine. | 1024 | 1022 | 1020. |
| Prognosis. | Fair | Good. | Excellent. |
| Special Feature. | Tic-Tac Rhythm. | — | Functional. |

| | | | |
|----------------------|-----------------|-------------------------------------|----------------------|
| Case. | No.10 | No.11. | No.12. |
| Urea Conc. | 2.8%. | 3.4% | 3.4%. |
| Disease. | PyoNephrosis. | Nephritis. | Cerebral Haemorrhage |
| Eye changes. | Nil. | Nil. | Arterio-Sclerosis. |
| Cardiac changes. | Nil. | Slight. | Moderate. |
| Blood Pressure. | 156. | 120. | 160. |
| Sp.Gr. night urine. | 1018. | 1022. | 1020. |
| Immediate Prognosis. | Good. | Good. | Fair. |
| Special Features. | Kidney excised. | Convalescent after Acute Nephritis. | _____ |
| Case. | No.13. | No.15. | |
| Urea Conc. | 2.3%. | 3.2% | |
| Disease. | T.B. Kidney. | Renal Calculus | |
| Eye changes. | Nil. | Nil. | |
| Cardiac changes. | Nil. | Nil. | |
| Blood Pressure. | 130. | 130. | |
| Sp.Gr. night urine. | 1010. | 1020. | |
| Immediate Prognosis. | Good. | Good. | |
| Special Features. | Kidney excised. | _____ | |

Conclusion:-

(a) The Urea Concentration, when within normal limits is of greater value for diagnosis, than prognosis, e.g. in cases No.4 and 9 it enables one to draw the conclusion that these are cases of pure Arterio Sclerosis.

(b) The normal Urea Concentration assists prognosis in the purely surgical cases, e.g. in cases No.10 and 13. It shows that the remaining kidney is functioning satisfactorily.

(c) The normal variations of the test seem to be too great, and are thus of little help in the mild case of nephritis.

(d) The clinical signs and symptoms grouped with the Urea Concentration results are of greater help in prognosis.

No.1.

PHENOLSULPHONEPHTHALEIN TEST.

For purposes of comparison I have grouped the results of this test into two classes:-

(a) 50% and under. (b) Over 50%.

(a) There are seven cases in this group:-

| Case. | No.2. | No.3. | No.6. | No.7. |
|----------------------------|------------------------|-----------------|-----------------|--------------------|
| Phenol sulph Test. | 5.7%. | 50%. | 43%. | 36%. |
| Disease. | Chr. Nephritis. | Chr. Nephritis. | Renal. | Enlarged Prostate. |
| Length of life after test. | 7 months. | Still alive. | Still alive. | Still alive. |
| Uraemia. | Not present. | — | — | — |
| Eye changes. | Albuminuric Retinitis. | Nil. | Nil. | Nil. |
| Cardiac changes. | Marked. | Slight. | — | Slight. |
| Blood Pressure. | 210. | 126. | 170. | 160. |
| Sp.Gr. night urine. | 1015. | 1017. | 1024. | 1020. |
| Immediate Prognosis. | Very bad. | Good. | Fair. | Good. |
| Special features. | Uraemia. | — | Tic-Tac rhythm. | — |

| Case. | No.10. 24%. | No.13. 21%. | No.14. 20%. |
|----------------------------|-----------------|----------------|--------------------|
| Phenol-sulph Test. | Pyo-Nephrosis. | T.B. Kidney. | Enlarged Prostate. |
| Disease. | Still alive. | Still alive. | Still alive. |
| Length of life after test. | _____ | _____ | _____ |
| Uraemia. | _____ | _____ | _____ |
| Eye changes. | Nil. | Nil. | Nil. |
| Cardiac changes. | Nil. | Nil. | Slight |
| Blood Pressure. | 156. | 130. | 170. |
| Sp.Gr. night urine. | 1018. | 1010. | 1016. |
| Immediate Prognosis. | Good. | Good. | Bad. |
| Special features. | Kidney excised. | Kidney excised | _____ |

Conclusion:-

(a) A very low dye excretion seems to indicate an ultimate unfavourable prognosis, but fails to show any time limit for immediate use.

