A Study of Different Nitrogenous Diets in Chronic Nephritis

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The object of this study has been to note the effect of diets containing different amounts of nitrogen on cases of chronic nephritis. To study this effect, attention has been paid especially to the different tests devised in recent years to show renal function, to the blood-pressure, and to the general condition of the patient.

Many articles have appeared in medical literature concerning the value and effects of different types of diets in chronic nephritis. No attempt will be made to review those articles which deal with the effect of diets on the general condition of the patient, nor shall we take up the literature which deals with the effect of diets in which other food elements than the nitrogen have been varied. In a study on nephritis in 1905 Widal[1] and Javal among other points showed that the urea of the blood became elevated in certain types of chronic nephritis when increased nitrogen in the food was consumed, or when urea was added to the diet. In 1913 Goodall[2] declared that the blood-pressure fell in chronic nephritis when the patients were placed on a low protein diet. In one case he found the non-protein nitrogen of the blood low after the low diet, and concluded that the general condition and blood-pressure were dependent on the presence of the end-products of protein metabolism in the blood. Seymour[3] in 1913, and Folin, Denis and Seymour[4] in 1914 reported on cases of chronic nephritis given diets containing average, high, and low amounts of protein. No accurate record was mentioned of the amount of the diet refused by the patient. They found that the patients on the high diet did not seem so well, and that the non-protein nitrogen of the blood could be increased or lowered by the diet. They found no relation between the blood-pressure and the nitrogen retention and no relation between

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* From the Department of Medicine, Harvard University, and the Medical Clinic of the Peter Bent Brigham Hospital.

1. Widal: La Semaine méd., 1905, xxv, 313.
2. Goodall: Boston Med. and Surg. Jour., 1913, clxviii, 761.
3. Seymour: Boston Med. and Surg. Jour., 1913, clxix, 795.
4. Folin, Otto, Denis, W., and Seymour, Malcolm: The Non-Protein Nitrogenous Constituents of the Blood in Chronic Vascular Nephritis (Arteriosclerosis) as Influenced by the Level of Protein Metabolism, THE ARCHIVES INT. MED., 1914, xiii, 224.

the phenolsulphonephthalein elimination and the non-protein nitrogen of the blood when the latter was varied by the diet.

The numerous observations from which this paper is compiled were made for the most part by one or the other of us. In some instances, however, the records of the Peter Bent Brigham Hospital were used. During the time the work was in progress frequent comparisons were made between our figures and those of the hospital physicians, so that we feel no hesitancy in using their figures when it is necessary.

Any one who has worked on a problem quantitatively in a general hospital will realize the possibilities of error that readily creep in. Careful supervision of the work in these experiments makes us feel that although an occasional error may have produced some unexpected result, the figures as a whole are relatively accurate. Of course, we should not draw any conclusions from a single observation in this kind of work.

For these studies three different types of diets were selected. They all contained as nearly as possible the same number of calories and the same amount of sodium chlorid. In addition to the salt in the food enough was added in the cooking to bring the total up to approximately 4 gm. a day in each diet. One diet, called the standard nephritic diet, contained about 73 gm. of protein daily. Another, called the high protein contained about 149 gm. of protein daily, and the third, called the low protein diet, contained about 26 gm. of protein daily.

For our estimations it was assumed that if the amount of protein was divided by 6.5 the result would show the number of grams of nitrogen. Thus the high protein diet contained practically 23 gm. of nitrogen, the standard diet 11.2 gm., and the low protein about 4 gm. of nitrogen daily.

The hospital dietitian, Miss McCollough, spent considerable time in endeavoring to make up meals which contained these amounts of protein and sodium chlorid in the twenty-four hours, and which would be palatable and variable from day to day. We take pleasure in this opportunity to extend to her our thanks. The figures for values of raw food were taken from the United States government bulletin, for cooked food from Locke's[5] tables. In the high protein diet it was necessary to increase the caloric value from the usual 2,100 to 2,600 in order to make the meals palatable.

As many of the studies could not be carried out completely owing to the patients leaving the hospital or to other causes, we shall have to report some cases in which only certain points have been brought out. The plan followed when possible consisted in letting the patient rest for a few days after entrance to the hospital on a simple light diet.

5. Locke: Food Values, D. Appleton & Co., 1911.

After the patient had become used to the new surroundings, the standard nephritic diet was started and an accurate record kept of the amount of protein eaten at each meal. While the patient was on the standard nephritic diet, on one day 10 gm. of sodium chlorid, on another 20 gm. of urea were added to the diet, in order to study the ability of the kidneys to excrete those substances. Widal[6] has divided nephritis recently into those cases which are unable primarily to excrete sodium chlorid and those that are unable to excrete non-protein nitrogen. Schlayer[7] and Monakow[8] have suggested the foregoing two tests to show the kidneys' ability in regard to salt and nitrogen.

After the patient had been on the standard nephritic diet for a few days the amount of non-protein nitrogen in the blood was determined and the phenolsulphonephthalein excretion test done. The patient then was placed on the high protein diet for a few days and these two tests repeated, then on the low protein diet for a similar period and the tests were done again. The amount of fluid intake and output was recorded as was also the specific gravity of the urine. The amount of nitrogen and salt excretion during many of the experiments was studied throughout, while in others only in part. Blood-pressure observations were made from time to time.

The amount of the non-protein nitrogen in the blood and the power to excrete phenolsulphonephthalein were taken as the two most comprehensive single tests for renal function at the present time. Recent work on these tests by us[9] has shown that the two tests in general parallel each other, although there may be considerable variation in the phenolsulphonephthalein excretion because of passive congestion or other unknown causes, in cases in which the blood nitrogen remains constant. Our feeling is that the amount of non-protein nitrogen in the blood is slightly the more reliable test of the two. By the methods used for determinations the normal amount of non-protein nitrogen in the blood is between 20 and 30 mg. per hundred c.c. The normal excretion of phenolsulphonephthalein in two hours is more variable, but roughly from 50 to 70 per cent.

The following methods were used for making the different determinations, and references are given to the description of the technic by the originators of the tests. As no modifications were employed, we shall not give a description of the technic. For determinations of the non-protein nitrogen of the blood we used the Folin and Denis[10]

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6. Widal: Mouvement méd., 1913, i, 1.
7. Schlayer and Takayasu: Deutsch. Arch. f. klin. Med., 1910-1911, cl, 333.
8. Monakow: Deutsch. Arch. f. klin. Med., 1911, cii, 248.
9. Frothingham and Smillie: The Archives Int. Med., 1914, xiv, 541.
10. Folin and Denis: Jour. Biol. Chem., 1912, xi, 527.

method. The method originally described by Rowntree and Geraghty[11] for the elimination of phenolsulphonephthalein was used. The nitrogen in the urine was determined by the method devised by Folin and Farmer,[12] and the sodium chlorid by the method suggested by Harvey.[13]

It seems most satisfactory to present the data on the individual cases in the form of tables and follow each table by a short description

