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ITS CLINICAL SIGNIFICANCE AS SHOWN BY CHEMICAL STUDY OF THE BLOOD

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Although many tests of kidney function have come into prominence and waned to insignificance, albuminuria has long been a simple criterion of abnormality. But albuminuria is not a sure indication of damaged kidneys; for it may appear when these organs are normal, as in orthostatic albuminuria,[1] or it may be absent in a wide spread degeneration of the kidneys, as in interstitial nephritis. Furthermore, as will be pointed out in this paper, albuminuria may be excessive from passive congestion of the kidneys, the primary difficulty being in the heart. When albuminuria is excessive and associated with oliguria and apparent uremia,[2] as a late event in arterial hypertension, or in circulatory failure, it may cause much apprehension; on the other hand, the absence of albumin in the urine may give a false sense of security.

The nephroses of acute infection or resulting from focal infection, are associated with albuminuria,[3] more or less severe; the damage may be transient, fulminating or permanent.[4]

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* Albuminuria as here referred to is associated with casts in varying abundance. Albuminuria resulting from pyonephrosis or inflammatory conditions in the urinary tract are not considered, since their recognition is obvious.

1. One observer estimates the frequency of orthostatic albuminuria as high as 19 per cent. in adolescents, many losing this tendency as they grow older.

2. Attention is directed to uremic symptoms resulting from cerebral edema, the latter being due to circulatory changes largely, and disappearing on adequate cardiac stimulation, as shown in a woman, aged 52, who had been stuporous and semicomatose for eight days with marked albuminuria and oliguria. Lumbar puncture showed increased pressure and a high urea content of the spinal fluid. The removal of spinal fluid and stimulation for the dilated, uncompensated heart seemed to start recovery. She was well for five years and died of intercurrent carcinoma of the stomach; during this period there was very little evidence of kidney involvement. That edema of the brain may occur in uremia is stated by N. B. Foster (Uremia, J. A. M. A. **76**:281 [Jan 29] 1921) as follows: "In its greatest severity edema of the brain occurs in but one type of uremia, that type in which stupor and coma without convulsions, without psychic or motor disturbances, is the prominent nervous symptom." For a clear discussion of uremia, as modernly understood, and cerebral edema, the reader is referred to Foster's paper.

3. George Baer and H. Lande (Glomerulonephritis as a Complication of Subacute Streptococcus Endocarditis, J. A. M. A. **75**:789 [Sept. 18] 1920) report twenty-seven cases of subacute streptococcus endocarditis in which nine patients died of uremia due to intercurrent glomerular nephritis or its sequel, chronic diffuse nephritis. They found that scarlet fever, acute and chronic streptococcus angina and streptococcus endocarditis are frequently complicated by acute glomerular nephritis.

(Footnote 4 on next page)

Nonnephritic albuminuria,[5] including "physiologic," "transient," "functional," "adolescent," "intermittent" and the albuminuria in pregnancy, etc., is a large group comparatively easy of detection. The difference between physiologic and pathologic albuminuria is quantitative, not qualitative, and the term "albuminuria" implies that serum albumin is present in the urine in such quantities that it can be detected by the not very delicate tests accepted as standard (as the heat and acid test).[6]

From the foregoing, it is readily seen that dependence on urinary findings alone leads to error. Furthermore, as stated by McLester,[7] many persons show albumin and casts in the urine for years, without any other signs of nephritis, while at the same time, they demonstrate their ability to withstand, without injury, all kinds of fatigue and hardships. Such people cannot be said to have nephritis. He also points out that chronic nephritis can be divided sharply into two groups; (1) the type with edema, and (2) that without edema. The latter is not a disease of the kidneys alone, for in the resulting disturbed physiology, other organs, notably the heart and arteries, play an equally important part; and in the last analysis it is the efficiency of these other organs which determines, as a rule, the fate of the patient.

RENAL FUNCTION TESTS

Discussion of albuminuria leads to a consideration of renal function. In attempting to explain the albuminuria as seen in the cases cited below, various methods which have been used in the last decade were reviewed

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4. Eli Moschowitz (Hypertension; Its Significance, Relation to Arteriosclerosis and Nephritis and Etiology, Am. J. M. Sc. **168**:668 [Nov.] 1919) is of the opinion that gross injury of the kidney parenchyma perhaps plays the greatest rôle in albuminuria of the acute infections, but that it (injury of the parenchyma) is not a factor of much importance in albuminuria associated with hypertension and also points out (ibid. p. 684) that albuminuria is not necessarily the result of injury (even profound) of the kidney and that badly diseased kidneys may show no albuminuria.

5. R. L. M. Wallis (Nonnephritic Albuminuria, Proc. Roy. Soc. Lond., Sect. Med. **13**:96, 1920), in discussing proteinuria not due to organic disease of the kidney, including physiologic, transient and intermittent albuminuria, and a group he designates as "leaky kidneys," points out that all ordinary tests for albumin are for serum albumin. In the group under discussion, the chemical examination of the blood shows no retention. Physiologic albuminuria is the result of serum albumin leaking through the kidneys, with excessive amounts of urinary constituents (after exercise, cold baths, alimentary causes, etc.). In functional albuminuria there is no relation to food or exercise as seen in adolescent, cyclic and postural albuminuria. A third group of "leaky kidneys" is a long standing proteinuria, and there is no evidence of kidney disease, or if present, it is not progressive. The chief protein in nonnephritic albuminuria is euglobulin associated with lipoids.

6. Emerson: Clinical Diagnosis, J. B. Lippincott, 1921, p. 224.

7. McLester, J. S.: Treatment of Chronic Nephritis Without Edema, J. A. M. A. **77**:88 (July 9) 1921.

and used to some extent. Methods using the urine alone as the object of examination were found to be disappointing, the chemical examinations of the blood along with a renal test diet being found most valuable in determining the state of kidney function.

Normal renal function depends so largely on the volume of blood passing through the kidneys, that they respond readily to blood flow and blood pressure. These organs differ from all other secreting glands in their intimate relation to the general circulation; a rise in blood pressure is accompanied by an increase in urine flow unless there is a simultaneous vasoconstriction in the kidneys; and a fall in blood pressure is followed in general by decreased urine flow unless the renal vessels are dilated. The determining factor is the capillary pressure in the glomerulus—not the general vascular pressure.

The modern view of secretion of the urine accepts Ludwig's [8] scheme of filtration through the capsules and the "vital secretion" of Heidenhain. Filtration is purely physical; reabsorption in the tubule requires a healthy cell. The function of the kidney is the filtration of noncolloidal constituents of the blood through the glomerulus and absorption of this fluid through the tubule cells; the capsule furnishes fluid as it is the circulation and the tubule returns to the blood the fluid best adapted to the tissues,[9] allowing the rest to escape in the urine.[10]

Albuminuria may be produced experimentally by interrupting the blood supply by compressing vein, artery or ureter. If the artery is clamped for thirty seconds, secretion stops completely and is reinstated after an hour or so; the urine contains abundant protein at first and ultimately resumes its normal character. This is due to alteration in the permeability of the capsule by asphyxia so that it permits the passage of the proteins of the blood.

