ON THE
CONDITION OF THE URINE
IN
THREE CASES OF EPILEPSY.

BY
F. W. GIBSON, M.D. LOND.,
ASSISTANT MEDICAL OFFICER TO THE CRIMINAL LUNATIC ASYLUM,
BROADMOOR.

COMMUNICATED BY
WILLIAM JENNER, M.D., F.R.S.

Received December 20th, 1866.—Read March 26th, 1867.

“THE subject of the influence of the nerves on the urinary excretion is not yet sufficiently advanced to admit of profitable discussion;”¹ nevertheless, the information derived from the experiments of Bernard and others would lead to the prediction of an increase in the urinary constituents, especially of the water, during the hours following an epileptic attack, for that paralysis of the sympathetic and dilatation of the small vessels of the system occur during that period is now tolerably well-established.

The following analyses in three cases of epilepsy² were undertaken with a view to determine if facts accorded with this theory. The first table contains a record of the twenty-four hours’ urinary excretion, during twenty-eight days, of

¹ Parkes ‘On the Urine,’ pp. 99, 100.

² In all the cases the brain alone was affected. The amount of urea and chloride of sodium was estimated by Liebig’s nitrate of mercury process; that of the phosphoric acid by the nitrate of uranium method of Neubauer.

a man, æt. 21, who suffered from epilepsy solely. He had had fits, as far as could be ascertained, during two years before his admission into the asylum in May, 1865. The number of fits recorded since that date has been on an average nineteen in the month; the majority occurred at night; not more than five have been observed during the twenty-four hours, but since he was (though very frequently visited during the night) not constantly watched, probably some escaped notice. The convulsions, though severe, did not, as a rule, continue longer than five minutes, nor did a profoundly comatose condition supervene at any time.

His daily diet during the period in which the analyses were made consisted of four ounces of cooked meat without bone, one pound of vegetables, one pound of bread, two pints of tea, half a pint of ale, and two pints of water.

The first meal was taken at eight o'clock in the morning, the principal at one o'clock in the afternoon, the last at five in the evening.

The following deductions are derived from the facts recorded in the table :

1. The mean excretion of water is slightly above the healthy average; that of the urea somewhat, that of the chloride of sodium and phosphoric acid considerably, below.

The mean¹ excretion per kilogramme is—water, 27·32 c.c.; urea, 0·414 gm.; chloride of sodium, 0·129 gm.; phosphoric acid, 0·029 gm.²

The man weighed 62 kilos.; was moderately muscular, and tolerably fat.

2. There is no constant change in the urine on the days on which the fits occurred.

a. The water on nine of the fit days is below the mean; on five the reduction is considerable, but can be accounted for by the great heat and dryness of those days.

On the remaining six days the water is above the average;

¹ Total for 62 kilos.—water, 1694 c.c.; urea, 25·6 gms.; chloride of sodium, 7·99 gms.; phosphoric acid, 1·79 gms.

² The normal mean, as given by Dr. Parkes, is—water, 23 c.c.; urea, 0·500 gm.; chlorine, 0·126 gm.; phosphoric acid, 0·048 gm.

on the day on which the largest amount was excreted two pints extra of fluid were added to the diet. Excluding these exceptional days, the mean of the water excretion on the fit days is 1935 c.c., considerably above 1075 c.c. the mean of all the low temperature days.

There would appear, therefore, to be a tendency to increase of water on the fit days.

b. The urea on seven of the fit days is above the mean, on seven slightly below; on none of the days save one are the maximum and minimum amounts greater or less than can be accounted for by the normal variations occurring in a healthy person, for the maximum and minimum amounts passed from day to day by such an individual are usually one fifth above or below his mean amounts.