TABLE 1.—Data of Patient 1078

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
May									
12	1,500	985	1.016	11.0	7.6	4.0	2.8	20.0	54
13	1,350	1,200	1.012	11.2	7.5	*14.0*	2.5	....	..
14	1,500	730	1.016	11.2	6.5	4.0	3.6		
15	1,360	1,470	1.012	11.2	9.0	4.0	2.6	....	..
16	1,375	1,040	1.016	11.2	8.3	4.0	2.4		
17	1,635	1,440	1.013	*21.2*	10.5	4.0	2.6		
18	1,590	1,260	1.013	11.2	8.0	4.0	2.4		
19	1,610	900	1.016	11.2	7.6	4.0	2.1	....	..
						10 KCl			
20	1,580	1,190	1.014	11.2	8.0	*14.0*	3.4		
21	1,510	1,670	1.011	11.2	8.2	4.0	4.0		
22	1,505	1,440	1.013	11.2	8.6	4.0	3.4	35.2	..
23	1,500	1,360	1.016	23.0	12.8	4.0	2.4	....	..
24	1,500	1,640	1.018	23.0	17.7	4.0	2.1		
25	1,500	800	1.023	23.0	12.9	4.0	0.8		
26	1,500	900	1.028	23.0	15.5	4.0	1.2	....	..
27	1,500	960	1.024	23.0	18.6	4.0	2.2	45.0	..
28	1,500	1,130	1.022	23.0	20.3	4.0	3.3		
29	1,500	840	1.023	17.5	14.3	4.0	1.7		
30	1,500	940	1.025	4.0	11.6	4.0	1.2	....	..
31	1,530	900	1.014	4.0	6.2	4.0	2.6		
June									
1	1,130	400+	1.016	4.0	3.7+	4.0	0.9+		
2	1,500	1,115	1.013	4.0	6.4	4.0	2.0	....	48
3	1,500	910	1.013	4.0	5.6	4.0	2.1	26.7	..
4	1,390	835	1.013	14.0	6.1	4.0	1.9		
5	1,350	1,265	1.014	14.0	10.9	4.0	3.3		
6	1,520	1,565	1.011	14.0	12.1	4.0	3.3	....	..
7	1,320	890	1.015	14.0	10.1	4.0	3.2		
8	1,305	990	1.020	4.0	4.6	4.0	2.8	31.2	..

of the points of interest in that individual case, or by any comments that seemed appropriate. Following the presentation of the individual cases we shall give a summary of the cases taken as a whole to see what conclusions may be drawn.

11. Rowntree and Geraghty: Jour. Pharmacol. and Exper. Therap., 1910, i, 579.
12. Folin and Farmer: Jour. Biol. Chem., 1912, xi, 493.
13. Harvey, S. C.: The Quantitative Determination of the Chlorids in the Urine, The Archives Int. Med., 1910, vi, 12.

The numbers used are the medical record numbers at the Peter Bent Brigham Hospital. The figures in italic in the nitrogen and salt columns signify the days on which the sodium chlorid and urea were added to the diet.

The first group of six cases (Tables 1-6, Chart 1) show types of nephritis which were unable to put out well added salt and urea. They fall into two groups: one in which the blood nitrogen varies with the

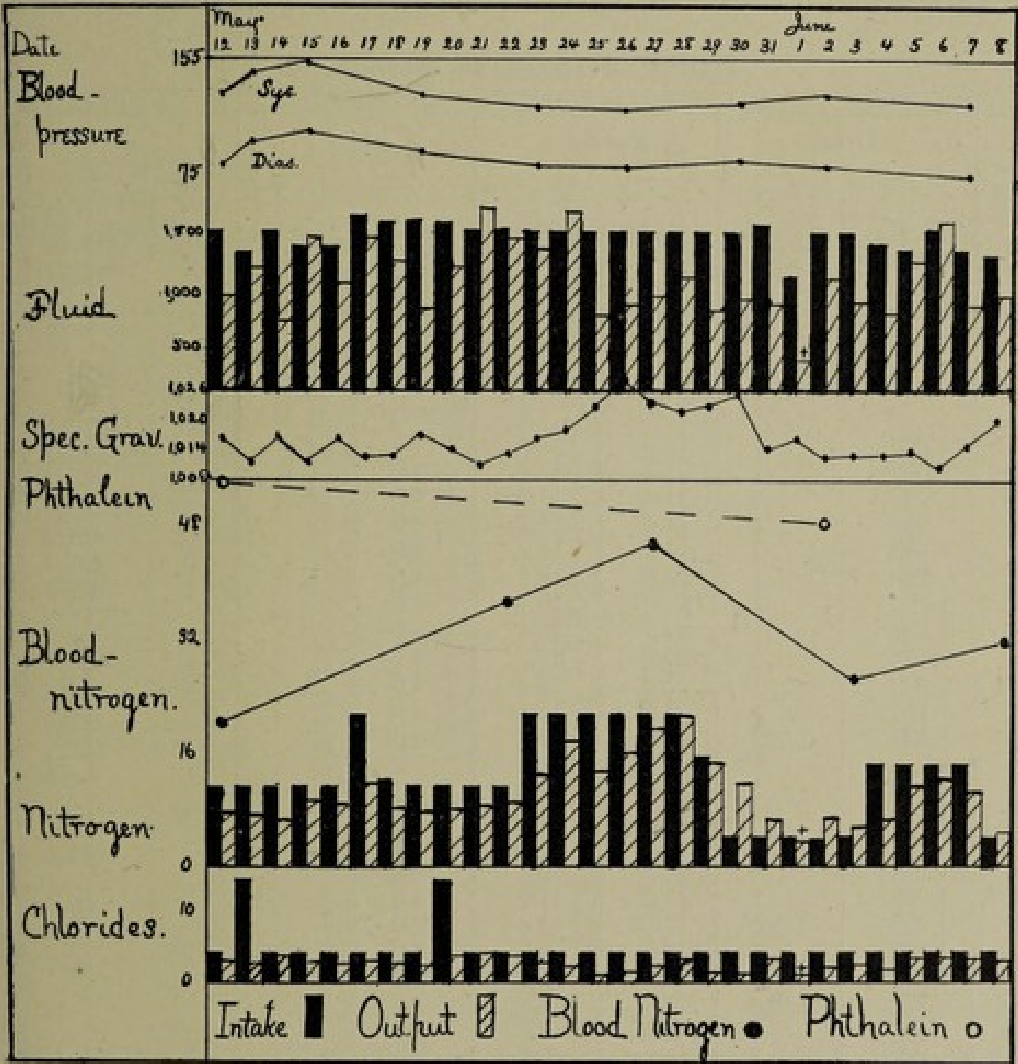

Chart 1.—Data of Patient 1078.

diet, the other in which the blood nitrogen rises despite a low protein diet.

Patient 1078 had cirrhosis of the liver with ascites in addition to a chronic nephritis. Salt and urea when added to the diet were excreted poorly. On both the standard and high protein diet the nitrogen excretion was less than the intake. The non-protein nitrogen of the blood rose steadily on both these diets and fell again on the low protein diet.

On June 4 for four successive days 20 gm. of urea were added to the low protein diet with a slight rise in the blood nitrogen. Only two phenolsulphonephthalein observations were made during this study, and they were practically the same. The blood-pressure did not show any appreciable changes with these variations in diet. On the high protein diet the patient did not feel as well as when on the other diets and had slight nausea. Ten gm. of potassium chlorid were not excreted any more readily than the sodium chlorid.