Since the urine is the excretory product of renal activity, estimation of renal function has been attempted through urine tests. Estimation of urinary nitrogen, chlorids, diastase, urea, uric acid, the power of the kidney to eliminate foreign substances, cryoscopy, its electrical conductivity, experimental polyuria, etc., have been disappointing, for the elimination of urine is complicated, depending on many factors beyond

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8. Cushny, A. R.: The Secretion of the Urine, London and New York, Longmans, Green and Co., 1917, p. 101.

9. Cushny, A. R.: The Secretion of the Urine, New York, Longmans, Green & Co., 1917, p. 47.

10. According to Cushny, casts are chiefly composed of albumin passing through the kidney capsule, enriched by the detritus of degenerating tubule cells, but Christian (Am. J. M. Sc. **161**:625 [May] 1916) thinks they originate from degenerated epithelium, the granular being young and the hyaline older.

accurate control, such as the state of circulation, food and fluid intake, and psychic and nervous conditions.[11]

Following the work of Schlayer [12] and others who attempted clinically to classify nephritis as tubular, glomerular and vascular (through the readiness with which water and lactose pass through the glomeruli, and potassium iodide and sodium chloride through the tubules), many attempts were made to make clinical and histologic nephritis conform. These have failed to give adequate information, and even Ambard's coefficient (the relation between urinary and blood urea) is unsatisfactory because of these variable factors in urine elimination. Further, the disease process in the kidney is rarely confined to one structure, but is diffuse.

The excretion of dyes (methylene blue, indigocarmine, phenolsulphonephthalein, etc.), offers a simple clinical method of estimating renal activity, but here again one must bear in mind the many factors concerned in their elimination, and that prostatic obstruction or passive hyperemia of the kidneys may produce a low excretion of these substances.[13]

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11. The readiness with which the kidneys eliminate an excess of any urinary constituents is utilized in giving urea, 15 gm., while the diet is kept fairly constant and the rate and amount of excretion is measured as described by Addis, McCaskey, McLean and De Wesselow. Recently Weiss (Weiss, E.: The Urea Concentration Test for Kidney Function, J. A. M. A. **76**:298 [Jan. 29] 1921) has added to this the estimation of the blood urea nitrogen with a review of the literature. Uric acid has been used in the same way by Upham and Higley and Magath. More recently T. L. Squier and L. H. Newburgh (Renal Irritation in Man from High Protein Diet, Arch. Int. Med. **28**:1 [July] 1921) have used high protein diets, attempting to obtain evidence in hypertension cases of disturbed kidney function by throwing an extra load on the kidneys. This was followed by albuminuria and casts and the presence of red corpuscles in the urine. There was no effect on blood pressure.

12. Hedinger and Schlayer: Deutsch. Arch. f. klin. Med. **114**:120, 1914.

13. Thayer, W. S., and Snowden, R. R.: Comparison of the Results of the Phenolsulphonephthalein Test of Renal Function with the Anatomic Changes Observed in the Kidneys at Necropsy, Am. J. M. Sc. **148**:781 (Dec.) 1914.

J. H. Agnew (A Comparative Study of Phthalein and Incoagulable Nitrogen of the Blood in Cardiorenal Disease, Arch. Int. Med. **13**:485 [March] 1914) stated that when phenolsulphonephthalein was below 40 per cent. the blood nitrogen was definitely increased.

Rowntree and his co-workers (Rowntree, L. G.; Marshall, E. K., and Baetjer, W. A.: Further Studies of Renal Function in Renal, Cardiorenal and Cardiac Diseases, Arch. Int. Med. **15**:543 [April] 1915) studied diastase, phenolsulphonephthalein, cryoscopy, total nitrogen and urea of the blood, finding diastase low in mild and severe nephritis. In cardiac and cardiorenal cases the findings were bizarre; phenolsulphonephthalein was then thought by them to be the test of choice, but "whenever phenolsulphonephthalein is decreased, even slightly, the total N or blood urea, or both, should be determined."

Renal test diets as suggested by v. Monakow in 1911, Hedinger and Schlayer in 1914 and as modified by Mosenthal,[14] Christian,[15] O'Hare [16] and others offer simple clinical means of estimating renal function through measuring the concentrating power of the kidney.

Mosenthal [14] has now modified his former method based on the observations of Hedinger and Schlayer in 1914, using an American standard diet and only one day of measured diet, covering the period of urine collections. It is applicable to the ambulatory patients and allows usual food and routine. The urine is collected at two hour intervals, only one direction being insisted on, that the night urine be collected at a time beginning three hours after supper and no sooner.

Normal renal activity is characterized by variations in specific gravity up to 1.020 in the two hour test. A high fixed gravity may be

TABLE 1.—Renal Test Diet. Showing Variations in Urine Output, Specific Gravity, Nitrogen and Chlorids in Normal (N) and Nephritic (neph) Urines (After Mosenthal)

	Renal Test Diet							
	Amount, C.c.		Specific Gravity		Sodium Chlorid, Gm.		Nitrogen, Gm.	
Hour	Normal	Nephritic	Normal	Nephritic	Normal	Nephritic	Normal	Nephritic
8–10	315	102	1.006	1.017	....	....	....	....
10–12	128	90	1.014	1.020	....	....	....	....
12– 2	120	98	1.017	1.020	....	....	....	....
2– 4	122	118	1.020	1.021	....	....	....	....
4– 6	76	88	1.022	1.020	....	....	....	....
6– 8	100	390	1.027	1.006	....	....	....	....
Total day	861	886	.....	.....	6.71	3.86	6.80	4.62
Total night	248	1,280	1.025	1.010	1.71	6.26	3.05	4.86
Total 24 hours	1,109	2,166	.....	.....	8.42	10.12	9.85	9.48
Intake	1,760	1,760	.....	.....	8.50	8.50	13.40	13.40
Balance	+650	−406	.....	.....	+0.08	−1.62	+3.55	+3.92

seen in normal persons because they take too little fluid, or may occur in disease characterized by edema and oliguria, as myocardial insufficiency, acute or chronic nephritis. A low fixed gravity is found in chronic nephritis, diabetes insipidus, marked anemia, the elimination of edema, pyelitis, polycystic kidney, postatic hypertrophy, etc. Such patients do well as long as polyuria compensates for the lack of power to concentrate. The normal total quantity should be 400 c.c. less than the intake and 750 c.c. or less is secreted at night; a larger amount may indicate that the kidney is putting forth a greater effort than it

14. Mosenthal, H. O.: Renal Function as Measured by the Elimination of Fluids, Salt and Nitrogen, and the Specific Gravity of the Urine, Arch. Int. Med. **16**:733 (Dec.) 1915; ibid. **22**:770 (Dec.) 1918.