(b) The nearer the dye output is to 50% the more difficult it becomes to give an accurate immediate prognosis, unless the clinical signs and symptoms are taken into account.

(c) A low dye output seems to be of more significance for prognosis in nephritis than in back pressure due to enlarged prostate.

(d) A low dye excretion with high blood pressure points to a bad prognosis.

No.2. (b) There are seven cases in this group.

| Case. | No.1. | No.4. | No.8. | No.9. |
|----------------------|-----------------|-------------------------|--------------|-------------------------|
| Phenol sulph Test. | 75%. | 75%. | 70%. | 70%. |
| Disease. | Chr. Nephritis. | Arterio Sclerosis. | Albuminuria. | Arterio Sclerosis. |
| Eye changes. | Nil. | Arterio Sclerosis. | Nil. | Nil. |
| Cardiac changes. | Slight. | Moderate. | Nil. | Slight. |
| Blood Pressure. | 110. | 230. | 124. | 190. |
| Sp.Gr. night urine. | 1026. | 1013. | 1020. | 1022. |
| Immediate Prognosis. | Good. | Bad. | Excellent. | Good. |
| Special features. | — | Pure Arterio-Sclerosis. | Functional. | Pure Arterio Sclerosis. |

| Case. | No. 11 75%. | No. 12. 55%. | No. 15. 52%. |
|----------------------|------------------------|-----------------------|-----------------|
| Phenol-sulph Test. | | | |
| Disease. | Nephritis. | Cerebral Haemorrhage. | Renal Calculus. |
| Eye changes. | Nil. | Arterio Sclerosis. | Nil. |
| Cardiac changes. | Slight. | Moderate. | Nil. |
| Blood Pressure. | 120. | 160. | 130. |
| Sp.Gr. night urine. | 1022. | 1020. | 1020. |
| Prognosis immediate. | Good. | Fair. | Good. |
| Special features. | After acute Nephritis. | Failing vision. | _____ |

Conclusion:-

(a) A Phenolsulphonephthalein Test of over 50% seems to indicate renal efficiency and a good immediate prognosis.

(b) Eye changes, when present, seem to be of more definite value for immediate prognosis.

(c) The clinical signs and symptoms are of the greatest importance and must be considered along with the dye excretion, if accuracy in immediate prognosis is to be obtained.

(A)

The tests have all been considered individually and it remains to group them together for a final analysis. As was pointed out earlier these tests have all been performed once, in the hope that the results might indicate which was the most useful. With this in view I have divided the findings into two classes:-

- (1) Those in which the results are all analogous.
- (2) Those in which difference arise which require explanation.

(1) There are eight in this group:-

| | (A) | (A) | (A) | (A) |
|----------------------|----------|----------|-----------------|----------|
| Case. | No.1. | No.3. | No.8. | No.9. |
| Blood Urea. | 39 mgrs. | 35 mgrs. | 32 mgrs. | 26 mgrs. |
| Phenol-sulph. | 75%. | 50% | 70% | 70%. |
| Urea Conc. | 2.8%. | 4%. | 2.5%. | 3%. |
| Immediate Prognosis. | Good | Good. | Excel- lent. | Good. |

| | (A) | (B) | (B) | (B) |
|----------------------|----------|---------------|-----------|-----------|
| Case. | No.11. | No.4. | No.5. | No.14. |
| Blood Urea. | 24 mgrs. | 34 mgrs. | 212 mgrs. | 180 mgrs. |
| Phenol-sulph. | 75%. | 75%. | Refused. | 20%. |
| Urea Conc. | 3.4%. | 3.8% | .7%. | 1.2%. |
| Immediate Prognosis. | Good. | Bad. <i>L</i> | Very bad. | Bad. |

7

Conclusion:-

In group (A) the immediate prognosis is good, — and the estimations are all within normal limits, so that the information required could have been obtained by performing one of the renal efficiency tests. I suggest that the Urea Concentration Test should be used, as it is the easiest to perform and causes much less upset to the patient than the others.

