hydrocephalus. The cause of his symptoms was a pulson diverticulum of the lateral ventricle, a rarity which does not usually figure in the differential diagnosis of this syndrome, though the history is characteristic of the few recorded cases.

We thank the consultant staff of the Department of Child Health for permission to publish this case.

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Thyroxine levels in normal newborn infants

It is well known that thyroxine (T4) levels in the blood are higher in infancy than at any other time of life. This was shown in the papers of Danowski et al. (1951), Durham et al. (1954), and Pickering et al. (1958). These papers were based on the measurement of protein-bound iodine and butanol-extracted iodine in infants. O'Halloran and Webster (1972) measured thyroid function in Australian Caucasian babies during the first year of life. They used a technique involving a resin column, 125I-labelled thyroxine, and a γ counter. This method of T4 measurement is marketed in the form of Tetrabore Kits (Abbott Laboratories), Tetratek Kits (Ames Company), and Thyropac 4 (Amersham Radio Chemical Centre). It is finding increasing favour in biochemistry laboratories as a method of estimating T4 levels in the blood, for it is quick, easy, accurate, and uses only 0.1 ml serum. The method is attractive to paediatricians because it can be performed on heel prick samples of blood.

In view of the probable increased use of this test, a study was done to define the normal range of T4 levels in Caucasian neonates in Britain.

Methods

T4 measurement was carried out on a series of venous and some capillary samples of blood. The estimations were carried out in the Fazakerley Hospital Biochemistry Department by one of us (D.W.) using a Tetrabore Kit and a Thyrimeter Gamma Counter (Ames Company) according to the printed instructions. 30 samples of cord blood, 30 blood samples from 6-hour- to 44-hour-old babies, and 30 samples from 4- to 7-day-old babies were taken for T4 estimations.

The infants in the trial were normal Caucasian term babies. Any complicating factor such as prematurity, small-for-dates status, jaundice, asphyxia, sepsis, etc., excluded the infant from the study. The only maternal complication allowed was an elective caesarean section for disproportion or because of a previous caesarean section. The samples were not taken serially from individual infants.

Results

The values of serum thyroxine in μg/100 ml blood were as follows. In 30 samples of cord blood the range was from 7.2 to 13.5 μg/100 ml. The mean value of the cord samples was 9.9 μg/100 ml and the normal range (mean ± 2 SD) was 6.1 to 13.7 μg/100 ml.

In 30 samples of blood from infants 6 to 44 hours old, T4 values ranged from 13.2 to 19.6 μg/100 ml. The mean value was 16.6 μg/100 ml and normal range was 13.4 to 19.8 μg/100 ml.

In 30 samples of blood from infants 4 to 7 days old, T4 values ranged from 8.6 to 18.5 μg/100 ml. The mean value was 14.4 μg/100 ml and normal range was 10.4 to 18.4 μg/100 ml.

Discussion

The cord blood values are similar to those found by O'Halloran and Webster (1972). The mean cord blood T4 in our series was 9.9 μg/100 ml, which was lower than their mean value of 11.3 μg/100 ml.

The mean T4 value of O'Halloran and Webster's 20 babies aged 0 to 13 days was 13.2 μg/100 ml. This is exceeded by the mean value of 14.4 μg/100 ml of our 30 4- to 7-day-old babies. The mean T4 levels of our 30 6- to 44-hour-old infants was even higher at 16.6 μg/100 ml.

Our findings are in keeping with the findings of Danowski et al. (1951) and Fisher and Odell (1969) who found that peak thyroxine levels occurred between days 1 to 4 of life. Fisher and Odell showed a marked increase in thyroxine stimulating hormone at this time. It can be seen that our
results show maximum $T_4$ levels at 6 to 44 hours, dropping by 4 to 7 days.

Perhaps the lower $T_4$ levels shown in O’Halloran and Webster’s 0- to 13-day-old infants can be explained by most of their infants being nearer in age to day 13 than to day 1. They would then be less affected by the highest levels of thyroid-stimulating hormone, or where there is maternal thyroid disease, where there is maternal antithyroid drug taking, or where the family history suggests an increased chance of hypothyroidism. It is well known that many babies who are discovered to be hypothyroid later in the first year of life do not appear cretinous at birth.

More frequent $T_4$ measurement in neonates who are jaundiced, with further tests on those whose $T_4$ levels are below the normal limits described, should be carried out. This policy might detect more of these occult cretins before brain damage has occurred through lack of early thyroxine treatment.

**Summary**

A study of $T_4$ values in normal term British Caucasian neonates was made. Mean $T_4$ values and normal ranges were: (1) cord blood, mean 9·9 μg/100 ml, normal range 6·1 to 13·7 μg; (2) infants 6 to 44 hours old, mean 16·6 μg/100 ml, normal range 13·4 to 19·8 μg; (3) infants 4 to 7 days old, mean 14·4 μg/100 ml, normal range 10·4 to 18·4 μg.

This study was performed on normal infants in Fazakerley Maternity Hospital with the informed consent of their mothers, whom we thank. We also acknowledge the help and encouragement of Dr. Hudson, Consultant Paediatrician to Fazakerley Maternity Hospital, on whose patients the study was performed.

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*Arch Dis Child* 1974 49: 410-411
doi: 10.1136/adc.49.5.410

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