15. Christian, H.: Some Phases of the Nephritis Problem, Am. J. M. Sc. **151**:625 (May) 1916. Tests for Measurements of Renal Efficiency in Relation to Prognosis in Nephritis, Penn. M. J. **21**:233 (Jan.) 1918.

16. O'Hare, J. P.: Renal Function in Vascular Hypertension, Boston M. & S. J. **132**:345 (April) 1920.

normally should. This overstrain may cause damage if continued indefinitely. In passive congestion water and salt are diminished while the nitrogen remains approximately normal. In the contracted kidney nitrogen and salt are retained. Hypertensive nephritis is characterized by nocturnal polyuria, a tendency to total polyuria, fixation of specific gravity, fixation of two hourly quantity and retention of salt and nitrogen (Table 1).

Another avenue of approach in the estimation of renal function is the chemical examination of the blood [17] for retention of substances normally excreted by the kidneys, particularly urea, uric acid, and creatinin. Blood sugar may also be increased in interstitial nephritis.[18] Since creatinin is readily excreted through the kidneys, urea less readily and uric acid least readily, it was shown by Meyers and Killian [19]

TABLE 2.—The Blood in Nephritic and Cardiac Albuminuria. Showing Normal Values for Nonprotein Nitrogen, Urea, Uric Acid, Creatinin and Sugar as Compared with Findings in Passive Renal Congestion or Nephritis as Shown by Gettler, Gradwohl, Meyers and Fine

	Nonprotein Nitrogen, Mg.	Urea Nitrogen, Mg.	Creatinin, Mg.	Uric Acid, Mg.	Sugar, Mg.
Normal	25–40	10–15	1–2	1–3	0.08–0.11
Gettler:					
Nephritis (600 cases)	40–460	20–275	2–42	3–17	0.075–0.375
Cardiac (350 cases)	35–220	18–180	15–12	2.5–7	0.07 –0.135
Gradwohl:					
Nephritis (4 cases)	.....	21–108	2.15–4.48	5.9–9.8	0.09 –0.188
Cardiac (4 cases)	.....	11–16	0.9 –2	2.4–3.3	0.096–0.155
Meyers and Fine:					
Chronic nephritis	30–80	15–50	1–3	1–4	.....
Uremic nephritis	120–350	80–300	4–84	4–15	0.10–0.20

that a marked retention of blood creatinin is of serious prognostic import. Upham and Higley [20] and Magath [21] and others fed uric acid as a test of renal insufficiency.

17. So much work has been done in this line in the last decade that it is hardly necessary to refer to the investigations of Folin and Dennis, Benedict and Lewis, Meyers and Fine and Christian and others who have opened the way for the clinical application of experimental physiologic chemistry.

18. J. R. Williams and E. M. Humphreys studied fifty cases of cardiorenal disease, finding the blood sugar varying from 0.06 to 0.25 per cent., and varying directly with the severity of the disease. (The Clinical Significance of Blood Sugar in Nephritis and Other Diseases, Arch. Int. Med. **22**:537 [May] 1919.) They quote Hopkins, who in 1915 studied twenty-six cases of nephritis, finding the blood sugar normal in only five; also Meyers and Bailey, who in 1916 studied eleven cases, finding blood sugar from 0.10 to 0.20 per cent.

19. Meyers, V. C., and Killian, J. A.: The Prognostic Value of Creatinin of the Blood in Nephritis, Am. J. M. Sc. **157**:674 (May) 1919. Meyers, V. C., and Lough, W. G.: The Creatinin of the Blood in Nephritis: Its Diagnostic Value, Arch. Int. Med. **16**:536 (Oct.) 1915.

20. Upham, R., and Higley, H. A.: Study of Renal Concentration Power for Uric Acid in Early Chronic Interstitial Nephritis, Arch. Int. Med. **22**:537 (Sept.) 1920.

21. Magath, T. B.: A Test for Renal Insufficiency, J. Lab. & Clin. Med. **6**:463 (May) 1921.

While diseased kidneys interfere with the excretion of these substances, causing them to be retained in the body,[22] passive renal congestion does not do so, as shown in the accompanying tables and case reports, and as pointed out by Gradwohl and Powell,[23] Christian,[24] Williams [25] and others (Table 2).

From the foregoing consideration of various renal function tests, it will be seen that groping, tedious effort and painstaking accumulation of laboratory data have at least given a clearer conception of the difficulties in establishing any one test for kidney efficiency. While most of the older methods of examination of the urine have been given up for reasons already cited, albumin and casts are easily found by any one, and immediately arouse suspicion of disturbed renal activity; they give a clue also as to the degree of this disturbance, but hardly of the extent of damage.

One is often surprised to find that patients who at first suggest the "cardionephritis syndrome" are suffering more from circulatory weakness than nephritis, for oliguria, edema, excessive albuminuria, and even apparent mild uremia improve with improved circulation. Again, patients with arterial hypertension show "nephritic" symptoms from time to time, which are due to myocardial weakness.

In considering the cases studied from the standpoint of albuminuria the following table is submitted for the differentiation of primary (or renal) from secondary (or extrarenal) albuminuria.

1. *Primary.*—With definite evidence of renal insufficiency and probable permanent damage (nephritis).[26]

2. *Secondary.*—Due to extrarenal factors: (*a*) Nonnephritic albuminuria (physiologic, adolescent, functional, etc.), (*b*) in cardiac

22. That nitrogen is not retained exclusively in the blood is shown by N. B. Foster (The Increased Extract Nitrogen in the Tissues, with Chronic Nephritis, Arch. Int. Med. **24**:242 [Aug.] 1919).

23. Gradwohl, R. B., and Powell, C.: The Usefulness of Blood Chemistry Methods in the Differential Diagnosis and Cardiac and Renal Diseases, Southern M. J. **11**:335 (May) 1918.

24. Christian, H. A.: The Use of Renal Function Tests in Cases of Nephritis, J. Urol. **1**:319 (June) 1917.

25. Williams, J. L.: The Total Nonprotein Nitrogen Constituents of the Blood in Chronic Nephritis with Hypertension, Arch. Int. Med. **28**:426 (Oct.) 1921. Williams found that in hypertension and uremia the nonprotein nitrogen was increased and phenolsulphonephthalein excretion decreased. Cardiac insufficiency without nephritis is associated with moderate retention of nonprotein substances of the blood, especially of uric acid. He says the presence of albumin and casts do not necessarily suggest nephritis but that improvement in the circulation is accompanied by decrease in nitrogenous extract in the blood, especially of uric acid.

26. C. P. Emerson (The Acute Element in the Nephropathies, J. A. M. A. **77**:745 [Sept. 3] 1921) considers that nephritis, when well established, is not a chronic process but due to repeated acute attacks. In the albuminuria due to extrarenal factors, especially from passive congestion, it is conceivable that permanent damage may result from repeated attacks.

decompensation with resultant passive congestion (oliguria, edema, uremic symptoms).

