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THYROID FUNCTION IN PREMATURE INFANTS

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INDEXING WORDS

thyrotropin; free T_4 ; premature infants; mass-screening

SYNOPSIS

The present study was performed using the simultaneous assays of free T_4 and TSH levels in dried blood spots of filter paper for mass-screening of inborn errors of metabolism in order to clarify the thyroid function of premature infants. The subjects were divided in three groups; A group infants less than 1500g at birth (n=34, 27.4 ± 2.6 weeks of gestational age), B group infants from 1500 to 2500g at birth (n=104, 35.6 ± 2.4 weeks) and C group infants over 2500g at birth (n=490, 39.0 ± 1.2 weeks). TSH levels were 4.51 ± 3.03 , 2.62 ± 2.24 and $2.84 \pm 2.06 \mu\text{U/ml}$ in A, B and C group respectively and significant difference was recognized in group A and C. Free T_4 levels were 0.71 ± 0.42 , 1.81 ± 0.96 and $2.15 \pm 0.67 \text{ ng/dl}$, in group A, B and C respectively, and significant differences were recognized in all three groups. There was positive correlation between free T_4 levels and gestational ages ($Y = -2.413 + 0.11725X$, $r = 0.206$, $p < 0.05$).

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INTRODUCTION

In premature infants, transient hypothyroxinemia, as low serum thyroxine (T_4) and normal serum thyrotropine (TSH), is frequently recognized during the several weeks after birth^{2,4,7)}. Thyroid function abnormality mentioned above is thought to be due to immaturity of hypothalamic-pituitary-thyroid axis cycle, especially due to hypothalamic hypothyroidism because of increased serum TSH and T_4 after TRH stimulation^{4,6)}. In order to clarify the thyroid function in premature infants, it is required to measure free thyroxine level.

The present study deals with the simultaneous assays of free T_4 and TSH levels in dried blood spot of filter paper for mass-screening of inborn errors of metabolism.

SUBJECTS AND METHOD

Thirty-four preterm infants (27.4 ± 2.6 weeks of gestational age) less than 1500 g, 104 preterm neonates (35.6 ± 2.4 weeks of gestational age) from 1500 g to 2500 g, and 490 term neonates (39.0 ± 1.2 weeks of gestational age) over 2500 g, admitted to Himeji Red Cross Hospital Neonatal Center between April 1990 and February 1991 were eligible for the study. Venous blood samples on filter paper were collected during 6th to 10th day after birth. These samples were held at -20°C until assay.

Free T_4 and TSH in the dried blood spot were measured, with the method of enzyme-linked immunosorbent assay (ELISA), for mass-screening of newborn infants (Ciba Corning Co). Correlation between free T_4 in dried blood spot and serum free T_4 was studied. Serum free T_4 was measured with the method of ELISA (Ciba Corning Co). Statistical analysis was by Wilcoxon test and P value of 0.05 or less was considered statistically significant.

THYROID FUNCTION IN PREMATURE INFANTS

RESULTS

The regression line for free T_4 in the dried blood spot against serum free T_4 indicated a positive correlation shown in Fig 1. The result suggests that free T_4 level in dried blood spot precisely reflects the thyroid function.

TSH concentration of dried blood spots were $4.51 \pm 3.03 \mu\text{U/ml}$ in the group less than 1500 g at birth (Group A), $2.62 \pm 2.24 \mu\text{U/ml}$ in the group from 1500 g to 2500 g at birth (Group B), and $2.84 \pm 2.06 \mu\text{U/ml}$ in the group over 2500 g at birth (Group C), respectively and there was significant difference between Group A and C, as shown in Fig 2. Free T_4 concentration of dried blood spots were $0.71 \pm 0.42 \text{ ng/dl}$ in Group A, $1.81 \pm 0.96 \text{ ng/dl}$ in Group B and $2.15 \pm 0.67 \text{ ng/dl}$ in Group C, respectively and there were significant differences between all three groups, as shown in Fig 3. The relationship between free T_4 concentration and gestational age is shown in Fig 4. The regression line of free T_4 concentration against gestational age indicated positive correlation ($P < 0.05$), while no significant correlation was recognized between TSH concentration and gestational age, as shown in Fig 5. The relationship between TSH and free T_4 concentration in dried blood spots is shown in Fig 6. There were no significant correlation between TSH and free T_4 concentration in the group less than 1500 g at birth (Group A) and over 1500 g at birth (Group B and C).

