Screening brief

Screening for congenital hypothyroidism

The disorder

- Congenital hypothyroidism occurs when the newborn's thyroid gland is unable to produce adequate amounts of thyroid hormones. In regions where iodine deficiency is not endemic, the disorder is most often caused by an ectopic or absent thyroid gland. Around 15% have recessively inherited disorders of thyroid hormone biosynthesis. If the infant is not treated, in most cases growth and mental development are seriously compromised.

Birth prevalence

- About 1:4000 births where iodine deficiency is not endemic.[1] The disorder is about twice as common in girls as in boys.
- Prevalence is lower in Afro-Caribbeans[2] and may be more common in South Asians.[3]

Prognosis in the absence of screening

- In the absence of early treatment, 40% of affected individuals have an IQ of less than 70 and 19% of affected individuals have an IQ of less than 55. The overall mean IQ is about 80.[4] With treatment, much intellectual impairment is avoided, but mean IQ and IQ distribution will not be restored to normal.[5] Even with early diagnosis and treatment, those with severe disease (50% of cases detected by screening) have a mean IQ of about 10 points lower than the general population. There may be increased prevalence of congenital abnormalities and death in infancy.[3]
- It is possible that, in some infants, impaired brain development has already occurred that cannot be rectified by postnatal treatment.

Screening procedure

- Thyroid stimulating hormone (TSH) measurement on filter paper blood spot during first seven days of life on all newborns, followed by thyroxine (T4) measurement on a serum sample when TSH is >20 mU/L; positive rate about 0.3 per 1000 when screened at 4–7 days of life[6]; 1–3 per 1000 when screened earlier than 4 days. TSH levels in unaffected infants can be high during the first 24 hours because of a neonatal surge, but the surge has usually passed by 2 to 3 days.
- Alternatively, T4 measurement followed by TSH measurements when T4 is ⩽10th centile.
- Screening could miss rare cases of congenital hypothyroidism —such as hypothalamic pituitary hypothyroidism, compensated disease (normal T4, elevated TSH), or delayed TSH rise; these are very rare (total perhaps 2 or 3 per 100 000).

Diagnosis

- T4 and TSH measurement in a venous blood sample, obtained as soon as possible after initial positive result.
- 90% of those with initial positive results will remain positive.
- Detection rate is approximately 90%. The remaining 10% of cases are less severely affected and do not become detectable by TSH until age 2–6 weeks.[7–8]
- Transient hypothyroidism will occur in 10% of infants,[9] or about 2.5 per 100 000 of newborns.[10]
- Less frequently transient congenital hypothyroidism will occur due to treatment of mothers during pregnancy with thiourea derivatives or iodides

Management of infants with positive diagnostic studies

- Initially, term newborns are treated with 10–15 mg/kg/day of L_thyroxine.[9] This dose is increased after two weeks if a repeat T4 level is <130 nmol/L. T4 is then maintained between 140 and 200 nmol/L during first year of life,with monthly monitoring.[10] 80–90% should have normal TSH by 4 weeks. TSH level is monitored and maintained below 10 mU/L.
- Premature newborns are treated until 8 weeks and then monitored to verify that T4 and TSH levels remain normalised.
- Infants whose mothers were treated during pregnancy with thiourea derivatives or iodides are monitored to verify that T4 and TSH levels have normalised.

Overall assessment

- Screening for congenital hypothyroidism in worthwhile.

1 Fisher DA. Dussault JH, Foley TP, *et al*. Screening for congenital hypothyroidism: results of screening one million North American infants. *J Paediatr* 1979;**94**:700–5.
2 Klein RZ, Mitchell ML. Neonatal screening. In: Braverman LE, Utiger RD, eds. *Werner and Ingbar's The Thyroid*, 8th edition. Philadelphia: Lippincott, Williams and Wilkins, 2000:973–7.
3 Grant DB, Smith I. Survey of neonatal screening for primary hypothyroidism in England, Wales, and Northern Ireland 1982–4. *BMJ* 1988;**296**:1355–8.
4 Klein AH, Meltzer S, Kenny PM. Improved prognosis in congenital hypothyroidism treated before age 3 months. *J Paediatr* 1972;**81**:912–15.
5 Tillotson SL, Fuggle PW, Smith I, *et al*. Relation between biochemical severity and intelligence in early treated congenital hypothyroidism: a threshold effect. *BMJ* 1994;**309**:440–5.
6 Law WY, Bradley DM, Lazarus JH, *et al*. Congenital hypothyroidism in Wales (1982–1993): demographic features, clinical presentation and effects on early neurodevelopment. *Clin Endocrinol* 1998;**48**:201–7.
7 AAP Section on Endocrinology and Committee on Genetics and American Thyroid Association Committee on Public Health. Newborn screening for congenital hypothyroidism: recommended guidelines. *Pediatrics* 1993;**91**:1203–9.
8 Meaney F, Riggle SM. *The Council of Regional Networks for Genetic Services newborn screening report for 1990*. New York: The Council of Regional Networks for Genetic Services, 1992.
9 Fisher DA. Clinical review nineteen. Management of congenital hypothyroidism. *J Clin Endocrinol Metab* 1991;**72**:523–9.
10 Frank JE, Faix JD, Hermos RJ, *et al*. Thyroid function in very low birthweight infants: effects on neonatal hypothyroidism screening. *J Paediatr* 1996;**128**:548.
11 Ehrich RM. Thyroxine dose for congenital hypothyroidism. *Clin Paediatr* 1995;**34**:521–2.