1. With valvular lesions (rheumatic, syphilitic, or sclerotic), with myocardial weakness and dilatation.

2. Resulting from long continued vascular hypertension and final cardiac breakdown.

DISCUSSION OF CLINICAL GROUPS

In studying the results of functional tests, and especially of blood chemistry in patients having albuminuria, those with vascular hypertension form one group, and the others have been studied as a miscellaneous group. In the former, the following points stand out: (1) these patients at sometime or other show "cardionephritic" symptoms. It will be seen that albuminuria varies greatly in the same patient, as do other evidences of renal embarrassment, and that there is often a definite relationship between cardiac breakdown and the nephritic symptoms (Table 3). (2) The predominating symptoms in hypertension express themselves as (*a*) cerebral,(*b*) cardiac, or (*c*) nephritic, appearing singly, or jointly. (3) In these patients, the chemical examination of the blood was of diagnostic value.

Some of the hypertension cases have been seen more or less regularly over a period of years (from five to eight). Since making chemical examinations of the blood one has the impression of assurance of the true state of the kidneys which formerly was doubtful.

Uric acid [27] values have been high in some cases, as in 17 K (5.75), 21 J L (5.75, 6.25 and 6.7) and 85 H (4.1), but at such times there was no particular change in the patient's general condition.

The alkali reserve was estimated in seven instances and was not of any particular help in the care of the patients.

Blood sugar was not high, as a rule. Case 29 H showed 0.204 in September, 1919, but there was no glycosuria, while Cases 45 F (0.12) 17 K (0.142 and 0.125) and 14 W (0.14) showed higher values than normal.

REPORT OF CASES

Hypertension Cases with Albuminuria (*Table 3*).— The following cases illustrate the points that have already been made; some are given at considerable length because they are typical of recurring albuminuria secondary to cardiac decompensation and resultant static changes (passive congestion) in the kidneys.[27a]

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27. All chemical methods were standard and done with the helpful advice of Professor Haskins of the Medical Department of the University of Oregon. Blood was obtained in the morning, the patient fasting.

27a. Measurements of enlarged heart are to left of midclavicular line. Quantitative albumin is in parts per thousand by Esbach's method.

TABLE 3.—Hypertension Group. Showing Increase in Albuminuria Often Coincident with Increased Cardiac Embarrassment. Cardiac Symptoms Were Dyspnea, Rapid Pulse, Increased Heart Borders, Cyanosis, Enlarged Liver, Edema, Etc. Cerebral Symptoms Varied from Mental Confusion, Headache, Sclerotic Retinal Vessels, Aphasia or Cerebral Hemorrhage. Nephritic Symptoms Were Oliguria, Marked Albuminuria and Casts, Edema, Uremia Symptoms

			Predominating Symptoms				Blood Chemistry					Urine		
Case	Age	Date	Cerebral	Cardiac	Nephritic	Blood Pressure	Urea	Uric Acid	Creatinin	Sugar	Alkali Reserve	Specific Gravity	Albumin	Casts
45 F	51	4/12/20	.....	++++	+++	210-135	....	....	....	....	..	1.016	+++	+++
		4/14/20	.....	++++	++	210-155	15	2.17	1.4	0.12	..	1.009	0.1%	++
		5/—/20	.....	+	±	195-135	14	2.62	1.17	0.11	..	1.010	±	+
		12/—/20	.....	++++	+++	195-130	16	3.12	2	0.10	..	1.014	0.35%	+++
		2/ 4/21	++	++++	+++	150-110	....	....	....	....	..	1.020	+++	+++
81 S	58	6/—/20	.....	++++	+++	155-125	....	....	....	....	..	1.020	+++	++++
				++	±	170- 90	15	2.75	1.9	0.08	62	1.010	+	
		9/—/20	+++	+	.....	180-140	12.5	1.25	2.2	0.083	72	1.012	+	+
50 C	50	3/—/20	++	++	++	225-150	....	....	....	....	..	1.020	++	++
		6/—/20	+	++	+	250-110	10	2.74	2.43	0.089	70	1.018	++	++
		8/—/20	+++	++	+	250-150	12.5	2.92	2	....	..	1.018	+	+
71 G	74	6/12/20	++	+	++	185-105	....	....	....	....	..	.....	++	+
		6/14/20	.....	.....	.....	.....	13.5	2.5	1.33	0.083	..	.....	0.2%	
6 J	59	5/—/19	+++	±	+	240-120	....	....	....	....	..	1.020	+	+
		7/—/19	+++	±	+	180-165	11	....	1.16	0.09	..	1.020	+	+
17 K	70	8/—/15	+	±	±	280-142	....	....	....	....	..	1.015	±	±
		8/—/19	+++	±	±	225-138	25.5	....	2	0.142	..	1.018	±	±
		1/—/20	++	±	±	220-130	...	2.37	1.17	....	..	1.018	+	+
		6/—/20	+++	±	±	240-135	14.5	....	1.7	0.125	70	1.017	+	+
		8/—/21	+++	++	++	139- 45	30.5	5.75	1.9	0.11	..	1.015	++	+
21 J L	69	4/—/14	+	+	+	205-130	....	....	....	....	..	1.018	+	+
		9/—/19	+	++++	++	190-105	27	....	4	0.10	..	1.013	++	++
		10/—/19	+	+	+	210-125	22.5	....	2	0.12	..	1.012	+	+
		5/—/20	+	+	+	240-130	25	6.7	4	0.11	..	1.012	+	+
		12/—/20	+++	+++	++	190-115	25	6.25	2.5	0.10	75	1.017	+	+
		8/—/21	++	+++	++	135- 95	30.5	5.75	1.9	0.11	..	1.014	+	+
79 R	57	6/—/20	++	.....	.....	210-125	10	2.25	1.81	0.09	..	1.020		
29 H	56	9/—/19	.....	+++	++	195-115	13.5	....	0.08	0.204	..	1.012	0.35%	+++
		10/ 9/19	.....	+++	++	190-125	....	....	....	....	..	1.014	0.275%	+++
		10/21/19	.....	+++	++	.....	32.5	....	3.08	....	..	1.018	0.4%	+++
85 H	50	7/ 3/20	.....	++++	+++	140- 95	17.5	4.1	2	0.11	77	1.024	++	++
		7/10/20	.....	+++	++	155-110	15	3.25	1.5	0.083	65	1.020	++	++
36 G	69	12/19/19	+	+++	++	185-105	....	....	....	....	..	1.026	0.1%	+++
		12/22/19	+	++	+	.....	22	....	1.95	0.07	..	1.022	+	+
20 H	68	8/30/19	+++	+	+++	235-125	....	....	....	....	..	1.020	+++	+++
		8/31/19	+++	+	+++	180-115	....	....	....	....	..	1.022	0.325%	+++
		9/ 1/19	+++	+	+++	160-115	99	....	7.4	0.096				
14 W	..	8/ 8/19	+	.....	.....	215-110								
		8/ 9/19	.....	.....	.....	195-105	11.5	....	1.6	0.14	..	1.025	+	+
22 T	..	8/29/19	++	.....	.....	190-125								
		9/—/19	.....	.....	.....	210-125	19	....	2	0.10	..	1.022		

CASE 1 (45).—*History.*—J. F., aged 51, seen April 12, 1921, complained of increasing dyspnea and recent orthopnea. He had been aware of some shortness of breath since a severe attack lasting several hours three years ago, when he ran up a long flight of stairs. For six weeks it had been more troublesome, so that he could only walk two blocks when he had to stop and rest, and for three weeks he had been unable to lie flat in bed, requiring three or four pillows. He had no digestive symptoms, edema or cough. He had not given up his business, which was mostly sedentary.