TABLE 2.—DATA OF PATIENT 624

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
Dec.									
17	.....	.....	.....	....	....	10.0	8.4		
18	.....	.....	.....	....	....	10.0	10.8		
19	.....	.....	.....	....	....	10.0	11.4	....	..
20	.....	1,300	.....	11.2	11.6	*14.0*	8.9		
21	1,100	1,100	.....	11.2	11.7	4.0	6.7		
22	950	900	.....	11.2	11.0	4.0	5.7	25.4	45
23	1,300	900	.....	11.2	14.2	4.0			
24	1,250	1,100	.....	11.2	12.7	4.0	....	....	..
25	1,300	850	.....	23.0	18.1	4.0			
26	1,150	1,150	.....	23.0	16.2	4.0			
27	1,410	1,200	.....	*33.0*	20.1	4.0			
28	1,350	1,450	.....	23.0	19.2	4.0			
29	1,700	1,300	.....	23.0	18.1	4.0	....	31.2	50
30	1,500	1,150	.....	23.0	Lost	4.0			
31	1,300	1,500	1.022	23.0	23.3	4.0	....	....	..
Jan.									
1	950	1,300	.....	23.0	24.0	4.0			
2	1,500	1,450	.....	11.2	11.2	4.0	....	36.5	..
3	1,300	850	1.022	11.2	13.0	4.0			
4	1,150	1,100	.....	11.2	12.5	4.0			
5	1,050	1,050	.....	11.2	11.0	4.0	....	....	..
6	1,700	1,450	1.022	11.2	10.0	4.0			
7	1,100	1,100	.....	4.0	9.0	4.0	....	28.5	50
8	1,600	1,000	.....	4.0	7.2	4.0	....	....	..
9	1,650	750	1.010	4.0	5.5	4.0	....		
10	1,300	1,450	.....	4.0	...	...	....	21.1	54

The data in this case are recorded also in Chart 1 in order to show the points more graphically.

In Case 624 accurate observations on the amount of the diet refused by the patient were not kept. Therefore we record under "intake" the amount offered. Observation in a general way made it evident that the major part of the diet was eaten. In this study the nitrogen excretion surpassed the intake on the days of standard diet and on some of the days of high protein diet. No explanation is offered for this. In this case as in the preceding one the non-protein nitrogen of the blood rose with the high protein diet and fell with the diet poor in nitrogenous content. Also, there was no appreciable variation in the phenolsulphonephthalein output or blood-pressure during these observations. The patient had very few subjective symptoms, and no change was noted in them during the period of study.

Patient 1197 had very few subjective symptoms from the chronic nephritis except slight dyspnea on exertion and headaches. This case showed a poor ability of the kidneys to put out salt and urea when

TABLE 3.—Data of Patient 1197

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
1,175	240+	1.019	11.2	2.3+	4.0	1.0+	39.0	54	225-135
1,970	800	1.019	11.2	9.9	4.0	1.5			
1,185	855	1.019	11.2	9.1	*14.0*	2.0	....	..	210-130
1,940	1,160	1.018	11.2	13.6	4.0	3.2			
1,860	1,100	1.015	*21.2*	13.9	4.0	2.4	....	..	230-140
1,430	1,180	1.018	11.2	13.7	4.0	2.0			
1,730	1,020	1.016	11.2	10.2	4.0	1.1	....	..	215-130
1,865	1,015	1.016	11.2	9.0	4.0	0.6	43.1	50	
990	1,450	1.012	11.2	12.8	4.0	1.2	....	..	200-120
					KCl 10				
1,365	1,305	1.016	6.7	10.9	*14.0*	3.2			
1,465	950	1.016	11.2	10.6	4.0	1.4			
2,305	950	1.017	11.2	10.6	4.0	1.2	....	..	195-110
2,356	1,070	1.018	17.8	13.0	2.5	2.3			
1,940	1,220	1.015	19.8	13.5	3.0	2.5	....	..	178- 95
1,940	1,536	1.015	23.0	16.1	4.0	3.2			
1,850	1,275	1.017	22.5	13.1	4.0	4.1			
1,800	1,320	1.014	20.5	Lost	3.5	Lost	39.6	..	180-100
1,760	1,600	1.011	7.0	10.6	4.0	4.5			
1,640	450	1.016	4.0	4.5	4.0	1.0			
1,640	560+	.....	4.0	Lost	4.0	Lost			
1,630	410+	1.010	3.6	3.0+	3.8	1.3+	25.9	..	175- 90

added to the diet. The blood nitrogen was high to begin with and remained elevated on the standard diet and the high protein diet, which were only fairly well eaten. On the low protein diet, however, the non-protein nitrogen of the blood very rapidly fell to normal. The blood-pressure in this case, with rest in the hospital and apparently irrespective of diet, fell steadily during this period of study. Only two phenolsulphonephthalein observations were made early in the study, and they showed no variation. The general condition of the patient varied very little with the change of diets, but showed a gradual improvement throughout her stay in the hospital.

Case 739, of chronic nephritis with slight subjective symptoms of hypertension, showed fair ability to put out added salt, but very little ability to put out added urea. Although the urinary nitrogen was fairly well excreted on the standard diet there was a sharp rise in the non-protein nitrogen of the blood on this diet. This was maintained but not elevated by the high protein diet, which was only fairly well eaten. On the low protein diet the blood nitrogen as in the other cases returned to normal. In this case the phenolsulphonephthalein excre-

TABLE 4.—Data of Patient 739

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthale
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
Jan.									
16	2,100	1,500	.....	....	...	...	...	22.8	58
17	1,300	1,150	1.017	10.7	8.8	...	...		
18	1,650	1,150	1.016	9.1	9.6	...	...	....	..
19	900	700	1.021	10.8	7.0				
20	1,250	800	1.020	10.5	...	...	...	....	..
21	1,000	1,290	1.012	*19.1*	9.8	...	...	41.0	32
22	950	1,180	1.015	9.1	11.7	...	...	....	..
23	1,100	580	1.019	7.6	7.3				
24	1,000	720	1.018	8.5	7.4				
25	900	500	1.020	10.7	5.0				
26	1,900	2,100	1.014	22.5	10.5	4.0	7.1	37.5	35
27	1,100	900	.....	17.9	...	4.0	4.8		
28	1,300	1,100	.....	18.0	...	4.0	6.2		
29	1,950	1,300	.....	17.5	...	*14.0*	11.2	....	..
30	1,750	2,100	.....	17.5	...	4.0	9.7	36.5	52
31	1,000	900	1.016	3.4	...	4.0	5.4	....	..
Feb.									
1	900	500	1.019	3.2	4.0				
2	1,500	900	.....	3.2	...	...	...	....	..
3	1,300	750	.....	3.8					
4	1,400	1,300	.....	3.1	...	...	...	25.5	52

tion fell as the blood nitrogen rose, but returned to normal before the blood nitrogen reached normal again. The blood-pressure and general condition in this case showed practically no variations with the changes in diet.