On one day, July 20th, on which very little solid food was taken, the usual meat being replaced by two pints of beef tea, the urea during the twenty-four hours following a very severe fit amounts to 32.16 gms. On October 21st, a day not recorded in the table, on which five fits were observed, the amount of food being the same as on July 20th, the urea amounted to 28.7 gms.; but on the other hand, on July 19th, a two-fit day, the urea amounts to 24.4 gms. only, although the ordinary diet was taken. The mean of urea on all the fit days is only slightly, 0.8 gm., above the mean of all the twenty-eight days.

c. The normal variations in the chloride of sodium and phosphoric acid are so great that little if any value can be deduced from these columns of the table.

The mean of the former excretion on the fit days is a little greater than that of the twenty-eight days, the mean of the latter a trifle less.

Table II contains a record of the urinary excretion during thirteen days and fifteen nights. The urine of the day includes that excreted between the hours of 8 a.m. and 8 p.m. The patient went to bed at 8 p.m. and rose at 6 a.m.

The following deductions are derived from the facts stated in this table:

1. The mean of the water and chloride of sodium during

the nights is less than the mean of these excretions during the day, that of the urea nearly equal, that of the phosphoric acid greater.

2. There is no constant change in the urine of the nights on which fits are recorded, but there appears to be a tendency to increase of water, urea, and chloride of sodium.

The mean of six fit nights is—water, 825 c.c.; urea, 13.93 gms.; chloride of sodium, 4.316 gms.; phosphoric acid, 0.9842 gm.

The mean of all the nights is—water, 704 c.c.; urea, 12.21 gms.; chloride of sodium, 3.143 gms.; phosphoric acid, 1.064 gms.

The water on the fit nights is four times above, on two below the mean.

The urea is thrice above the mean.

The chloride of sodium four times above.

The phosphoric acid thrice above.

On the days preceding the fit there is no notable change in the urine, save on July 27th, on which day is a marked reduction in all the constituents. The usual diet was taken on that day.

The third table gives the mean hourly excretion for an equal number of hours before and after the fits. The facts therein recorded show that there is no constant or important change in the urine in either period.

The average of the hours before the fit is almost exactly the same as that of the hours after; hence, since the latter were fasting hours, the evidence is in favour of increase in the latter period.

The fourth table contains an account of the excretion during nine hours following a severe fit. The fit occurred at half-past eleven in the morning; no food had been taken since half-past eight.

The excretion of water, urea, chloride of sodium, and phosphoric acid, is certainly large during the hour following the fit, considering that the amount of food taken at breakfast consisted only of half a pound of bread and a pint of tea.

The amount of the constituents during the corresponding

hour after the mid-day meal, which consisted of a pint of good beef-tea with four ounces of bread, is very much less.

The urine was examined at each analysis for albumen and sugar, which were invariably absent. On two occasions only did any deposit occur; on each it consisted of urates. All, therefore, that can be fairly deduced from the results of the repeated analyses in this case is this:

"There is no constant change in any of the urinary excreta, although there appears to be some connection between the occurrence of the fits and increase in the water, urea, and (chloride of sodium?)."

Table V contains a record of the urinary excretion during fourteen nights of an epileptic man, *æt.* 33, who had had fits from a very early childhood. He is reported to have had, before his admission, as many as seven a day. Since his admission fits have been recorded at intervals of two or three days, never more than two in the twenty-four hours. The character of the attacks was very similar to that of the fits in the former case.

The urine could not, on account of his mental state, be collected during the day; he was therefore made to pass his water at eight o'clock in the evening, at which hour he went to bed, and again at eight in the morning; and the urine thus obtained was, together with that made during the night, subjected to analysis.

The last meal of the day, consisting of a pint of tea and half a pound of bread, was taken at half-past five o'clock. No food was taken during the period above named.

Deduction from this table:

There is a tendency to increase in the water on the fit nights. There is no constant change in the urea or chloride of sodium on these nights.

The mean of the fourteen nights is—water, 416 c.c.; urea, 10.75 gms.; chloride of sodium, 1.434 gm.