Examination.—Moderate cyanosis, dilated heart (left border 5 cm. to the left, in the sixth space) with moderate systolic murmur at apex, transmitted to axilla, and a softer systolic murmur at the base was noted. There was moderate respiratory effort. Blood pressure, 210/135; pulse regular. Urine passed in the office showed excessive albumin, and many hyaline, fine and coarse granular and cellular casts, no blood.

The picture was that of a cardiac breakdown assumed to be secondary to hypertension of some duration. The urine suggested nephritis and further study.

Treatment.—He was put to bed, given digitalis in sufficient dosage, and when seen two days later he was breathing easier and passing sufficient urine, and there was but a trace of albumin. The chemical examination of the blood is shown in Table 4, revealing practically normal values. From this and the general picture, it was assumed that the kidneys, while in all probability the seat of interstitial change, were embarrassed from insufficient circulation (chronic passive congestion).

TABLE 4.—RESULTS OF EXAMINATION OF BLOOD OF J. F. (CASE 1)

Date	Blood Pressure	Urea	Uric Acid	Creatinin	Sugar	Specific Gravity	Albumin	Casts
April 12	210/135	..	....	....	....	1.016	Excessive	Many
April 14	205/130	15	2.17	1.4	0.12	1.010	Trace	Few
May 20	190/135	14	2.62	1.17	0.11	1.010	Trace	Few
Dec. 15	195/130	16	3.12	2	0.10	1.012	Excessive	Many

Course.—The course of the disease seemed to bear this out, for after six weeks of general supervision, he had less dyspnea, the heart borders were nearer normal, and he was able to walk eight blocks without distress. He had required frequent courses of digitalis for recurrent cardiac embarrassment. During these recurrences albumin increased.

In the next five months he was up, and spending some time at the seashore, but with slight unusual effort cardiac symptoms recurred, always attended with increase in the evidences of renal embarrassment, but controlled by rest and digitalis. At one time, the heart dilated to the anterior axillary line, the liver became enlarged and tender, and slight edema appeared at the ankles. December 18 he was again seen in decompensation, the left border of the heart being in the anterior axillary line, the apical murmur loud, and the liver swollen and undoubtedly pulsating. He was given digitalis to nausea; the pulse rate dropped to 40 per minute, and the pulse became bigeminal, improving gradually on withdrawal of the drug and without the use of atropin; polygrams showed heart block. The electrocardiograph was not available then. The urine was much decreased in amount, contained excessive albumin (3.5 gm. per liter in twenty-four hours' urine), and there were numerous casts; indican was excessive, and urobilin moderate. He was definitely jaundiced, and the liver was four and one-half finger breadths below the costal margin.

The course was steadily downward from this time to February 4, when he was mentally confused and so drowsy that he fell asleep while being examined. There was marked cardiac dilatation with dyspnea and Cheyne-Stokes respiration, anasarca; enlarged liver. The urine had cleared up considerably, there being a moderate trace of albumin, and a moderate number of casts of all kinds. He died two days later.

Comment.—This is primarily a case of heart disease throughout the clinical course of nine months, with recurring nephritic symptoms, the latter cleared up with cardiac improvement. At no time until a few days before death did a suggestion of uremia (drowsiness, mental confusion) appear; these symptoms were assumed to be due to cerebral edema, since the urine output was sufficient and albumin and casts had decreased. The patient died of heart failure. There were never evidences of other cerebral insults.

Albuminuria in this case seemed directly associated with cardiac weakness; there were no evidences of retention in the blood. While albumin decreased on the second day after rest and digitalis had been instituted, the practically normal blood values gave a sense of security as to serious damage in the kidneys, and later observations bore this out.

CASE 2 (81)—*History.*—C. S., aged 58, a farmer, complained of shortness of breath for over a year, dating back to six years before when he overworked and was laid up with his heart for a month. The amount of twenty-four hour urine, he said, was about 1 quart. He was under a physician's care three months before, when, after a few weeks in bed, he was so much better that he was able to take up light work on the farm. He had had increasing difficulty with breathing, and much swelling of the legs for two weeks.

TABLE 5.—RESULTS OF EXAMINATION OF THE BLOOD OF C. S. (CASE 2)

Date	Blood Pressure	Urea	Uric Acid	Creatinin	Sugar	Specific Gravity	Albumin	Casts
June 25	155/125	..	....	....	....	1.020	Excessive	Excessive
June 28	160/125	15	2.75	1.9	0.089	1.010	Trace	Few
Sept.	180/140	12.5	1.25	2.2	0.083	1.018	Moderate	Moderate

Examination.—Slightly cyanotic, considerable respiratory effort. The heart was 6.5 cm. to the left of the midclavicular line in the sixth space, the sounds were distant, due to some emphysema; there were no murmurs; blood pressure, 155/125. The arteries were considerably thickened. The legs were markedly edematous, the swelling extending to the abdomen, and there was some ascites. Urine (office specimen) showed excessive albumin, excessive hyaline, large and small granular and few cellular casts, no urobilin.

Treatment.—He was put to bed, diet restricted, and given sufficient digitalis. He had much nausea and vomiting for three days. The urine on the fourth day showed specific gravity, 1.010; trace of albumin; no casts found. The heart was compensating well, and with very little distress; there was but a faint trace of albumin, and no casts. Blood pressure, 170/90; pulse, regular; heart borders, 3.5 cm. to left of midclavicular line in fifth space.

Course.—Two weeks later there was some return of dyspnea and edema, and, after ten days of rest and occasional use of digitalis, he was up and about and steadily improving. Two months later, he had a cerebral hemorrhage with paralysis in the right arm and face. Blood pressure was then 180/140. Urine showed moderate albumin, moderate granular, and few cellular casts. He died in coma two days later. Result of chemical examination of the blood is shown in Table 5.

Comment.—Cardiac symptoms predominated until two days before death, when there was a cerebral hemorrhage. At first nephritic symp-

toms were prominent, but there was no particular blood retention and these symptoms improved with cardiac compensation.

CASE 3 (50).—*History.*—J. C., aged 50, seen first March 26, 1920, complained of occipital headaches for two weeks, which awakened him in the early morning. Headaches formerly were occasional, but for the last few days had been constant and severe. For years he had been a hard worker in a responsible position as manager in a large paper mill.

Examination.—Blood pressure was 225/150. The brachials were moderately thickened; the heart was moderately dilated, but there was no edema or cyanosis. The urine showed a definite trace of albumin, with few casts. There were some infected teeth.