Case 762, of nephritis, entered with a moderate amount of edema and slightly broken cardiac compensation. The ability to put out added salt and urea was poor. The nephritis as shown by the non-protein nitrogen of the blood and by the phenolsulphonephthalein test was of a moderately severe grade. The diets were eaten extremely well. On a standard and high protein diet the non-protein nitrogen of the blood rose and the phenolsulphonephthalein elimination fell. The patient did not seem in as good general condition at this time. On a low protein diet the blood nitrogen fell, but the phenolsulphonephthalein excretion remained the same. Then on a standard diet the blood nitrogen sud-

TABLE 5.—Data of Patient 762

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
1,600	1,300	1.015	6.0	...	10.0	...	43.4	35	190-110
1,550	1,500	1.022	6.0	...	4.0	3.8			
1,500	1,580	1.018	11.2	8.0	4.0	9.2	....	..	195-125
2,100	1,550	1.017	11.2	9.5	4.0	9.6			
1,950	1,350	1.017	11.2	9.1	4.0	8.1			
1,500	1,300	1.016	11.2	9.3	4.0	6.8	....	..	190-120
1,750	1,780	1.016	*21.2*	13.2	4.0	7.5			
1,750	1,700	1.015	11.2	10.1	4.0	7.6			
1,700	1,000	1.016	11.2	7.6	4.0	4.4	50.0	..	175-110
2,100	1,650	1.016	11.2	11.6	4.0	7.1	....	36	
2,100	1,500	1.017	11.2	...	4.0	6.6			
1,750	1,420	1.017	11.2	...	4.0	7.5	....	..	180-110
1,950	1,500	1.015	11.2	...	4.0	5.5			
1,900	1,500	1.015	23.0	...	*14.0*	6.5			
1,950	1,550	1.017	23.0	...	4.0	5.0	47.6	26	190-120
2,250	2,800	1.014	23.0	...	4.0	10.2			
2,300	2,050	1.019	21.5	...	4.0	6.5			
2,100	1,900	1.017	23.0	...	4.0	5.2	56.1	..	195-130
2,300	1,700	1.018	4.0	...	4.0	2.4	....	18	
2,100	1,900	1.014	4.0	...	4.0	5.8			
2,100	1,900	1.016	4.0	...	4.0	5.6	....	..	180-125
2,300	1,300	.....	4.0	...	4.0				
1,900	1,650	.....	4.0	...	4.0	...	44.7		
1,500	1,600	1.012	4.0	...	4.0	....	....	16	180-130
1,500	1,150	.....	4.0	...	4.0				
1,590	1,100	1.015	4.0	...	4.0				
1,500	1,100	.....	4.0	...	4.0	...	39.8	18	
1,500	790	.....	11.2	...	4.0				
1,500	1,220	.....	11.2	...	4.0	...	....	..	175-125
750	700	.....	4.0	...	2.0				
1,500	1,100	.....	11.2	...	4.0				
1,500	1,700	.....	11.2	...	4.0				
1,500	1,170	1.017	11.2	...	4.0	...	78.6	15	170-120
1,600	1,120	.....	11.2	...	4.0				
1,500	1,490	.....	11.2	...	4.0				
1,500	1,700	.....	11.2	...	4.0	...	....	..	150-115
*							86.0	33	

n Feb. 24 to March 7, diet 11.2 gm. nitrogen, 4 gm. salt each day.

denly began to rise quite markedly, and eventually the phenolsulphonephthalein excretion rose. At the same time the blood-pressure fell, and the general condition of the patient became so improved that he went home. The edema disappeared as the stored-up salt was gradually eliminated. Two months later the patient reported to the out-patient department in pretty fair shape with a non-protein blood nitrogen of 46 mg. per hundred c.c. of blood. This unexpected rise on the standard diet to a higher level than formerly we cannot explain.

Case 1056 represented a severe nephritis with symptoms suggestive of pending uremia without edema. The patient did not change in condition while in the hospital and left against advice. For several days practically no diet was eaten. Added salt or urea were very poorly excreted. The phenolsulphonephthalein excretion remained only a trace throughout. The non-protein nitrogen content of the blood rose steadily even on a very low protein diet. The blood-pressure made no important fluctuations.

TABLE 6.—Data of Patient 1056

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.		
April									
12	1,500	1,200	1.014	1.3	4.1	2.0	4.0	78.9	Trace
13	1,500	720	1.013	1.5	3.8	2.0	2.5	....	..
14	1,900	680	1.015	1.5	5.7	2.0	2.1		
15	1,850	820	1.015	0.6	2.2	*12.0*	2.9	....	..
16	1,750	230	1.013	0.0	0.7	0.0+	0.7		
17	1,750	410	1.015	0.0	2.1	0.0+	1.6	86.9	Trace
18	1,700	860	1.014	0.0	3.7	0.0+	2.9	....	..
19	1,100	435	1.012	*10.0*	1.8	0.0+	1.7		
20	1,700	1,230	1.014	1.8	6.4	2.0	3.6	....	..
21	2,000	800	1.020	2.4	5.2	3.4	7.4		
22	1,500	675	1.016	2.5	4.1	3.0	1.7	129.9	Trace
23	?	630	1.015	4.0	2.8	4.0	1.7	....	..

The next group of five cases (Tables 7-11, Chart 2) show types of nephritis which apparently can eliminate added nitrogen in the form of urea or the nitrogen of a standard diet fairly well, but which cannot put out added salt well. The non-protein nitrogen of the blood, however, becomes elevated on the high protein diet. As in the other group it returns to normal on the low protein diet.

Patient 1097 entered the hospital in poor condition and showed auricular fibrillation and extensive edema. The edema quickly disappeared with the tremendous diuresis April 23. The non-protein nitrogen in the blood was above normal on admission. Added salt to the diet on May 1 was put out very poorly by the kidneys. Added urea was put out fairly well. The output of nitrogen in the urine the first few days was in excess of the intake, which suggested a high protein intake or retention with the edema before admission. This was consistent with the high non-protein nitrogen in the blood at entrance. On the standard and low protein diet the nitrogen was excreted well and the blood nitrogen dropped to nearly normal. On the high protein diet which this patient ate well the output of nitrogen in the urine did not approximate the intake so closely. During this period of high

TABLE 7.—DATA OF PATIENT 1097

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
.....	.....	.....	....	...	...	...	43.4	40	190-110
1,300	340	1.021	4.0	5.0	1.0	0.2	....	..	215-115
1,000	1,865	1.016	4.0	13.2	1.0	9.0			
800	5,800	1.013	4.0	7.9	1.0	38.0	....	..	215-120
800	1,200	1.018	4.0	4.8	6.0	8.6			
1,000	1,400	1.016	6.0	7.1	6.0	4.0	....	..	230-130
1,000	310	1.022	6.0	5.3	6.0	1.6			
1,000	837	1.020	6.0	8.0	6.0	2.3			
1,300	990	1.020	6.0	7.4	6.0	2.8	....	..	210-120
1,200	885	1.018	6.0	6.1	6.0	3.0			
1,200	1,030	1.019	6.1	8.5	6.0	4.0			
1,500	890	1.022	6.0	7.7	*16.0*	4.5			
1,250	550+	1.018	6.0	3.5+	6.0	7.7+	....	..	195-110
1,500	700	1.019	6.0	4.7	6.0	5.5			
1,200	1,465	1.017	*16.0*	12.5	6.0	9.6	....	..	180-100
1,500	410+	1.020	6.0	2.6+	6.0	3.2+	....	51	
1,300	Lost	Lost	6.0	Lost	6.0	Lost			
1,300	840	1.018	11.2	6.4	4.0	5.2			
1,500	1,465	1.017	11.2	13.1	*14.0*	10.2	32.2	..	190- 85
1,500	980	1.020	11.2	7.0	4.0	5.8			
1,200	1,165	1.022	11.2	13.4	4.0	5.2			
1,550	950	1.022	11.2	10.7	4.0	5.0	....	51	200-100
1,250	1,310	1.013	11.2	8.0	4.0	3.7			
1,075	1,015	1.015	10.7	9.1	4.0	1.0			
1,100	600+	1.020	23.0	8.1	4.0	0.6+			
1,250	1,570	1.018	23.0	19.3	4.0	3.0	....	..	180- 90
1,300	920	1.021	22.5	10.6	4.0	2.2			
1,680	960	1.020	23.0	12.3	4.0	2.0			
					KCl 10				
1,550	960	1.021	23.0	9.4	*14.0*	5.7	46.3	..	
1,250	910	1.020	8.4	11.8	4.0	4.4	....	40	
1,640	650	1.020	4.0	8.9	4.0	3.4			
1,730	1,058	1.010	4.0	5.3	4.0	3.0			
1,810	980	1.012	4.0	4.6	4.0	4.0			
.....	.....	.....	....	...	...	...	37.3		

protein diet following the standard diet the non-protein nitrogen of the blood again rose. It took apparently a larger amount of nitrogen intake to cause an increase in blood nitrogen. Again, on May 20, when the low protein diet was given, the urinary nitrogen exceeded the intake and the non-protein nitrogen of the blood fell. During the entire period of study the phenolsulphonephthalein excretion ranged from 40 to 51 per cent. It was higher when the blood nitrogen was lower. Ten gm. of potassium chlorid added to the diet were not excreted any better than sodium chlorid.