On all of the six nights on which fits are recorded the water is above the mean; on two considerably. On two of these nights the urea is above the mean, on one considerably. On two it is slightly below the mean, on two con-

siderably. There is no important variation in the chloride of sodium.

The mean of all the fit nights is—water, 561 c.c.; urea, 9.16 gms.; chloride of sodium, 0.915 gm.

Table VI gives the secretion of a varying number of hours before and after the fits. Table VII the mean hourly secretion on six nights of a nearly equal number of hours. Had it been possible, I should have arranged that the number should have been equal in each case.

The water in the former period is on five occasions in excess of the water in the latter; perhaps this excess is partly due to the water taken at half-past five, at the evening meal. The urea in the former period is on five occasions below that excreted in the latter; and considering that the effect of food would be more felt in the former period than in the latter, it would seem that there is a tendency to increase of urea in the hours following the fits.

I have not given the mean hourly excretion of the chloride of sodium or phosphoric acid, as no important deduction can be derived from the analyses as to the influence of the occurrence of the fits on these excretions. Neither albumen nor sugar was found at any time in this man's urine.

Table VIII shows the urinary excretion during eleven days of a male epileptic, æt. 49; he had had fits since four years of age. Since his admission in August, 1864, he has had them almost daily, sometimes as many as five of a severe character during the day, with numerous attacks of *petit mal* in addition. Occasionally, however, they intermitted for two or three days. He weighed 54 kilogrammes. His diet, save that the quantity of water was less, was the same as that of the first case.

The mean excretion per kilogramme is—water, 22.1 c.c.; urea, 0.289 gm.; chloride of sodium, 0.083 gm.; phosphoric acid (eight days), 0.027. The water is about equal to the nominal standard; the other constituents are very considerably below the mean.

Fits are recorded on three of these days; on one the water is considerably above the mean. On this day three fits

occurred; on one it is slightly below the mean, on one considerably below. On all of the days the urea is slightly above the mean.

The chloride of sodium is once considerably above the mean, once slightly above, and once slightly below. There is no important alteration in the phosphoric acid.

On the day immediately preceding that on which the three fits took place there is a marked reduction in the water, urea, and chloride of sodium.

On the day before that on which one fit took place there is a marked increase in these constituents.

I much desired to obtain analyses of the urine in those cases in which the fits take place at long intervals, and which exhibit distinct interparoxysmal periods, but I have not at present any such case amongst the epileptic population of this asylum available for the purpose of urinary analysis, since the mental state of the patients whose attacks are of this character is such as to render the collection of the urine during the paroxysmal period almost impossible.

All therefore that can be derived from the examination of these three cases is—

“There is no constant change in the urine, although there appears to be some connection between the occurrence of the fits and increase in the water and urea, and this increase is subsequent to the occurrence of the fits.”

I may state in conclusion that I have taken the temperature of a great many epileptics, both during the fits and at various other times, and that in no case of uncomplicated epilepsy have I found any deviation from the normal standard.

TABLE I.