Treatment.—Two weeks later, on restricted diet and rest, his blood pressure was 180/120, and the urine showed a faint trace of albumin; the headaches were less, and he was generally better. June 11 blood chemistry showed: urea, 10; creatinin, 2; uric acid, 2.92; sugar, 0.08. The urine showed definite trace of albumin, specific gravity, 1.018, and a few granular casts.

Course.—August 13 he had sudden dimness of vision of left eye, which was due to edema of the retina. His blood pressure was then 250/150, and remained high in spite of bed rest, diaphoresis, catharsis, etc. September 7, he complained of more headache and was having some anginoid pain in the precordium. In the next six weeks he improved considerably, and left for New York on a business trip where he developed acute pulmonary edema. He was seen by Dr. Frank Meara. After a time he went to Boston, and was seen by Dr. Locke, because he was having shortness of breath, and some edema of the ankles.

His course was gradually downward from this time on, and he died in June, 1921, of cardiac decompensation.

Comment.—The symptoms in this case of arterial hypertension were primarily cerebral, and later cardiac. During the period of cardiac embarrassment, there was an increase in albuminuria. At no time were nephritic symptoms predominant. The blood chemistry did not indicate retention.

CASE 4 (71).—*History.*—G., aged 74, seen first June 12, 1920, complained of dizzy spells and weakness.

Examination.—Some respiratory effort; marked arteriosclerosis. The left border of the heart was 4 cm. to left of the midclavicular line, in the sixth space, with showers of small râles at bases posteriorly. The urine showed 0.2 per cent. albumin, with many fine granular and rare cellular casts. Blood pressure, 185/105.

Course.—He made marked improvement on rest and digitalis, so that, within a month, the albumin decreased to a very faint trace. There were only a few fine granular casts. Blood chemistry, June 14: urea, 13.5; uric acid, 2.5; creatinin, 1.33; sugar, 0.083.

CASE 5 (6).—*History.*—J., aged 59, seen first May 12, 1920, had slight dyspnea on effort, flatulence, some mental confusion and amnesia.

Examination.—This revealed: Heart 2.5 cm. to left of midclavicular line, in fifth space; soft, blowing, systolic murmur at apex. No marked evidences of cardiac embarrassment. Arteriosclerosis moderate. Blood pressure, 240/125. May 12, blood showed: urea, 11; creatinin, 1.16; sugar, 0.09. Urine showed a trace of albumin and a few granular and hyaline casts.

Course.—At present, two years after first seen, he is up and about, showing progressive mental confusion.

CASE 6 (17).—*History.*—Mrs. K., seen first Aug. 31, 1916, aged 65, had had several fainting attacks, especially while straining at stool.

Examination.—Blood pressure, 280/150. Cerebral symptoms predominated, and increased gradually. The urine showed definite trace of albumin, and moderate casts, and the heart never gave any particular concern. In August, 1919, she had a partial aphasia, mental dulness and amnesia. Her blood pressure was then 225/138. Blood urea, 25.5; creatinin, 2 and sugar 0.142. The urine showed no increase in albumin and casts.

Course.—In Januafy, 1920, she had lobular pneumonia when albumin and casts increased in the urine, and the heart became dilated. Blood chemistry at this time showed: uric acid, 2.37; creatinin, 1.17. The blood pressure was 240/135. Her heart gave no difficulty but she was more aphasic and amnesic. Blood urea was then 30.5; uric acid, 5.75; creatinin, 1.9 and sugar 0.11. The alkali reserve was 70.

The fundi, at no time, have shown hemorrhage.

Comment.—This patient has had predominating cerebral symptoms since 1914, is ambulatory, and has never, except during pneumonia, shown cardiac embarrassment or nephritic symptoms. The condition has been attributed to cerebral arteriosclerosis rather than to chronic uremia.

CASE 7 (21).—*History.*—J. L., was seen first April 19, 1914, aged 69, complaining of persistent headaches, and his physician had told him he had kidney trouble.

Examination.—He was then a sturdy appearing, well built man with ruddy face and a tendency to cyanosis. His blood pressure was 205/130. Heart borders slightly increased, and some crepitant râles at the bases of both lungs. Urine showed definite albumin, and many, fine, granular casts. He was mentally alert and normal. Peripheral arteries were moderately thickened.

Course.—Up to May, 1919, he was seen at intervals, and much improved, with albumin appearing in faint traces or absent. At that time, he had an acute cardiac breakdown with much albumin and many casts, gradually improving during the summer. In September, his blood urea was 27, creatinin 4 and sugar 10. To August, 1921, he gradually showed mental confusion, some amnesia, and general feebleness, though he was able to be up and about, and cardiac and nephritis symptoms were not prominent. He then had another cardiac breakdown following obstinate constipation. The blood showed high uric acid values in May and December, 1920, and August, 1921, and in September, 1919, creatinin was high (4 mg.), but in August, 1921, it had dropped to 1.9. All this time his diet had been practically constant and restricted.

Comment.—This man has been seen more or less regularly for eight years. His long continued hypertension has resulted in decreasing cardiac strength. On several occasions of heart decompensation, albumin and casts have appeared, disappearing with improved circulation. The kidneys have given no other cause of concern, though for nine months the urine has shown definite traces of albumin, and a few or moderate hyaline, granular or cellular casts.

CASE 8 (29).—*History.*—H., aged 51, was seen Sept. 28, 1919, complaining of shortness of breath and swelling of legs, for two months. Was passing less than a quart of urine daily. Digestion was normal. Recurring symptoms for one and one-half years.

Examination.—He showed moderate cyanosis and marked dyspnea, with heart dilated to anterior axillary line and regular; systolic murmur at apex. Blood pressure, 195/125. Urine: specific gravity, 1.012; albumin, 0.35 per cent.; many hyaline and granular casts, and few cellular casts. Blood urea, 13.5; creatinin, 0.08.

Course.—Under treatment the symptoms improved somewhat, though the heart remained dilated, and albumin and casts persisted. The edema decreased. October 21 the blood urea was 32.5; creatinin, 3.03, and sugar 0.0204. Urine showed more albumin (0.4 per cent.) and many hyaline, granular and cellular casts. He was then lost sight of, but died a few weeks later.

Comment.—This patient's symptoms were predominatingly cardiac, with obstinate renal embarrassment. The high sugar content of the blood is noteworthy though glycosuria did not appear.

CASE 9 (85).—*History.*—H., aged 50, was a typical "cardionephritic."

Examination.—When admitted to the clinic his blood pressure was 195/120; orthopnea; slight edema; oliguria, and marked albuminuria were present, with heart dilated and decompensated. His course was steadily downward for six months, although for a time he improved under cardiac stimulation, rest and limited diet.