The blood-pressure showed some variations during the stay in the hospital, but not in any special relation to the diets. It tended to be

TABLE 8.—Data of Patient 428

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
Nov.									
7	1,000	1,130	.....	8.0	7.0	6.0	10.3		
8	1,000	1,265	.....	8.0	8.0	6.0	11.5		
9	1,000	1,665	.....	8.0	6.3	*16.0*	12.3		
10	1,000	1,465	.....	8.0	6.0	6.0	10.8		
11	1,000	2,050	.....	*18.0*	14.0	6.0	16.8		
12	1,000	1,316	.....	8.0	...	6.0	10.0		
28	1,000	1,300	1.020	11.2	...	4.0	...	21.5	51
29	1,000	900	.....	11.2	...	4.0	...	....	..
30	1,000	900	.....	11.2	...	4.0	...		
Dec.									
1	1,000	1,050	1.020	11.2	...	4.0	...	....	..
2	1,000	980	.....	11.2	9.7	4.0			
3	1,000	840	.....	11.2	14.2	4.0			
4	1,000	1,450	.....	11.2	15.0	4.0	...	20.2	..
5	1,000	1,360	.....	23.0	20.6	4.0			
6	1,000	1,050	.....	23.0	19.6	4.0			
7	1,800	1,650	.....	23.0	19.0	4.0			
8	1,800	1,540	.....	23.0	17.0	4.0	...	39.1	45
9	1,800	1,600	.....	11.2	13.0	4.0			
10	1,800	1,200	.....	11.2	14.0	4.0			
11	1,800	1,300	.....	11.2	13.4	4.0	...	....	..
12	1,800	1,150	.....	11.2	9.9	4.0	...	28.5	
13	1,800	1,180	1.030	11.2	10.6	4.0			
14	1,800	1,090	.....	11.2	11.8	4.0			
15	1,800	1,030	1.012	11.2	9.4	4.0			
16	1,800	950	.....	11.2	7.5	4.0		....	..
17	1,800	980	1.020	11.2	6.7	4.0	...	23.9	45
18	1,800	1,020	.....	4.0	7.6	4.0			
19	1,800	780	1.021	4.0	...	4.0	...	....	..
20	.....	.....	.....	4.0	...	4.0			
21	.....	.....	.....	4.0	...	4.0	...	19.6	..

lower the longer the patient was in the hospital, despite the period of high protein diet. On leaving the hospital the patient had no edema, his general condition was improved and the auricular fibrillation persisted.

In patient 428 the amount of food actually eaten was not measured, so the amount offered is recorded. Frequent observations, however, made us feel pretty certain that practically everything offered was consumed. This patient showed early in November an ability to put out urea when added to the diet, but not salt. As in the preceding case it was necessary to put the patient on the high protein diet in order to elevate the non-protein nitrogen in the blood. On the low protein or standard diets the nitrogen in the blood remained normal. The phenol-

TABLE 9.—DATA OF PATIENT 1154

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
2,500	2,254	1.010	11.2	13.0	4.0	10.7	30.9	45	
1,950	1,305	1.013	11.2	9.1	4.0	5.8	....	..	220-140
1,350	1,020	1.021	11.2	10.3	4.0	5.3			
1,500	765	1.025	11.2	6.5	*14.0*	2.4			
1,450	940	1.026	9.9	10.9	4.0	3.6	....	..	260-160
1,800	600	1.016	11.2	7.1	4.0	1.1	....	..	255-155
2,700	3,300	1.010	*20.7*	19.1	4.0	4.3	....	60	230-150
2,100	940	1.020	9.9	9.3	4.0	1.4			
1,900	1,830	1.017	9.7	9.3	4.0	0.9			
2,100	1,150	1.011	8.7	7.3	KCl 10 *14.0*	2.7			
1,700	1,330	1.013	20.0	8.8	2.0	4.9	....	..	220-150
1,650	1,245	1.013	22.5	12.0	4.0	2.8	35.1	..	
1,650	1,810	1.014	20.0	13.7	2.0	4.1	....	..	210-140
1,750	1,070	1.015	11.2	8.0	2.0	1.5			
1,670	965	1.015	8.4	7.8	2.0	1.0			
3,100	2,980	1.005	4.0	7.0	4.0	2.0	37.3	51	205-130
2,130	930	1.010	4.0	5.3	4.0	1.3			
1,910	1,165	1.010	4.0	5.9	4.0	3.0			
950	740	1.011	4.0	3.7	4.0	1.2	....	..	180-110
1,730	365	1.018	4.0	3.8	4.0	1.2	33.1		
1,500	650	.....	4.0	...	4.0				
1,700	1,100	.....	6.3	...	2.0				
1,300	850	.....	11.2	...	4.0	...	....	..	190-120
1,900	1,150	1.012	10.7	5.7	4.0	3.0	32.6		
1,960	1,440	1.010	10.7	6.0	4.0	2.6	....	..	170-110
1,750	1,460	1.010	17.8	9.0	3.5	3.0			
1,800	1,150	1.014	18.6	9.2	3.6	2.6			
1,525	1,430	1.011	19.6	9.6	4.0	2.0			
1,825	1,530	1.012	20.5	9.2	3.5	4.6	41.3	..	150-100

sulphonephthalein excretion and the blood-pressure showed no appreciable variation with the changes in diet. By the time this study was made the patient was practically without symptoms except slight edema and remained so during the study.

Patient 1154 is again an example of a marked retention of added salt. In putting out his added urea it is interesting to note that it caused a diuresis as is frequently seen. He was also unable to excrete

