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Influence of Postnatal Age on Kidney Function of Premature Infants.*

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In the course of an investigation on the development of kidney function, data have been obtained on the influence of postnatal age on kidney function of premature infants and values have been collected for current kidney function tests in premature infants. Measurements were made in 2 groups of premature infants all weighing between 2130 and 2520 g at the time of observation. The ages of infants in the first group (Group A) ranged from 3 to 13 days; those in the second (Group B) from 49 to 107 days.

Methods. The clearance procedures and chemical methods have been described previously.¹

Results. Mean values for inulin, urea, mannitol and para-aminohippurate (PAH) clearances and PAH tubular maxima in 17 well female premature infants are shown in Table I.† Protocols for each subject are included in the table. The individual values in Table I are calculated without correction as UV/P. For comparison with adult values, the means for each group are corrected for surface area. With this correction, the inulin clearances are 41% (Group A) and 58% (Group B) of normal adult values; the PAH clearances 25 and 34% and PAH tubular maxima 17 and 27%, respectively.

It may be seen from the data in Table I that although some overlapping occurs, mean

values for all measurements are higher in the older than in the younger infants. A marked increase in clearances is noted only in the oldest infant, ST, whose corrected inulin clearances are actually within the normal adult range. For the most part, however, the magnitude of the differences between the two groups is surprisingly small. Examination of values for individual infants gives emphasis to this latter fact: for example, at 12 days of age, PI "A" had higher values for all determinations than WI had at 66 days and higher PAH clearances than KO had at 95 days of age.‡

The C_{IN}/C_{PAH} ratios are higher in these infants than in adults. A high ratio in early infancy falling to adult values during the first few months of life has been reported.^{2,3} It is of interest that the C_{IN}/C_{PAH} ratios in the two groups of infants reported here are almost identical.

Discussion. Cessation of new glomerular formation in the kidneys of fetuses and infants weighing between 2100 and 2500 g has been reported to be dependent on the size the fetus has attained rather than related to the fact that birth has occurred.⁴ Our data on premature infants of the same

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¹ Barnett, H. L., Hare, K., McNamara, H., Hare, R. S., *J. Clin. Invest.*, in press.

† The detailed data for inulin and urea clearances in Group A have been presented in Table Ib of a previous report.¹

‡ Part of this wide scatter may be attributed to inaccuracy of body weight as an index of gestational age. However, the difference between the two groups in range of birth weights and postnatal ages is so great that variations in maturity related to multiple births, race, or other factors, would be minimized.

² Rubin, M. I., Bruck, E., and Rappaport, M., *Proc. Fifth International Congress of Pediatrics*, 1947, p. 99.

³ West, J. R., Smith, H. W., and Chasis, H., *J. Pediat.*, 1948, **32**, 10.

⁴ Potter, E. L., and Thierstein, S. T., *J. Pediat.*, 1943, **22**, 695.

TABLE I.
Protocols and Data on Renal Clearances in Premature Infants.

Subject	Day of observation			Birth wt, g	Clearances ^a ml/min				PAH tubular maxima mg/min	C _{IN}	
	Age, days	Wt, g	Ht, cm		Inulin					PAH	C _{PAH}
					Inulin	Mannitol	Urea	PAH			
Group A											
BA†	3	2130	46	2180	3.48	3.07	1.77	11.86	0.61	.29	
GU†	4	2276	46	2300	5.47	4.64	—	16.46	1.85	.32	
RA†	9	2380	47.5	2468	4.60	3.99	3.28	13.75	0.77	.33	
PI†	9	2216	47	2118	5.49	4.46	3.34	13.92	1.17	.42	
PI†	12	2320	47	2066	6.59	6.09	4.06	20.10	2.31	.32	
MA	12	2190	46	2182	4.06	3.98	2.98	15.82	1.44	.27	
RO	13	2164	45	2090	4.36	3.97	2.90	9.91	—	.42	
PA	13	2164	—	2100	3.29	3.12	2.25	—	0.69	—	
Mean: uncorrected					4.67	4.17	2.94	14.55	1.26	.34	
Mean: per 1.73 M ²					47.8	42.7	30.1	148.5	12.9	—	
Group B											
MC	49	2300	46	1360	6.38	5.64	3.75	22.09	2.28	.31	
LE	51	2360	47	1340	5.78	5.13	4.45	16.05	1.39	.31	
PR†	53	2470	45.3	1310	7.02	6.81	4.73	22.88	1.47	.30	
MB	54	2156	43.5	1018	7.33	6.19	4.52	18.77	1.62	.41	
KO	55	2404	46	1175	6.79	5.41	4.85	18.08	1.67	.33	
WI	66	2440	47	1240	5.09	—	2.67	12.77	1.56	.42	
MN	73	2420	44	960	6.06	—	2.96	20.89	1.20	.29	
KU	95	2510	47	740	6.77	—	4.74	19.20	2.84	.37	
ST†	107	2520	45	820	11.09	—	8.04	35.02	5.31	.34	
Mean: uncorrected					6.92	5.84	4.52	20.64	2.15	.34	
Mean: per 1.73 M ²					67.4	58.0	44.0	200.7	20.8	—	

* Each value represents the mean of 3 to 10 clearance periods.

† Negro.

‡ Twin.

weight range show some increase in kidney function related to postnatal age. However, judging from the rate of development of kidney function in larger infants^{3,5} and in rabbits,⁶ the magnitude of the increase observed in our older infants may be less than would be expected in larger infants. In addition, the C_{IN}/C_{PAH} ratios did not change in our infants with increasing clearances. These latter findings suggest that development of kidney function in infants weighing up to 2500 g may be influenced by a gestational factor not operating in larger infants. A more complete de-

⁵ Gordon, H. H., Harrison, H. E., and McNamara, H., *J. Clin. Invest.*, 1942, **21**, 499.

⁶ Williamson, R. C., and Hiatt, E. P., *PROC. SOC. EXP. BIOL. AND MED.*, 1947, **66**, 554.

scription of these relationships requires direct comparison of these results with similar data on full term infants. Such observations are planned.

Conclusions. Mean values for inulin and PAH clearances and PAH tubular maxima corrected for surface area in premature infants ranged from 17 to 58% of normal adult values. Greater postnatal age appears to increase the rate of development of kidney function in premature infants weighing between 2100 and 2500 g although to a less extent than might be expected in full term infants.

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Strains of the Virus of Foot-and-Mouth Disease Recovered from Outbreaks in Mexico.

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(Introduced by R. E. Shope.)

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The present series of papers deals with studies on strains of the virus of foot-and-mouth disease from outbreaks in Mexico. The work was undertaken at the request of the Bureau of Animal Industry of the United States Department of Agriculture on behalf of a joint Mexican-American Commission to whom all the results recorded here have been reported.*

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During the experiments recourse has been made to many new methods that have been developed at this institute, to which some preliminary reference should perhaps be made. The necessity of having a quantitative appreciation of a biological problem is becoming increasingly apparent especially in approaching problems of immunity. No great reliance can be placed on the results of "field" vaccination experiments, for example, in estimating the real value of an immunizing agent as it is not possible to analyse satisfactorily the many factors involved. This can be done only under controlled experimental conditions. Again before satisfactory interpretations can be made of the results of experiments carried out under controlled conditions it is necessary to have reliable "standard methods."

The main program of the scientific staff of this Institute for the last eight years has