? No 4.

In group (B) the prognosis is bad but case 4 is one in which the Renal Function Tests do not assist, as the outlook depends upon other factors. In cases 5 and 14 the same amount of information could have been obtained by performing the Urea Concentration Test alone, and I suggest it should be used for the same reasons as in the paragraph above.

then why not
it is B
proof?

(B)

(2) There are seven cases in this group.

| | a. | b. | c. | d. |
|----------------------|-----------|----------|----------|----------|
| Case. | No.2. | No.6. | No.7. | No.12. |
| Blood Urea. | 140 mgrs. | 50 mgrs. | 34 mgrs. | 44 mgrs. |
| Phenol-sulph. | 5.7%. | 34%. | 36%. | 55%. |
| Urea Conc. | 1.8%. | 2.2%. | 1.8%. | 3.8%. |
| Prognosis Immediate. | Very bad. | Fair. | Good. | Fair. |

| Case. | d. No.15. | e. No.10. | g. No.13. |
|----------------------|--------------|--------------|--------------|
| Blood Urea. | 46 mgrs. | 34 mgrs. | 30 mgrs. |
| Phenol sulph. | 52%. | 24%. | 21%. |
| Urea Conc. | 3.2%. | 2.8%. | 2.3%. |
| Prognosis immediate. | Good. | Good. | Good. |

Conclusion:-

In case a. the Phenolsulphonophthalein Test seems to be out of proportion with the others, and suggests that for immediate prognosis it has a greater value. The moderate result of the Urea Concentration is not of great assistance.

b. The raised Blood Urea might be explained by the age of the patient, but the Phenolsulphonophthalein seems to indicate some slight degree of renal inefficiency, which is of value for immediate prognosis.

c. The results are difficult to explain in this case, but it seems that the Urea Concentration and Phenolsulphonophthalein reveal renal efficiency not disclosed by the Blood Urea, and thus are of value in immediate prognosis.

d. The Urea Concentration Test is very satisfactory, and as the Phenolsulphonophthalein is over 50% the slight rise of Blood Urea has not a serious influence on the prognosis.

e. Both the cases in this group are Surgical and the low Phenolsulphonophthalein suggests definite Renal Inefficiency, which is not disclosed by other tests. It is thus a determining factor in the immediate prognosis.

(C)

Specific Gravity of the Night Urine.

It is a noticeable feature of the cases, except No.10, that where the Sp. Gravity of the night urine is below 1016, the immediate prognosis is bad.

Notes on the tests, as applied to General Practice.

Blood Urea. This test has one drawback and that is, that one must remove blood from the patient. This detracts from its value, as many patients object and it is difficult to have the test repeated.

Urea Conc. Test. This is by far the easiest test to carry out, and the estimation presents no difficulties.

Phenolsulphonephthalein Test. This test provides many obstacles, as the patient objects to the hypodermic needle and complains of pain afterwards. The end result is very difficult to judge, and there is a certain per cent^h of error which always arises, even with the greatest care.

7

age

SUMMARY.

The Renal Function Tests by themselves are of great assistance in prognosis, but fail to help in the immediate outlook, as they do not indicate whether the patient may survive for months or years. The Urea Concentration Test gives the greatest assistance, as there are less factors to be taken into account in drawing conclusions from the result.

The blood urea is also an adjuvant but requires more careful study. In the surgical case, the Phenolsulphonephthalein Test seems to be able to indicate renal inefficiency before the others.

The greatest assistance is obtained by the Urea Concentration Test and the Blood Urea examination, but there are a few cases in which these results are further helped in the elucidation of the problem by the Phenolsulphonephthalein Test. These results cannot be considered by themselves, but must only be used in conjunction with the clinical signs and symptoms of the case.

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