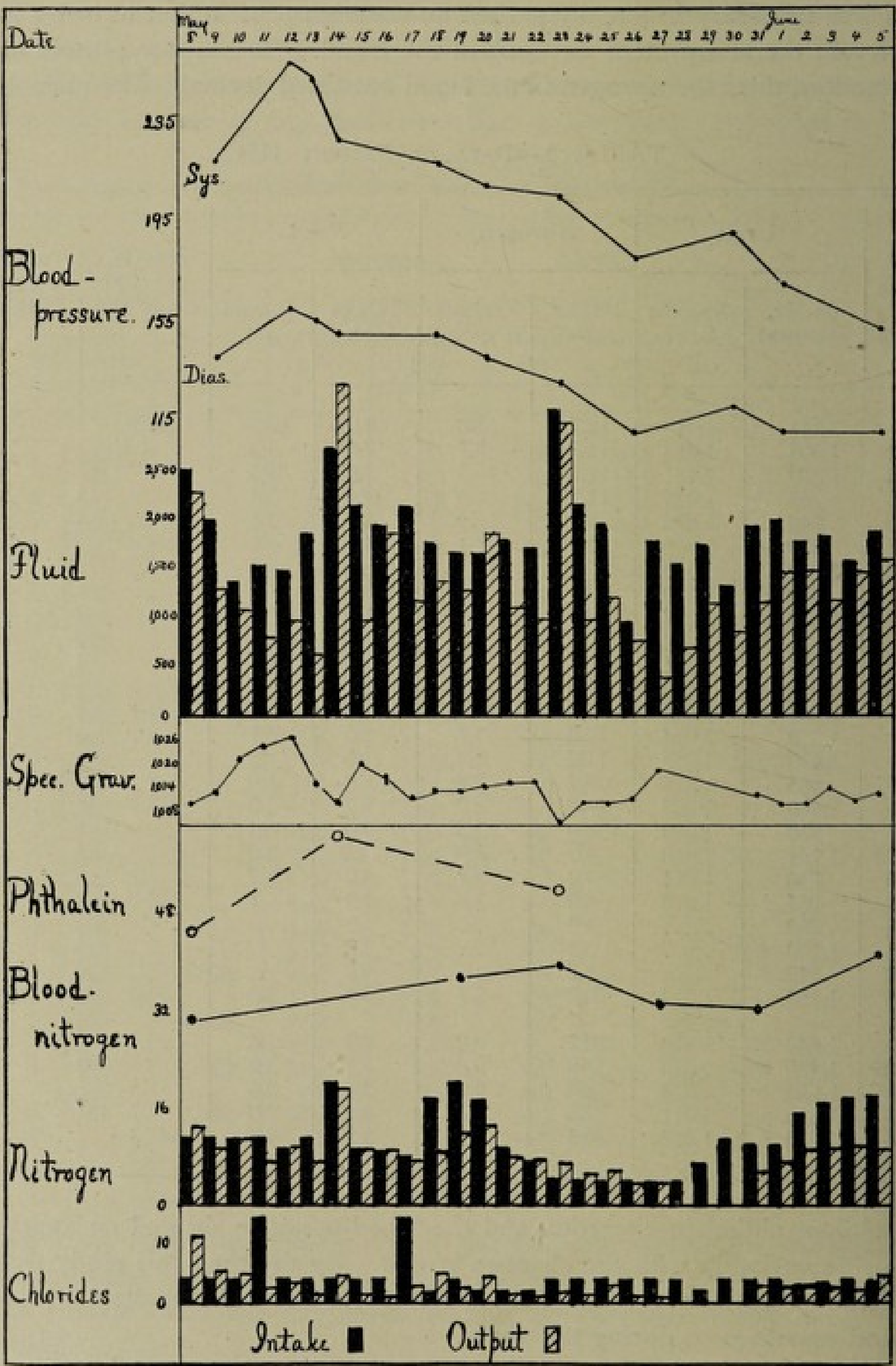

Chart 2.—Data of Patient 1154.

TABLE 10.—Data of Patient 1075

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
800	980	1.025	4.0	14.1	1.0	3.1	....	..	190-110
800	800	1.025	4.0	7.2	1.0	3.2	23.8	55	175- 95
800	645	1.026	4.0	10.0	1.0	3.0			
1,000	910	1.022	8.0+	8.6	3.0+	7.2			
1,000	1,100	1.020	8.0+	9.9	3.0+	10.5			
1,000	875	1.021	8.0+	7.5	3.0+	7.8	....	..	165- 90
1,550	1,280	1.016	11.2	7.0	4.0	8.8			
1,600	1,560	1.018	11.2	9.7	4.0	7.6			
1,600	2,340	1.014	11.2	10.5	4.0	10.2	....	..	165-100
1,700	2,740	1.012	*21.2*	17.8	4.0	13.0			
1,650	2,125	1.015	11.2	12.8	4.0	7.6			
1,550	1,300	1.019	11.2	7.2	4.0	8.4	20.7		
1,400	1,590	1.017	11.2	8.2	4.0	6.8	....	62	155-100
1,500	1,940	1.013	11.2	8.1	4.0	4.2			
1,300	1,350	1.018	23.0	18.9	4.0	3.5			
1,400	1,450	1.026	23.0	17.8	4.0	4.8	....	..	160- 95
1,200	820	1.023	23.0	7.8	*14.0*	3.7			
1,700	1,340	1.025	23.0	15.8	4.0	7.7	....	..	140- 95
1,700	1,310	1.023	23.0	15.3	4.0	3.6			
1,700	940	1.021	23.0	12.4	4.0	2.0			
1,900	780	1.019	23.0	9.6	4.0	2.2	....	..	140- 95
1,700	1,665	1.018	23.0	20.0	4.0	2.0	36.5	45	

TABLE 11.—Data of Patient 817

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
							....	..	210-140
.....	.....	.....	11.2	...	4.0	...	....	56	
2,000	1,300	1.022	11.2	...	4.0	...	31.8	..	220-145
2,100	700	.....	11.2	...	4.0	...			
1,700	850	.....	11.2	...	4.0		....	..	200-130
1,950	750	1.023	11.2	11.6	4.0	2.4			
1,900	750	1.027	11.2	12.3	4.0	1.4	30.0	53	
1,950	850	1.023	11.2	12.0	4.0	1.0	....	..	200-135
2,100	1,100	1.022	*20.2*	18.1	4.0	1.4			
1,950	950	1.027	11.2	15.2	4.0	1.8			
1,600	950	1.027	11.2	...	*14.0*	4.0	....	..	195-130
1,500	750	1.027	23.0	...	4.0	3.6			
2,000	750	1.028	23.0	...	4.0	1.2			
1,500	950	1.026	23.0	...	4.0	3.2	....	..	195-130
1,500	950	1.025	21.5	...	4.0	3.2	35.2	51	
1,500	1,150	1.025	18.5	...	4.0	5.4			

TABLE 12.—Data in Case 1200 (Control)

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
May									
30	1,650	1,820	1.015	11.2	11.4	*14.0*	11.0	23.8	
31	1,460	1,700	1.016	*21.2*	20.2	4.0	5.6		
June									
1	1,350	990	1.020	11.2	13.6	4.0	2.0		
2	1,375	925	1.024	23.0	16.0	4.0	2.0	25.3	
3	950	1,020	1.020	17.8	16.0	3.0	4.0		
4	1,425	1,230	1.018	22.0	15.4	3.8	2.7		
5	1,475	2,290	1.015	22.0	18.2	3.8	11.4		
6	1,725	1,180+	1.014	23.0	10.6+	4.0	3.6+	22.4	58
7	1,425	760	1.025	22.0	15.2	3.8	2.0		
8	1,280	1,660	1.015	10.0	...	4.0	2.2		

TABLE 13.—Data in Case 1033 (Control)

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
April									
11	1,500	1,100	.....	11.2	....	4.0			
12	1,600	900	.....	11.2	....	4.0			
13	1,500	1,400	.....	11.2	....	4.0			
14	1,250	550	1.026	11.2	....	4.0			
15	1,300	1,150	.....	11.2	....	4.0			
16	1,500	1,150	.....	11.2	....	4.0	...	21.6	58
17	1,650	580	.....	11.2	....	4.0			
18	1,350	1,300	.....	11.2	....	4.0			
19	1,100	900	.....	11.2	....	4.0			
20	1,650	900	.....	11.2	....	4.0			
21	1,850	500	1.018	11.2	....	4.0			
22	1,610	900	.....	11.2	....	4.0	...	17.6	
23	2,100	1,100	.....	23.0	....	4.0			
24	2,100	1,100	.....	23.0	....	4.0			
25	1,950	700	.....	23.0	....	4.0			
26	1,900	700	.....	23.0	....	4.0			
27	1,800	580	.....	23.0	....	4.0			
28	1,850	500	.....	23.0	....	4.0	...	20.6	

