Protein-bound Iodine in Premature Infants

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The normal pregnant woman and the newborn infant both have raised hormonal iodine levels (Rose, Russell, and Starr, 1963; Pickering *et al.*, 1958). The very early fetus has a low hormonal iodine which rises as gestation proceeds, but the level in premature babies is still lower than that of full-term infants (Andreoli and Robbins, 1962; Rose *et al.*, 1963; Marks and Man, 1965).

The serum protein-bound iodine (PBI) levels in the full-term newborn infants rise to a peak at about 48 hours (Perry, Hodgman, and Starr, 1965; Danowski *et al.*, 1951) and then tail off slowly. The levels in the premature baby also rise to a maximum at 48 hours (Perry *et al.*, 1965) and drop over the next 8 days, but there is scant information about levels of the premature infant at birth and through the early weeks of life.

Material and Methods

Blood was sampled from the umbilical or peripheral vein of 25 consecutive premature infants (see Table), 22 of whom weighed 2500 g. or less, though the gestation was over 36 weeks in 6 instances. 3 infants of diabetic mothers were included because they were born before 36 weeks, though weighing more than 2500 g. Their results are included in Group 2 of Fig. 1. Some of the premature infants were sick, and developed respiratory distress syndrome, so that deaths reduced numbers available for follow-up to 15 at the end of the first week, and to 13 at 2 months. Only 3 were tested at 3 months.

Venous samples from each infant were taken within the first 6 hours, at 48 hours, at 1 week, and at monthly intervals until 3 months. PBI was estimated by Auto-analyser (normal adult range 3.5–8 $\mu\text{g./100 ml.}$).

Results

The results for PBI levels are shown in Fig. 1 and 2. The cord blood specimens ranged from 3.8–10.0 $\mu\text{g./100 ml.}$ The lowest result of 3.8 $\mu\text{g.}$ was found in only one; this apart, the range for the others of 5.6–10.0 $\mu\text{g./100 ml.}$ corresponds with

the values given by Danowski *et al.* (1950) for pregnant women in the second and third trimester.

Two infants of birthweight less than 1000 g. had cord levels of 6.0 and 10.0 $\mu\text{g./100 ml.}$ The youngest infant of less than 28 weeks' gestation had the highest cord PBI in the series. For the rest, the means of the PBIs show a slight rise with increasing gestation. At 1 to 6 hours, there was very little change in the means and ranges, with perhaps a slight rise, with more infants in the high ranges.

The most striking change occurred within the first week, with a rise in the means of all weight and gestation groups. The highest levels were found at the end of the first week, but there was little difference between values at 48 hours and 1 week. The means at 48 hours are about the upper

FIG. 1.—Mean PBI levels from birth to 3 months in 4 groups of infants. Group 1: 6 infants >36 weeks' gestation, birthweight <2500 g.; Group 2: 14 infants 33–36 weeks' gestation (including 3 with diabetic mothers); Group 3: 3 infants 28–32 weeks' gestation; Group 4: 2 infants <28 weeks' gestation.

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FIG. 2.—Mean PBI levels of all infants of 36 weeks' and earlier gestation from birth to 3 months. Vertical lines indicate ± 1 SD.

TABLE
Mean, Range, and Standard Deviation of PBI
According to Gestation

Age at Testing	Gestation	Range	No.	Mean	SD
Cord	<28	10.0	1		
	28-32	3.8- 8.0	3	5.9	
	33-36	5.6- 9.0	11	7.1	1.2
	36+	6.7- 8.3	3	7.3	
6 hr.	<28	3.3- 7.6	2	5.45	
	28-32	5.8- 6.1	2	5.95	
	33-36	4.4- 9.8	14	6.9	1.7
	36+	5.0- 9.8	6	7.8	1.7
48 hr.	<28		0		
	28-32	6.0- 6.2	2	6.1	
	33-36	3.6- 9.8	9	7.3	2.1
	36+	6.1-14.4	5	9.6	2.6
1 wk.	<28		0		
	28-32		0		
	33-36	5.9-15.6	10	9.8	3.0
	36+	7.8-11.0	4	9.0	1.2
1 mth.	<28		0		
	28-32	5.7-10.2	3	7.4	
	33-36	5.4-13.0	8	7.5	2.2
	36+	6.4- 8.0	3	7.5	
2 mth.	<28		0		
	28-32	6.4	1		
	33-36	5.2-10.3	7	7.3	1.5
	36+	4.6-10.0	4	7.5	2.0
3 mth.	<28		0		
	28-32	6.4	1		
	33-36	8.6	1		
	36+	5.6	1		

limit of adult normal values. At 1 month the means are lower, but still there were several infants with values above the upper limit of adult normal (8 $\mu\text{g./100 ml.}$). At 2 months 2 infants still had results of 10 $\mu\text{g./100 ml.}$ The means are still high, but are lower than at 1 month. The diabetic infant tested had a level of 12.0 $\mu\text{g./100 ml.}$

Discussion

Man *et al.* (1952) found that the serum butanol-extractable iodine of normal infants fell to between 5 and 8 $\mu\text{g./100 ml.}$ some time between 30 and 60 days.

The present study confirms the findings of Perry *et al.* (1965) for the first week of life of the premature baby, and shows in addition that the high PBI levels persist for one month, and in some of the bigger premature babies for at least two months, above the upper adult limit.

These results show that young premature infants normally have no chemical evidence of hypothyroidism. In the diagnosis of hypothyroidism in premature infants, note must be made of the fact that the normal premature baby has a raised PBI level for at least one month and maybe longer. A premature infant, therefore, might be hypothyroid with a PBI level within the limits found in normal adults.

Summary

The protein-bound iodine level of premature infants tends to be high in cord blood. It shows a striking rise to levels well above adult normal within 2 to 7 days after birth and gradually falls over the next three months. A premature baby could be hypothyroid with a PBI within the range of normal adult levels.

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