treatment, serum T₃ and T₄ levels were in the high normal range, by which time the serum TSH level had fallen dramatically. Thereafter, with increasing serum T₃ and T₄ the serum TSH fell to persistently undetectable levels.

Most clinicians have their own dosage schedule of thyroxine for the treatment of hypothyroidism and hitherto have tended to judge dosage against satisfactory linear growth and osseous maturation. Additionally, on the basis of evidence that the developing brain and skeleton require more thyroxine than other tissues for adequate development (Hutchinson, 1969), it has been felt by some that it is advisable to keep serum T₃ and T₄ levels marginally above normal levels. While such high levels cannot completely reverse the intrauterine damage to the brain, it can be claimed that modestly high circulating levels of T₃ and T₄ ought to permit maximum brain growth and hopefully improve the ultimate IQ.

In patients with juvenile hypothyroidism there is perhaps less need for higher than normal T₃ and T₄ serum levels since intrauterine brain development is likely to have been normal. It is only the increasing systemic requirement for thyroid hormones beyond the capacity of the patient’s thyroid which induces clinical hypothyroidism. It might then be concluded that normal serum T₃ and T₄ levels would permit subsequent normal growth and development.

While it is known that increased circulating levels of cortisol suppress both corticotrophin and growth hormone (Franchimont and Libon, 1966), it is not known if persistent suppression of TSH with exogenous thyroxine results also in suppression of other trophic hormones. Certainly if this were so our experience suggests that any suppression that may occur is not liable to give rise to clinical features suggestive of a trophic hormone deficiency. However, it is clear that these relatively new tests have provided tools by which serum levels in response to the various regimens of thyroxine therapy may be monitored in future and when these are correlated with the clinical response (in growth, osseous maturation, and IQ) a greater degree of certainty will be permissible.

Summary

It is desirable to detect early hypothyroidism of the mildest degree even before conventional tests of thyroid function become abnormal. Serum TSH levels (normal: undetectable to 4 μU/ml) rise in patients with mild hypothyroidism long before serum T₄ and T₃ levels fall. In the patient described the serum TSH level was 310 μU/ml, while other tests of thyroid function gave normal results. After treatment with thyroxine, serum TSH returned to normal. It should now be accepted that patients with mild hypothyroidism have a raised serum TSH and that thyroid insufficiency can be confidently excluded if the serum TSH concentration is normal. It is thus important to assay serum TSH when suspicion of hypothyroidism is aroused.

We are indebted to Dr. J. G. Radcliffe, Regional Radioimmunoassay Laboratory, for undertaking analysis of many of the serum samples.

REFERENCES


W. HAMILTON and JAMES H. HUTCHISON*
University Department of Child Health, Royal Hospital for Sick Children, Glasgow G3 8SJ.

*Correspondence to Dr. J. H. Hutchinson.

Neonatal respiratory failure due to myotonic dystrophy

The occurrence of myotonic dystrophy in the newborn causing extreme and generalized hypotonia, bilateral facial weakness, ptosis, bilateral talipes equinovarus, and feeding difficulties has been documented for more than a decade (Vanier, 1962). Respiratory difficulties, principally attacks of cyanosis associated with ineffective swallowing and pulmonary aspiration, have also been recorded (Dodge et al., 1965). In the following case respiratory involvement was marked, and caused death within 2 days of birth.

Case report

The patient, a male weighing 2.95 kg was born at 37 weeks' gestation by vaginal delivery. Before delivery hind water rupture had produced 4 l amniotic fluid. Immediate Apgar score was 8, but at 3 minutes the child became blue and limp, the cyanosis responding to airway aspiration and administration of 100% oxygen. Initial examination of the infant showed generalized
hypotonia and bilateral talipes equinovarus. Incubator care with 40% ambient oxygen was given. During the first 14 hours of life 3 cyanotic attacks occurred. Blood pH was 7·22, PCO₂ 45 mmHg. Chest x-ray showed normal lung fields. On auscultation weak breath sounds were heard. Oral feeding produced nasal regurgitation. Hypotonia persisted and was associated with absence of tendon reflexes; oedema appeared, becoming marked and generalized. Edrophonium 1·5 mg was given intravenously without effect. From 19 hours after birth cyanotic attacks increased in frequency and severity and at 22 hours the baby was intubated and ventilated. At first there was an excellent response, blood pH 7·27, PO₂ 111 mmHg, PCO₂ 54·5 mmHg. Despite this no limb movements were seen apart from slight toe flexing on stimulation. Cyanosis reappeared when the infant was aged 47 hours and was unaffected by reintubation. Subcutaneous oedema became even more marked and death occurred at 49 hours after birth.

Necropsy examination. At necropsy there was widespread pulmonary consolidation with congestion, oedema, and intra-alveolar leukocytes and macrophages in both lower lobes, the right middle lobe, and parts of both upper lobes. The skeletal muscles were pale on inspection but histological examination of deltoid, pectoral, sternomastoid, and posterior calf muscles was normal.

On admission details of the family history were unknown. Later it became clear that the child's mother was diagnosed in 1971 as having myotonic dystrophy confirmed on electromyography. Her father also has myotonic dystrophy. Her first pregnancy, accompanied by hydramnios, resulted in the birth in December 1972 of a male infant with bilateral facial palsy, bilateral talipes equinovarus, and generalized hypotonia. He required tube feeding for 10 days but showed no respiratory difficulty. The mother's diagnosis was not known to the Obstetric and Paediatric Departments at that time and the diagnosis of myotonic dystrophy was not made then in this child. He is now 22 months old and shows facial weakness with lack of expression and generalized developmental retardation of at least 6 months' extent. He has no myotonia as yet.

