

Thyroid Function Tests in the Newborn

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Chadd, M. A., Gray, O. P., and Davies, D. F. (1970). *Archives of Disease in Childhood*, 45, 374. **Thyroid function tests in the newborn.** The ^{131}I tri-iodothyronine (T_3) resin uptake test reflects thyroid function more closely than other acceptable tests currently available.

The T_3 uptake and protein-bound iodine (PBI) level were estimated in 20 premature and 20 full-term infants at birth and at the end of 1 week.

The full-term infant has normal adult values, whereas the premature baby has results extending into the hyperthyroid range at birth, but these fall to within normal limits at 1 week.

There are few studies of thyroid function in the newborn and neonatal period of infants born earlier than the 37th week of gestation. Protein-bound iodine (PBI) levels are similar to those obtained for full-term infants (Danowski *et al.*, 1950). The radioactive iodine (^{131}I) uptake test has limited value because of the risk from irradiation.

The *in vitro* test of radioactive ^{131}I -labelled tri-iodothyronine uptake using red blood cells was introduced by Hamolsky, Stein, and Freedberg (1957). A similar test was used by later workers using a resin substituted for red blood cells (Nava and De Groot, 1962; Godden and Garnett, 1964). This test measures the degree of saturation of thyroid-binding globulin, whereas the PBI test measures the protein-bound thyroid hormones thyroxine, tri-iodothyronine, and iodotyrosine.

Comparison of this test with the conventional PBI test in the neonatal period was made by Evans (1966), using paired maternal and cord blood samples. This work included very few premature infants. We have therefore undertaken a study comparing these two tests in premature and full-term infants.

Materials and Methods

Blood was obtained from the umbilical cord after delivery of placenta or from a peripheral vein within 12 hours of birth for estimation of values and tri-iodothyronine resin uptake values from 20 full-term infants and 20 low birthweight infants (less than 37 weeks' gestation).

The tests were repeated on the 8th day of life. Plasma-bound iodine was estimated by Auto-analyser. The ^{131}I tri-iodothyronine (T_3) resin uptake test was estimated after the method of Gimlette (1967). The T_3 adult euthyroid range is for this laboratory 70–140%.

The T_3 test can now be performed on as little as 0.1 ml. plasma.

Results

The PBI levels in both the full-term and premature infants confirm the known high mean and wide ranges of cord blood, with even higher levels at the end of the first week (Table). However, T_3 resin uptake is normal for the full-term infants both at birth and at the end of the first week. The premature infants' cord results show a high mean with a very wide range at birth, but by the end of the first week these results also show a normal mean and range.

The mean cord blood PBI in both term and premature infants is at the upper limit of adult normal euthyroid values ($3.5 \mu\text{g.}$ – $8.0 \mu\text{g.}/100 \text{ ml.}$ plasma) (Perry, Hodgman, and Starr, 1965; Rose, Russell, and Starr, 1963).

Both full-term (Danowski *et al.*, 1950) and premature infants (Chadd, Davies, and Gray, 1968) showed a rise of the PBI values, above the upper limit of adult euthyroid normal, $8 \mu\text{g.}/100 \text{ ml.}$, during the first week of life. Values of 10 – $14 \mu\text{g.}/100 \text{ ml.}$ were frequently obtained between 48 hours and 8 days of life by Chadd *et al.* (1968) in premature infants. These values gradually fell over the next 2–3 months.

TABLE
Plasma Protein-bound Iodine Levels and T_3 Uptake Test in Newborn Infants

	Birthweight (kg.)	Gestation (wk.)	Protein-bound Iodine at Birth ($\mu\text{g./100 ml.}$)	T_3 Uptake at Birth (%)	Protein-bound Iodine at 8 Days ($\mu\text{g./100 ml.}$)	T_3 Uptake at 8 Days (%)
<i>20 Premature</i>						
Mean	2.0	33.6	7.8	138	8.7	94
Range	1.0-3.9*	26-35	5.4-11.2	62-227	5.8-12.8	69-140
1 SD			1.83	34.79	1.70	21.76
<i>20 Full-term</i>						
Mean	3.0	39	9.5	98	9.8	100
Range	2.5-3.9	36-41	6.1-13.8	70-160	8.8-14.4	71-157
1 SD			2.67	32.8	3.16	21.26

*N.B. 1 premature diabetic infant included, but birthweight 3.9 kg., gestation—36 weeks.

The radioactive iodine (^{131}I) test has been used to assess thyroid function in the neonatal period in both full-term infants (Van Middlesworth, 1954) and in premature infants (Martmer *et al.*, 1956). Their results confirm the impression of transient hyperthyroidism in the neonatal period. This test is not widely used because of the risks of irradiation.

The raised PBI in the newborn may be due to oestrogen binding and falsely suggests increased thyroid activity. T_3 resin uptake test, however, measures the saturation of thyroid activity. Evans (1966) found in normal newborn infants mean cord blood PBI of $7.5 \mu\text{g./100 ml.}$, and 81% for the T_3 resin uptake test.

In term infants the T_3 resin uptake is well within the adult normal euthyroid range for our laboratory (70-140%), and is unchanged at the end of the first week of life.

The premature newborn infant, however, shows a raised T_3 uptake test at birth, which falls to within the normal euthyroid adult range (70-140%) by the end of the first week. This suggests that at birth the premature infant has a true increase in thyroid hormones.

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