TABLE 14.—Data in Case 920 (Control)

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
1,500	2,300	.....	10.5	....	3.8	...	....	..	125 -50
1,500	1,800	1.022	11.2	....	4.0	...	27.0	..	115- 50
1,500	1,700	.....	11.2	....	4.0	...	....	58	
1,500	1,450	.....	10.7	....	4.0				
1,500	950	.....	11.2	....	4.0				
1,500	1,350	.....	21.5	....	3.8				
1,500	1,300	.....	23.0	....	4.0	...	....	..	140- 80
1,500	1,150	.....	22.9	....	4.0				
1,500	1,750	.....	23.0	....	4.0				
1,500	1,580	.....	21.5	....	3.8	...	26.6	..	150- 80

TABLE 15.—Data in Case 1252 (Control)

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
1,400	1,100	.....	11.2	....	4.0				
2,300	1,900	.....	11.2	....	4.0	...	20.1	..	150- 90
1,500	2,150	1.008	4.0	....	4.0				
2,260	1,660	1.008	4.0	4.0	4.0	3.2			
1,450	1,160	1.009	4.0	4.2	4.0	2.3			
2,100	200+	.....	4.0	....	4.0	...	19.2		

potassium chlorid any better than sodium chlorid. It was only on a high protein diet, which he ate fairly well, that the non-protein nitrogen of the blood rose, although throughout the study the blood nitrogen was on the upper border of normal limits. The phenolsulphonephthalein elimination varied a little, but not with any special change in diet. The blood-pressure showed a steady tendency to fall during the period of study, which was from the beginning of his stay in the hospital, but did not seem to bear any relation to the diets. The general condition showed slight improvement with his stay in the hospital irrespective of diet, although the albuminuric retinitis and anemia from which he suffered changed but little.

The data in this case also are recorded in Chart 2 in order to bring out the essential points more clearly.

Patient 1075 had marked edema and poor ability to excrete salt. As the salt was eliminated the edema disappeared and the blood-pressure fell steadily irrespective of the nitrogen content of the diet. The nitrogen elimination was good on the low protein and standard diets, and it was only after prolonged high protein diet, which was well taken, that the non-protein nitrogen of the blood rose. The phenolsulphonephthalein elimination fell slightly with the rise in blood nitrogen.

Case 817 is included as it shows changes similar to those in the preceding case, except that there was no edema.

The next four cases (Tables 12-15) were controls in persons, so far as we could tell, absolutely free from nephritis. Three of them were placed on a high protein diet following the standard diet, and one on a low protein after the standard diet. The diets were well taken and accurately measured. It will be readily seen that the high protein diet was taken for a considerable time without rise in the non-protein nitrogen of the blood; nor was there any appreciable drop in the patient's non-protein nitrogen of the blood after the low protein diet.

The next two cases (Tables 16 and 17) did not have the added salt and urea tests made, but seem worth recording because of the sharp rise in non-protein nitrogen of the blood, in Case 589, on a high protein diet, and in Case 785, on a diet very low in nitrogen. The latter patient died the day following the last estimation of blood nitrogen.

It would not be fair to omit the following four cases (Tables 18-21) which show varying degrees of inability to put out added salt and urea. They also show other evidences of nephritis, yet very little if any rise in non-protein nitrogen in the blood on even high protein diet. In these cases, also, there seems to be no relation between the phenolsulphonephthalein excretion or the blood-pressure and the diets. The general condition of the patients did not vary with the diets. Their symptoms

TABLE 16.—DATA OF PATIENT 589

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
1,100	1,500	1.009	6.0	....	6.0	...	20.8	27	
1,200	1,350	.....	6.0	....	6.0	...	....	..	198-115
1,200	1,040	.....	6.0	....	6.0				
1,420	2,100	.....	11.2	....	4.0				
1,360	1,300	1.014	11.2	....	4.0	...	....	..	195-110
1,200	1,700	1.015	11.2	....	4.0	...	....	50	
1,200	1,500	1.018	11.2	4.2	4.0				
950	1,050	.....	11.2	5.3	4.0				
950	1,100	1.018	23.0	5.8	4.0	...	....	..	170-100
1,200	900	.....	23.0	8.5	4.0				
1,300	1,550	.....	23.0	12.1	4.0	...	43.5	24	

TABLE 17.—DATA OF PATIENT 785

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
3,145	1,840	1.009	9.2	5.1	4.0	5.1	....	0	
2,750	1,300	1.009	10.0	3.0	4.0	3.0	117.0	0	130- 90
1,305	1,220	1.007	9.8	4.0	4.0	2.8			
2,595	460	1.007	7.0	1.5	3.5	0.64	130.0	0	135- 95
1,000	450	1.011	9.2	1.3	3.5	0.72	....	..	†
2,700	380	.....	4.6	....	2.0	...	179.0	0	180- 80
2,500	150	.....	4.0	2.0					
1,300	0	.....	0.0	....	0.0	...	....	..	140- 65
Died									

vulsion.

TABLE 18.—DATA OF PATIENT 1072

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
April									
16	1,100	1,480	1.015	10.7	3.1	4.0	7.2	....	..
17	1,300	1,100	1.010	9.7	3.0	3.0	1.2	31.8	60
18	950	840	1.015	10.7	6.3	*14.0*	4.0	....	..
19	1,300	1,180	1.009	8.8	3.5	3.0	2.7		
20	1,300	2,400	1.010	*18.7*	8.2	4.0	6.7	....	..
21	1,500	1,810	1.010	10.7	8.0	4.0	3.2		
22	1,680	1,915	1.010	11.1	7.4	4.0	4.0	....	..
23	1,900	1,190	1.011	10.0	4.1	4.0	4.6		
24	1,300	2,060	1.011	12.6	3.7	4.0	2.8	29.4	..
25	1,500	1,150	1.015	17.3	7.1	3.0	1.0		
26	1,300	1,630	1.012	17.3	8.2	3.0	1.9		
27	1,500	1,320	1.011	19.0	7.5	3.0	1.2		
28	1,550	2,045	1.011	20.4	7.0	3.5	2.4	....	..
29	1,400	1,565	1.012	17.0	6.0	3.0	2.0		
30	1,500	1,570	1.013	17.0	8.4	3.0	2.5	....	..
May									
1	1,350	1,630	1.012	19.7	8.1	3.0	2.0	34.0	
2	1,500	1,450	1.010	13.0	6.7	2.0	1.6	....	..
3	1,350	1,460	1.008	4.0	4.8	4.0	1.5		
4	1,200	1,092	1.010	4.0	4.6	4.0	1.9	....	..
						KCl 5			
5	1,100	1,355	1.010	4.0	2.8	*9.0*	*7.2*	23.7	51