Discussion

When the family history became known there was little doubt that death was due to respiratory insufficiency resulting from neonatal myotonic dystrophy and neonatal pneumonia. The picture was similar to that described by Bell and Smith (1972), whose case also showed hydramnios, profound hypotonia, feeble respiratory efforts, little response to painful stimuli, and remained cyanosed in 40% oxygen. Their patient died at age 90 hours in spite of positive pressure ventilation, and also showed no microscopical changes characteristic of myotonic dystrophy in the muscles.

Absence of histological changes in muscles is not unusual in the neonate with myotonic dystrophy. Normal muscle biopsies have been recorded several times in young children (Watters and Williams, 1967; Dodge et al., 1965). Davies et al. (1972) stress that a family history may help to explain a ‘floppy’ infant, since many of the causes are genetically determined. However, the elder brother of the present case was born before the mother's diagnosis was known and his diagnosis was missed until events leading to the death of the second child caused it to be reviewed.

In the present case and in that of Bell and Smith (1972), the diagnostic problem was one of respiratory failure, associated with extreme hypotonia and almost total lack of movement or response. Differential diagnosis included cerebral depression from drugs administered to the mother or from cerebral haemorrhage; cerebral cord injury; neonatal myasthenia; spinal muscular atrophy; Pompe's disease; hyperglycaemia and neonatal myotonic dystrophy. Though the severe form of Pompe's disease may cause respiratory failure and severe hypotonia, it is also likely to cause some heart enlargement, while the excessive glycogen deposits are readily apparent on muscle biopsy (Dubowitz and Brooke, 1973). Bladder paralysis is likely to occur in cervical cord injury and would be a useful clue, but an injury of this severity is most unlikely to occur without a history of traumatic delivery. Though general anaesthetic agents and drugs such as morphine and allied compounds administered to the mother may cause respiratory depression in the infant, this is unlikely to be associated with muscular paralysis.

Ketotic hyperglycaemia can cause marked hypotonia, poor sucking, diminished reflexes, apnoeic attacks, and convulsions (Visser, Veenstra, and Pik, 1964). Profound hypotonia is also a feature of nonketotic hyperglycaemia, when it is usually associated with myoclonus (Baumgartner, Audo, and Nyhan, 1969). In both forms, however, the effects of the metabolic abnormality develop as a result of protein feeding, and therefore onset should occur after an interval of normal progress lasting a few days. Neonatal myasthenia gravis may cause hypotonia with weak limb movements, absent primitive reflexes, diminished tendon responses, and feeding problems, and occasionally respiratory difficulty with cyanosis. It occurs in about 3% of infants born to mothers with myasthenia (Namba, Brown, and Grob, 1970). Examination of the mother should lead to diagnosis of the infant. Congenital myasthenia gravis is usually a slowly progressive illness, which is not life threatening in the neonatal period.
In most, but not all, cases of neonatal myotonic dystrophy, the mother of an affected child will be found at some stage of the child’s life to have myotonic dystrophy herself. Harper and Dyken (1972) report on 40 children with myotonic dystrophy during the first 5 years of life. In 4 of these children the onset was during the neonatal period. If respiratory failure in a newborn infant is due to myotonic dystrophy it is extremely likely, though not inevitable, that the mother of the child will also have the features of the condition.

Death from myotonic dystrophy in the neonatal period is uncommon. It would be helpful to know of any case which had survived involvement as severe as that recorded here.

Summary

Myotonic dystrophy should be included in the differential diagnosis of neonatal respiratory failure accompanied by hypotonia. The effect of this disorder in an infant who died from it 49 hours after birth is described, and the importance of examining the mother of a possible case is emphasized.

REFERENCES


**TABLE I**

Characteristics of infants in study

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of infants</th>
<th>Birthweight (kg) (mean and range)</th>
<th>Gestational age (w) (mean and range)</th>
<th>Head circumference (cm) (mean and range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>11</td>
<td>1·60 (1·16–1·80)</td>
<td>35 (32–36)</td>
<td>29·2 (27·5–31·6)</td>
</tr>
<tr>
<td>II</td>
<td>10</td>
<td>1·62 (1·32–1·77)</td>
<td>35 (32–38)</td>
<td>30·0 (27·5–31·5)</td>
</tr>
<tr>
<td>III</td>
<td>10</td>
<td>1·60 (0·93–1·80)</td>
<td>34 (32–37)</td>
<td>29·4 (26·0–31·5)</td>
</tr>
<tr>
<td>IV</td>
<td>11</td>
<td>1·62 (1·12–1·80)</td>
<td>34 (30–36)</td>
<td>28·9 (27·1–31·5)</td>
</tr>
</tbody>
</table>


KENNETH SIMPSON*
Leicester General Hospital, Leicester.

*Correspondence to Dr. K. Simpson, The Leicester Royal Infirmary, Leicester LE1 5WW.

**Effect of thermal environment and caloric intake on head growth of low birthweight infants during late neonatal period**

It has been shown that exposure of low birthweight infants to environmental temperatures slightly below the thermoneutral zone is associated with decreased rates of weight gain and linear growth (Glass, Silverman and Sinclair, 1968, 1969). It has been suggested that a combination of low environmental temperature and suboptimal caloric intake may be responsible for decreased rates of head growth (Davies and Davis, 1970; Glass, Silverman, and Sinclair, 1971), and by inference, brain growth (Winick and Rosso, 1969).

In the present study, matched low birthweight infants were reared under one of 4 combinations of thermal environment and caloric intake after the first week of life. The retarding effect of the subthermoneutral temperatures on head growth was confirmed.

**Subjects and methods**

Forty-two asymptomatic neonates (birthweight 930–1800 g), matched for birthweight and gestational age, were included in the study (Table I). During the first