Course.—July 3, six months after he was first seen, he again presented himself, with marked edema, cyanosis, dilated heart with auricular fibrillation. His blood at that time showed: urea, 17.5; uric acid, 4.1; creatinin, 2; sugar, 0.11. The alkali reserve was 77. There was marked oliguria, excessive albumin and casts. July 10: urea was 15; uric acid, 3.25; creatinin, 1.5; sugar, 0.083. Alkali reserve was 65. He died of heart failure a few weeks later.

CASE 10 (36).—*History.*—G., aged 69, complained of dyspnea and orthopnea; considerable cough and flatulence.

Examination.—Blood pressure, 185/105. Arteriosclerosis was marked; the heart was dilated 5 cm. to the left of midclavicular line and showed auricular fibrillation. Urine contained albumin, 0.1 per cent. The blood showed: urea, 22; creatinin, 1.95; sugar 0.07.

Course.—In the next two weeks there was some improvement, but he died suddenly. Necropsy showed marked myocarditis.

CASE 11 (20).—*History.*—H., aged 69, when first seen was semicomatose. For two months he had headaches on awaking, but for one week past was weak and had severe headaches, anorexia, and vomited the day before.

Examination.—Blood pressure, 225/125; urine much decreased and showing excessive albumin (0.35 per cent.); many casts of all kinds.

Course.—That night he had three convulsions on the left side of the body, but, when seen the next day, was not paralyzed. Blood pressure had fallen to 160/118, with pulse regular but weaker and the heart moderately dilated. The blood, next day, showed extremely high values, as follows: Urea, 99; creatinin, 7.4; sugar, 0.96. He died that night.

Comment.—This was evidently a case of hypertension of some duration seen near the termination of the disease when cerebral symptoms predominated. The high blood values showed serious retention. His heart, when first seen was fairly compensating. The clinical picture then suggested cerebral edema or uremia.

Another case of cerebral edema simulating uremia or "cardionephritis" is the folowing:

TABLE 6.—Miscellaneous Group, Showing Normal Blood Values in Two Cases of Orthostatic Albuminuria, Marked Albuminuria in Cardiac Decompensation Which Cleared Up with Improved Circulation. The Very High Values in the Case of Bichlorid Poisoning Have Been Noted by Others

			Urine						Blood	Blood Chemistry						Test Diet Urine					
Case	Age	Diagnosis	Albumin	Casts	Blood	Oliguria	Edema	Uremia	Pressure	Urea	Uric Acid	Creatinin	Sugar	Alkali Res.	Pn	D.	N.	Sp. Gr.	Cl	N	Remarks
67 S.	28	Syphilitic nephritis	0.4%	+++	..	+	+	..	140/ 95	12.5	1.88	1.9	0.10	..	39	1,125	135	N.	0.98	7.27	Nephritic symptoms disappeared after specific treatment
92 R.	18	Orthostatic albuminuria	++	++	..	..	..	..	120/ 80	12.5	2.5	1	0.10	78	55	N.	N.	N.	....	....	No symptoms
64 R.	30	Orthostatic albuminuria	++	++	..	..	..	..	120/ 84	10	1.25	2	0.08	..	60	N.	N.	N.	....	....	No symptoms
M.	23	Cardiac decompensation	0.6%	+++	..	+	+++	..	130/ 80	....	....	....	....	..	..	435	263	F.±	4.76	14	Symptoms disappeared with cardiac improvement
83 McD.	28	Bichlorid poisoning	..	..	..	AN	..	+++	150/ 90	11.0	7.5	8	0.17	..	..	.....	. .	....	....	....	Anuria 48 hours; died
41 S.	12	Uremia	++++	+++	+	+	++	+++	140/ 90	5.25	6.25	3.99	....	..	22	....	...	....	....	....	
23 C.	45	Chronic parench. nephritis	+++	+++	++	++	+++	+	190/120	4.25	....	2.5	....	11	..	....	...	....	....	....	Duration 15 years, relapses with purpura
S.	62	Acute focal nephritis	+	+	+	+	+	..	145/100	....	....	....	....	..	..	412	571	F.±	2.97	9.5	Pus in tonsils; fever

CASE 12.—*History.*—Man aged 52, admitted to county hospital with some mental confusion and complaining of shortness of breath, cough and bloody sputum, was taken sick the day before. He had had heart trouble for about five months, saying that he got it by trying to save someone from drowning. He had swelling of the ankles for four or five years. Difficult to get history because of mental confusion.

Examination.—Much edema of the face and legs. The pupils were equal and reacted normally to light and accommodation. The heart area was increased, being about 2 cm. outside the left nipple line. The heart was irregular in force and rhythm and there was pulse deficit. The first sound at the apex was replaced by a blowing murmur. On account of obesity the outline of the liver was not made out but there was also edema of the abdominal wall. Urine showed specific gravity, 1.014, albumin and hyaline and granular casts, two plus.

Course.—He became comatose, had involuntary urination and defecation, and died in two days. Patient was shown before a class of medical students and discussed as a possible case of cerebral edema rather than one of uremia. Blood chemistry the day before death showed: urea, 29; creatinin, 1.01.

Necropsy Findings.—"Besides general edema there is an early gangrene of the toes of the right foot. The tips of the fingers are cyanotic and the hands are edematous. Two or three liters of amber colored fluid were found in the

TABLE 7.—URINE FINDINGS IN CASE 13

Day Urine	Albumin	Specific Gravity
On arising	0	1.028
11 a. m.	Def. trace	1.014
1:30 a. m.	Def. trace	1.024
4 p. m.	Def. trace	1.014
6 p. m.	Def. trace	1.018
8 p. m.	Def. trace	1.022
10 p. m. (retired)	Trace	1.024
11:30 p. m.	0	1.020

peritoneal cavity. The bowel wall is watery. The lungs are markedly emphysematous in front, both pleural cavities contain about a liter or more of straw colored fluid. The pericardial sac is distended with amber fluid. In the right auricle, especially in the anterior wall and in the appendix there is a large grayish organizing antemortem clot which is adherent to the wall. There are vegetations on the mitral valve. Sclerosis of the vessels and of the heart are not marked. There is a large infarct in the posterior portion in the upper lobe. The grayish antemortem embolus causing this infarct is found plugging one of the branches of the pulmonary arteries and there are multiple smaller infarcts. The whole lung is markedly edematous and congested. The left lung also shows several small hemorrhagic infarcts. The kidneys are of average size; the surfaces made by sectioning disclosed an hyperemia but no other gross changes. There is a marked edema of the brain. The pia arachnoid is raised high above the convolutions. There is no scarring of the meninges. The vessels at the base of the brain are moderately sclerotic but there is no evidence of thrombosis or softening in any portion of the brain."

MISCELLANEOUS GROUP

CASE 13 (92).—*History.*—R., aged 18, case of orthostatic albuminuria (Table 6), who had been refused admission to Annapolis on account of albuminuria. Never ill, nor conscious that anything was wrong. Table 7 shows albumin present only in the day urine.