DISCUSSION

The present study also indicated the state of hypothyroxinemia with low free thyroxine in premature infants, as well as previous reports^{2,4,6,7)}. Kanarek et al reported that the free T_4 levels of very-low-birth-weight increase from 27 Pmol/L at 5~11 days after birth to 50 Pmol/L at 19 days after birth without symptoms of hypothyroidism in this period⁵⁾. Fuse et al mentioned that thyroid hormone feedback control of pituitary TSH release in extreme premature infants begins to mature after 6 weeks of post-

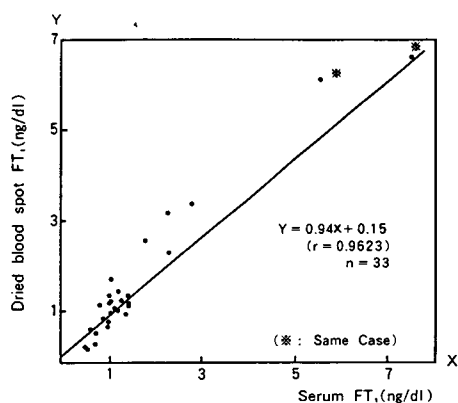


Fig. 1. The regression line for free T₄ in the dried blood spot against serum free T₄, using the grown infants out of the subjects (1 ~ 3 months old after birth). The positive correlation was recognized.

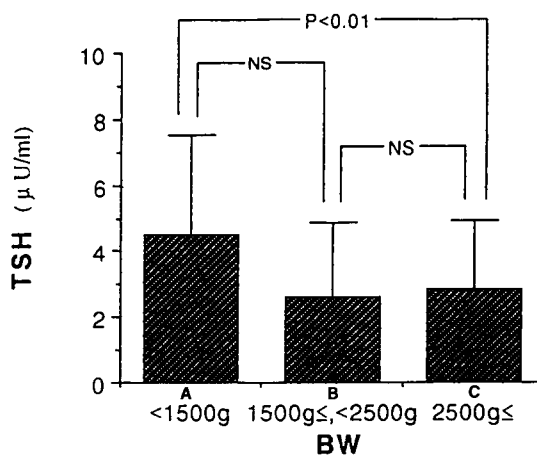


Fig. 2. TSH concentrations of dried blood spots in the groups less than 1500 g at birth Group A (n=34, 27.4±2.6 weeks of gestational age), from 1500 to 2500 g at birth Group B (n=104, 35.6±2.4 weeks of gestational age) and over 2500 g Group C (n=490, 39.0±1.2 weeks of gestational age). NS indicated not significant. Significant difference was recognized between A and C.

THYROID FUNCTION IN PREMATURE INFANTS

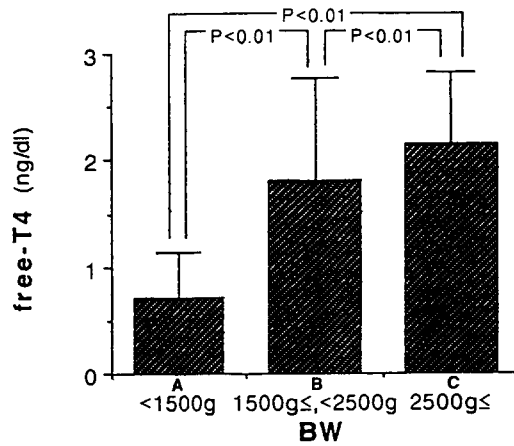


Fig. 3. Free T₄ concentrations of dried blood spots in the groups less than 1500 g at birth (Group A), from 1500 g to 2500 g at birth (Group B) and over 2500 g at birth (Group C). Significant differences were recognized between all three groups.

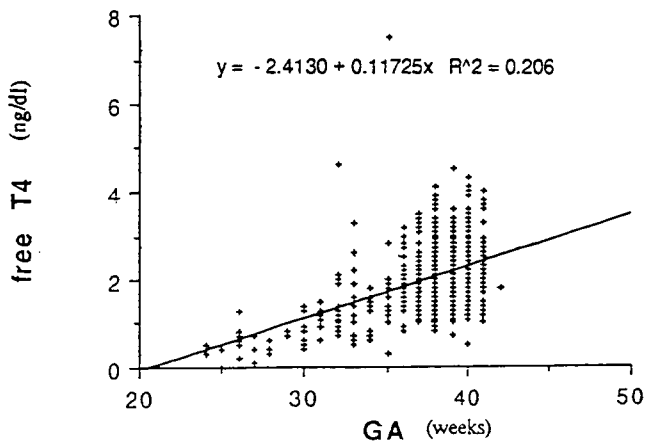


Fig. 4. The relationship between free T₄ concentration and gestational age. The regression line of free T₄ concentration against gestational age indicated positive correlation ($p < 0.05$).