TABLE 19.—DATA OF PATIENT 675

Date	Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein
		24-Hr. Amount c.c.	Specific Grav-ity	Intake gm.	Output gm.	Intake gm.	Output gm.		
Jan.									
7	1,750	1,100	1.012	4.0	....	4.0			
8	1,780	1,150	.....	4.0	....	4.0	1.9		
9	1,170	300+	.....	4.0	....	4.0	3.5	34.0	54
10	1,200	700	.....	4.0	....	4.0	2.3		
11	1,160	500	.....	4.0	....	*14.0*	6.5		
12	1,100	900	.....	4.0	4.1	4.0	5.2	....	..
13	1,100	900	.....	4.0	4.7	4.0	4.0		
14	1,650	900	.....	8.4	4.8	3.6	...	21.6	55
15	1,550	1,300	1.022	*21.2*	12.3	4.0	...	....	..
16	1,550	1,300	1.016	11.2	9.2	4.0			
17	1,500	750	1.021	11.2	8.7	4.0			
18	1,520	880	1.011	7.9	7.4	3.0	...	26.3	..
19	1,150	500	.....	6.9	....	3.0	...	....	51
20	800	580	.....	6.8	....	3.0	...	....	..
21	550	1.080	.....	19.8	....	3.0			
22	1,700	1,260	1.015	13.0	8.2	2.0			
23	1,100	1,020	1.012	13.0	7.0	2.0	...	....	..
24	1,550	820	1.015	13.0	6.0	2.0			
25	950	1,250	.....	11.2	....	2.0	...	29.0	43

TABLE 20.—Data of Patient 1029

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
900	570	1.021	11.0	3.1	4.0	2.8			
1,300	1.080	1.014	5.2	5.0	2.0	3.8	28.5	60	220- 95
1,300	430	1.020	6.7	4.0	2.0	0.86			
1,500	520	1.026	2.7	6.0	*12.0*	3.7	....	..	185- 90
1,300	305	1.021	4.0	1.8	2.0	2.4			
1,100	300	1.028	5.1	3.8	2.0	1.2	....	..	190- 90
1,300	510	1.013	*15.1*	6.2	2.0	0.9			
1,300	605	1.015	6.7	5.5	2.0	1.3			
1,100	305	1.026	6.7	5.1	2.0	0.9	....	..	185- 95
1,300	830	1.015	15.7	5.6	2.6	1.7	19.5	75	180- 95
1,300	1,010	1.013	9.7	6.0	1.8	3.0			
1,500	440	1.026	10.7	5.5	2.0	2.8			
1,300	1,115	1.020	20.0	9.0	3.8	4.2			
1,300	500	1.026	12.0	7.0	2.1	1.1	....	..	185- 80
1,300	760	1.020	14.3	8.7	2.5	2.2			
1,650	1,800	1.017	14.4	11.1	2.5	2.3			
1,600	1,270	1.020	14.0	10.8	2.5	1.1			
1,650	1,530	1.016	15.0	9.8	2.6	3.4	21.7		
1,300	1,132	1.022	15.0	11.3	2.6	2.0	....	..	205-105

TABLE 21.—Data of Patient 684

Fluid Intake c.c.	Urine		Nitrogen		NaCl		Mg. N. per 100 c.c. Blood	Per Cent. Phthalein	Blood Pressure
	24-Hr. Amount c.c.	Specific Gravity	Intake gm.	Output gm.	Intake gm.	Output gm.			
950	480	.....	11.2	....	4.0	...	35.9	65	210-100
700	690	.....	11.2	....	4.0				
1,150	300	.....	11.2	....	4.0				
1,250	700	.....	4.0	....	4.0	5.2	....	..	200-110
1,900	1,300	.....	4.0	....	4.0	3.0			
1,380	1,700	.....	4.0	....	4.0	3.0			
2,100	1,780	.....	4.0	3.2	*14.0*	6.2	....	..	220-130
1,150	910	.....	4.0	4.2	4.0	7.1			
1,900	2,100	.....	11.2	8.4	4.0	4.5	23.3	70	
1,900	1,700	1.015	*21.1*	16.0	4.0	...	....	..	210-110
1,380	1,950	1.014	11.2	12.6	4.0	...			
1,700	1,500	1.012	11.2	6.3	4.0	...	....	..	200-110
1,700	1,500	1.011	10.7	....	4.0				
1,650	1,900	.....	10.8	....	4.0	...	27.7	57	
2,000	1,590	.....	10.7	....	4.0	...	....	..	200-110
1,350	1,280	1.012	10.7	8.1	4.0				
1,300	1,100	1.019	8.2	10.8	1.5	...	....	..	180-108
1,650	980	1.026	21.0	17.0	3.6				
2,650	1,750	1.015	21.0	15.0	3.6				
1,650	1,620	.....	21.5	....	3.8				
2,100	2,300	.....	....	...	...	...	21.0	47	220-120

were slight in all the cases. In all these cases the non-protein nitrogen of the blood fell to the lower level of normal limits on the low protein diet.

In endeavoring to draw any conclusions from such a study as this or from any study of nephritis, it must be borne in mind that it is frequently impossible to decide accurately what type of nephritis from a pathological-anatomical point of view we are dealing with. In this study in most of the cases the kidneys have been studied from the point of view of their functional ability rather than with any attempt to classify the cases on an anatomical basis. The functional tests consisting in the addition of salt and urea to the diet do not permit in our series of cases such a sharp classification as Widal makes. Apparently, cases do occur in which the salt is not excreted and the nitrogen is. In the cases with a nitrogen retention, however, of our series the salt was also poorly excreted.

It is safe to say that not all of our cases of presumably the same type of functional renal disturbance act in the same way in response to the changes in diet. On the other hand, the majority of them do. Thus those cases which eliminate added urea and salt poorly tend to show an increase in the non-protein nitrogen of the blood on a diet not excessive in nitrogen, while those cases which excrete urea well but salt rather poorly, only show an increase in non-protein nitrogen of the blood on a diet rich in protein.

We find, as did Folin, Denis and Seymour, that the elimination of phenolsulphonephthalein in the urine in most of these cases of nephritis does not vary especially with the diets. In a few cases, however, it follows in a slight degree inversely to the changes in the non-protein nitrogen of the blood.

The blood-pressure did not seem to vary with the amount of nitrogen in the diet or of non-protein nitrogen in the blood as Goodall described it. It did seem to fall gradually after rest in the hospital, and especially in those cases of salt retention after the salt had been eliminated by a prolonged diet low in sodium chlorid content.

The general condition of the patient did not seem to be affected by the diets except in a few cases on the high protein diet, at which time the patients did not feel so well. This is somewhat different from Seymour's findings in which the high protein diet usually made the patients feel poorly. In his cases, however, the high protein diet was continued a longer time. The high protein diet as a rule was not enjoyed by many of the patients.

The low protein diet almost always caused a drop in the non-protein nitrogen of the blood.

Since frequently the variation in the amount of non-protein nitrogen in the blood is the only result of the changes in diet which can be made out, the question may fairly be raised of how much value in prognosis is a rise in the non-protein nitrogen in the blood when brought about by an increased nitrogen content in the diet. Is there any appreciable change in the patient's renal condition with these changes in diet which only this test will show? These questions cannot be answered at present, but undoubtedly the diet should be considered when the amount of non-protein nitrogen in the blood is used as a basis for determining the prognosis. Presumably a rise in non-protein nitrogen in the blood in response to increased protein in the diet indicates a slighter degree of renal disturbance than is indicated by a rise when the patient is on a low protein diet.

It seems justifiable to conclude that in certain types of chronic nephritis the nitrogenous content of the diet should be carefully watched in order to prevent an increase in non-protein nitrogen in the blood. The exact effect of an increase in blood nitrogen produced by a high nitrogenous diet is not known at present, but presumably it is unfavorable to the best interests of the patient, since in some it increases their discomfort as shown by Cases 1078 and 762 of this series and cases studied by Seymour. A diet low in nitrogen content will frequently keep down to normal the non-protein nitrogen of the blood in chronic nephritis.