Course.—The albuminuria was uninfluenced by diet and exercise, and repeated examinations showed no albumin in the urine passed on arising. The two hour

test diet was normal. The phenolsulphonephthalein output was 55 per cent. in two hours. Blood chemistry showed: urea, 12.5; uric acid, 2.5; creatinin, 1; sugar, 0.10. Alkali reserve, 78. This patient was later admitted to Annapolis.

CASE 14 (64).—*History.*—R., aged 30, printer, case of orthostatic albuminuria, never knew he had albumin until he failed to pass the physical examination for the army. Repeated examinations of the urine showed trace of albumin and a few granular casts in spite of low protein diet, and not modified by exertion. Blood chemistry showed: urea, 10; uric acid, 1.25; creatinin, 2; sugar, 0.8. Two hour test practically normal. Phenolsulphonephthalein output, 60 per cent. Albumin was present only when patient was upright. In neither case was there any evidence of polycythemia as noted by F. Eichenberger.[28]

These two cases of albuminuria showed normal blood values and the effect of posture on the albuminuria. Ludwig Jehle,[29] in 1913, showed the effect of lordosis and kinking of the ureter in producing this phenomenon. Barker and Smith [30] reported six cases, finding that, if the patient stood in an exaggerated lordotic position for one half hour, albumin and casts appeared in the urine. Sonne catheterized the ureters in his patients, and found typical orthostatic albuminuria in the left kidney only, giving the explanation that the vertebrae compress the renal vein. More recently W. and S. L. Rieser,[31] show that the aorta, or mesenteric artery, acts as pincers of the left renal vein. These become operative when the aorta is projected forward by lordosis, or when the mesenteric artery is pulled to tautness by visceroptic tug from the mesocolon.

CASE 15 (83).—McD., bichlorid poisoning; seen in coma. Had passed no urine for forty-eight hours. Blood showed extremely high values as follows: urea, 110; uric acid, 8; creatinin, 7.5; sugar, 0.17. Died within a few hours.

CASE 16 (67).—S., aged 28; syphilitic nephritis; albumin, 4 per cent.; many casts. Phenolsulphonephthalein, 39 per cent.; blood showed: urea, 12.5; uric acid, 1.88; creatinin, 1.9; sugar, 0.1. The test diet was given with the following results:

Time	Volume, C.c.	Specific Gravity	Cl	N
8-10	165	1.010	0.29	0.6
10-12	330	1.008	1.056	0.729
12- 2	210	1.012	1	0.814
2- 4	150	1.016	1.2	0.726
4- 6	150	1.017	1.32	0.732
6- 9	120	1.016	1.10	0.75
Total day	1,125		0.70	0.727
Total night	135			

The albuminuria disappeared on specific treatment.

CASE 17 (23).—C., aged 45; chronic parenchymatous nephritis; had had nephritis for eighteen years, with occasional relapses. Four years before had

28. Parkes Weber: Polycythemia, etc., New York, Paul Hoeber, 1922, p. 11.

29. An Explanation of Orthostatic Albuminuria, Editorial, J. A. M. A. **77**: 127 (July 9) 1921.

30. Barker, L. F., and Smith, J.: Functional Renal Tests in Orthostatic Albuminuria, Am. J. M. Sc. **141**:44, 1916.

31. Rieser, W., and S. L.: Etiology of Orthostatic Albuminuria, J. A. M. A. **78**:64 (March 4) 1922.

albuminuric retinitis. Blood pressure varied between 210 and 110. In July, 1918, was seen with anuria for forty-eight hours, and profuse purpura on the arms and legs, and marked hematuria. For six months she had been gradually failing; albuminuria had been excessive, there was marked edema, hydrothorax and ascites. Blood chemistry showed: urea, 42.5; uric acid, 2.5; sugar, 0.11. She was too sick to have a test diet, and died within a month.

CASE 18.—S., aged 62; acute focal nephritis. This patient was seen during an attack of acute tonsillitis with fever. Her blood pressure was 125/100. Heart negative. Urine showed trace of albumin and few hyaline and granular casts, but ten days later, there was oliguria, some edema of ankles and lower eyelids, and the urine showed a definite trace of albumin, hyaline and granular casts and red corpuscles. There was no urinary calculus, and pyelitis and pyelonephrosis were ruled out. The test diet was as follows:

Time	Volume, C.c.	Specific Gravity	NaCl	N
8-10	37	1.009	....	....
10-12	75	1.014	....	....
12- 2	44	1.009	....	....
2- 4	61	1.014	....	....
4- 6	27	1.009	....	....
6- 8	168	1.005	....	....
Total day	412		2.97	9.5
Total night, 10/8	571			

Within a few weeks nephritic symptoms had all disappeared, and when seen three months later, she was entirely well.

CASE 19.—Mrs. M., aged 23; cardiac decompensation; had been in bed for six weeks with cardiac decompensation. Left border of the heart 1½ inches to the left of midclavicular line, with mitral insufficiency and stenosis. The liver was four finger breadths below the costal margin, and tender, marked edema of ankles, face, eyelids and buttocks. Albumin, 0.6 per cent.; many hyaline and granular casts. The two hour test was as follows:

Time	Volume, C.c.	Specific Gravity	NaCl	N
8-10	39	1.012	....	....
10-12	59	1.012	....	....
12- 2	79	1.012	....	....
2- 4	76	1.016	....	....
4- 6	87.5	1.008	....	....
6- 8	94	1.012	....	....
Total day	345		4.76	14
Total night	263	1.011		

CASE 20 (41).—S., aged 12; nephritis with edema; had been in bed for some time before, with edema for last seven weeks. Urea, 52.5; uric acid, 6.25; creatinin, 3.99; alkali reserve, 0.22. Patient died three weeks later.

CONCLUSIONS

1. Albuminuria as described may not be due to serious damage in the kidney and may even be excessive from extrarenal factors. Passive congestion of the kidneys occurs not only in cardiac breakdown due to valvular insufficiency but may be a result of long continued heart strain from arterial hypertension.

2. Albuminuria occurs so frequently as a part of the clinical picture of arterial hypertension that these cases form a large group in the

patients studied. While chronic interstitial nephritis is assumed to be present, the "renal crisis" is often due to myocardial weakness and results in passive renal congestion.

3. In a miscellaneous group, two cases of orthostatic or postural albuminuria are cited. Renal function tests show no marked disturbance in the kidneys.

4. But few cases of primary nephritis are recorded because not many were encountered.

5. Of the various functional tests, those using the urine are disappointing. The chemical examination of the blood seems to offer a means of early differentiation between renal or extrarenal albuminuria. The test diet for fixation of specific gravity, and for the estimation of chlorid and nitrogen excretion and water output also gives an early clue of renal function.

6. The term "cardionephritis" seems a misnomer in view of the fact that the nephritic symptoms may be largely due to congestion and not to extensive renal damage.

7. Efforts to make clinical and pathologic nephritis conform still fail because of the complicated mechanism of renal secretion.

8. Attention is called to the predominating symptoms in vascular hypertension. Sooner or later every patient shows singly or jointly (*a*) nephritis (*b*) cardiac or (*c*) cerebral symptoms.