Date.	Fits, hour of occurrence.	Urinary excretion.			
		Water.	Urea.	Chl. Sod.	Phos. Acid.
1866.		C. C.	Gms.	Gms.	Gms.
June 27—28†	12.25 a.m.†	820	24.15	8.19	1.442
28—29†	2.45 a.m.†	775	26.5	5.07	1.394
29—30	—	760	24.6	7.54	1.063
30—	—	820	28.19	6.32	2.015
July... 1	}	700	21.17	6.65	1.26
1—2		1850	29.6	12.9	1.87
2—3		1800	27.	12.6	1.35
*3—4		1000	1.	6.6	.6
4—5†	11.45 p.m. 1 a.m.†	900	23.4	9.	1.53
12—13†	1.30 a.m.†	800	26.4	8.8	2.08
13—14	—	800	23.2	4.8	2.
14—15	—	600	21.	6.	2.2
15—16	—	925	24.9	9.25	1.61
16—17†	1.40 a.m.†	1290	29.6	7.09	2.322
17—18	8.50 p.m.	1500	24.	8.25	1.71
18—19†	11.40 p.m. 1.20 a.m.†	3940	32.16	16.4	2.872
20—21	10.30 a.m.	2600	27.175	4.83	1.746
22—23	—	2950	24.	8.85	2.03
23—24	—	2940	30.71	9.787	2.323
24—25†	4 a.m.†	3250	27.725	13.29	2.23
25—26	11.10 p.m.	1675	23.75	7.86	1.995
26—27†	12.30 a.m.†	1665	25.475	8.237	1.652
27—28†	1 a.m.†	1780	27.7	6.83	1.691
28—29†	12.20 a.m.†	3175	29.5	9.027	1.88
29—30	—	1666	19.26	3.18	1.534
30—31	—	2555	24.437	4.487	1.836
August *6—7	1.35 a.m.*	2425	22.22	3.63	1.783
7—8	—	1470	26.28	5.88	2.068
9—10	—				

TABLE II.

DAY.					NIGHT.				
Hour of fit.	Water.	Urea.	Ch. Sod.	Ph. Acid.	Hour of fit.	Water.	Urea.	Ch. Sod.	Ph. Acid.
10.30 a.m.	C. C.	Gms.	Gms.	Gms.	—	C. C.	Gms.	Gms.	Gms.
—	2780	18.72	12.6	1.087	—	1160	13.92	5.8	1.74
—	2225	17.8	3.337	0.666	—	3375	9.375	1.5	1.08
—	2500	15.0	7.50	0.882	—	450	9.000	1.35	1.475
—	1875	15.	5.6	0.937	4 a.m.	1065	15.71	5.187	1.385
—	2025	10.575	7.665	1.05	11.10 p.m.	1225	17.15	6.125	1.225
—	1175	11.75	4.11	0.88	12.30 a.m.	500	12.00	3.75	1.1075
—	750	9.00	1.5	0.6	1 a.m.	915	16.47	6.63	1.052
—	1200	15.6	4.8	0.7	12.10 a.m.	580	12.1	2.03	0.991
—	2200	15.4	6.6	1.108	—	975	13.65	2.427	0.780
—	1200	9.6	1.8	0.5	—	460	9.66	1.38	1.034
—	—	—	—	—	11.35 p.m.	725	10.15	2.175	0.92
—	1900	13.3	2.85	0.79	—	655	11.137	1.637	1.046
—	1925	13.47	1.88	0.96	—	500	8.75	1.75	0.823
—	1700	16.38	4.68	1.108	—	300	9.9	1.2	0.96

TABLE III.

Hours.	Food.	Water.	Urea.	Chl. Sod. Ph. Acid.	Hour of fit.	Food.	Water.	Urea.	Chl. Sod. Ph. Acid.	Hours.
		C.C.	Gms.	Gms.			C.C.	Gms.	Gms.	
12	Tea 1 pint, bread 8 oz., at 8 a.m. Meat 4 oz., vegetables 16 oz., beer 1 pint, at 1 a.m. Tea 1 pint, bread 8 oz., at 5 p.m.	168	0.881	0.597	0.08	Tea 1 pint, bread 8 oz., at 8 a.m.	102	1.42	0.51	0.102
12	Ditto	98	0.98	0.34	0.07	Ditto	41	1.0	0.31	0.092
12	Ditto	100	1.3	0.4	0.05	Ditto	48	1.0	0.15	0.082
6	Tea 1 pint, bread 8 oz., 5 p.m.	70	1.65	0.14	0.17	None	59	0.649	0.27	0.03
7	Ditto	96	1.73	0.17	0.18	Ditto	55	1.375	0.157	0.06
5	Ditto	70	1.185	0.48	0.08	Ditto	80	1.5	0.6	0.08
3	Bread 8 oz., tea a pint, 8 a.m.	138	1.57	0.63	0.05	Beef tea a pint at 1 p.m.	295	1.784	0.785	0.09

TABLE IV.