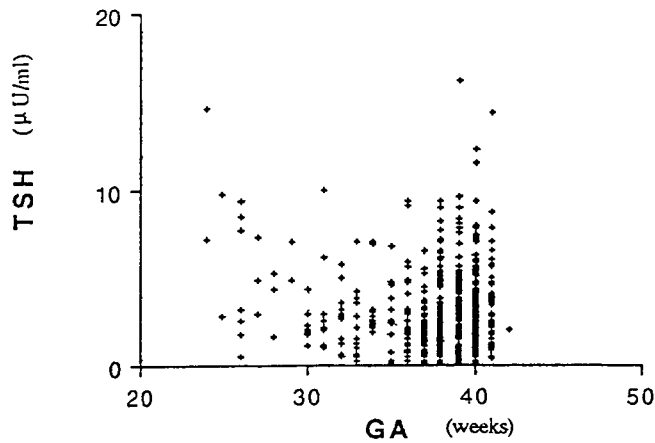


Fig. 5. The relationship between TSH in dried blood spots and gestational age. There was no correlation.

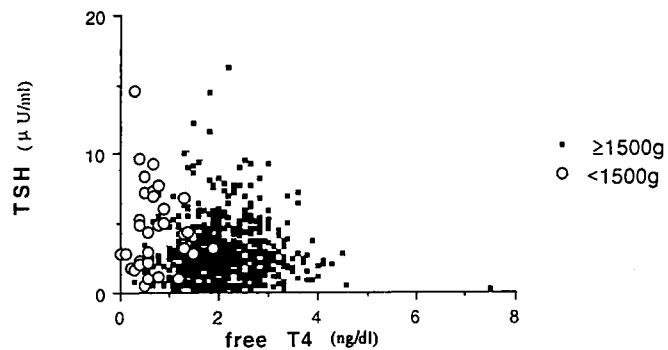


Fig. 6. The relationship between TSH and free T_4 concentrations in dried blood spots. ○ and ■ indicated premature infants less than 1500 g at birth and over 1500 g at birth, respectively. There was no correlation between them.

THYROID FUNCTION IN PREMATURE INFANTS

natal age³⁾. However, in very-low-birth-weight premature infants with hypothyroxinemia, thyroid replacement therapy was not effective on growth and development, and there was no significant difference in the treated and nontreated infants after one year of follow-up¹⁾. In our study, there was no premature infants with symptomatic hypothyroxinemia as Mercado et al reported⁸⁾.

These results may suggest that premature infants of transient hypothyroxinemia with low TSH level do not suffer disadvantages in physical and mental development.

REFERENCE

1. Chowdhry, P., Scanlon, J.W., Auerbach, R., and Abbassi, V.: *Pediatrics*. 1984. 73. 301/306. Results of controlled doubleblind study of thyroid replacement in very low-birth-weight premature infants with hypothyroxinemia.
2. Diamond, F.B., Paks, J.S., Tenore, A., Mario, J.M., and Bongiovanni, A.M.: *Clin. Pediatr.* 1979. 19. 555/556. Hypothyroxinemia in sick and well preterm infants.
3. Fuse, Y., Shimizu, M., Uga, N., Fujii, T., and Irie, M.: *J. Develop. phys.* 1991. 14. 17/22. Maturation of feedback control of thyrotropin in premature infants.
4. Hadeed, A.J., Asay, L.D., Kllin, A.H., and Fisher, D.A.: *Pediatrics*. 1981. 68. 494/498. Significance of transient hypothyroxinemia in premature infants with and without respiratory distress syndrome.
5. Kanerek, K.S., Villaveus, C., Duckett, G., and Root, A.: *Am. J. Dis. Child.* 1988. 142. 993/995. Serum concentration of growth hormone, insulin, thyroxine, thyrotropin and cortisol in very-low-birth-weight infants receiving total parental nutrition.
6. Klein AH, and Fisher DA.: In Dussalt, J.H., Walker P., ed., *Congenital hypothyroidism* (Marcel Dekker, New York). 1983. 127/143. Thyroid physiology in full term and premature infants.

7. Kok, J.H., Hart, G., Kopper, J.G., and Devijlder, J.J.M.: Arch. Dis. Child. 1983. 58. 190/194. Normal ranges of T_4 screening values in low birthweight infants.
8. Mercado, M., Szymonowicz, W., Victor, Y. H. Yu., and Gold, H.: Clin. Pediatr. 1987. 26. 343/345. Symptomatic hypothyroxinemia with normal TSH levels in preterm infants.