Hours after fit.	Food.	Water.	Urea.	Chl. of Sod.	Phos. acid.
		C.C.	Gms.	Gms.	Gms.
1	A pint of beef tea, bread 4 oz.	390	3.51	1.638	0.156
2	—	290	1.72	0.493	0.116
3	—	235	1.292	0.352	0.067
4	—	360	2.34	1.512	0.108
5	—	165	1.65	0.907	0.056
6	—	335	2.177	1.675	0.134
7	Tea a pint, bread 4 oz.	540	2.66	2.16	0.087
8	—	305	2.44	1.67	0.225
9	—	160	1.76	0.8	0.138

TABLE V.

Fits.	Water.	Urea.	Chloride of Sodium.
	Cubic cent.	Grammes.	Grammes.
1	505	9.15	0.937
2	600	17.6	0.8
2	500	10.5	1.0
2	430	11.91	1.102
—	650	15.6	2.27
—	500	10.0	1.25
—	290	9.86	1.74
—	360	10.8	1.08
1	815	7.89	1.722
2	520	7.93	1.032
—	300	11.75	3.6
—	375	7.125	0.7
—	475	9.025	0.95
—	625	9.375	1.875
Mean	416	10.75	1.434

TABLE VI.

Hours.	Water.	Urea.	Chl. Sodium.	Phos. Acid.	Hour of fit.	Hours.	Water.	Urea.	Chl. Sodium.	Phos. Acid.
	C.C.	Gms.	Gms.	Gms.			C.C.	Gms.	Gms.	Gms.
3	325	3.25	0.487	0.563	11.20 p.m.	9	180	5.9	0.45	0.522
7	400	4.8	0.4	0.28	3 a.m.	5	200	12.8	0.4	0.33
7	270	6.21	0.542	0.27	3	5	160	5.7	0.56	0.192
4	615	3.69	0.922	—	12	8	210	4.2	0.8	—
5	310	3.10	0.61	—	1 a.m.	7	210	4.83	0.42	—
4	475	2.85	0.385	0.145	12	8	210	5.88	0.525	0.672
6	350	7.	1.05	0.609	2 a.m.	6	210	6.33	0.42	0.437
6	510	4.08	1.02	0.21	2 a.m.	6	260	6.56	0.93	0.754
5	100	3.3	0.4	0.29	1	7	600	6.6	1.2	0.54
4	290	5.22	0.87	3.19	12	8	160	5.12	0.48	0.464

TABLE VII.

Hours.	Water.	Urea.	Hour of fit.	Water.	Urea.	Hours.
	C.C.	Gms.		C.C.	Gms.	
7	57	0·68	3 a.m.	40	2·5	5
7	37	0·88	3 a.m.	32	1·1	5
5	62	0·62	1 a.m.	30	0·69	7
6	58	1·1	2 a.m.	35	1·00	6
6	85	0·68	2 a.m.	43	1·00	6
5	20	0·6	1 a.m.	85	0·92	7

TABLE VIII.

Fits.	Water.	Urea.	Chl. of Sod.	Phosphoric acid.
	C.C.	Gms.	Gms.	Gms.
2	1075	16·5	4·75	1·307
—	1950	22·	8·5	1·57
—	1300	18·2	5·2	1·45
1	950	16·15	4·27	1·925
—	1120	20·16	5·6	1·255
—	1500	15·	3·75	—
—	660	11·22	2·31	—
—	1000	11·	2·25	—
—	900	10·8	3·6	1·087
3	1400	17·2	6·3	1·4
—	1350	13·5	4·05	1·115
Mean	1195	15·6	4·5	1·475
Per kilo.	22·1	0·289	0·083	0·027