

## Short reports

### Cause of neonatal convulsions

#### Towards more precise diagnosis

M I LEVENE AND J Q TROUNCE

Department of Child Health, Leicester University Medical School, Leicester

**SUMMARY** All infants presenting with neonatal seizures over a two year period were carefully investigated for the cause. In 20% either intracranial haemorrhage or infarction of a major cerebral artery was detected by real time ultrasound. Routine imaging techniques should be performed in all infants with neonatal convulsions.

The incidence of neonatal convulsions varies between 1.5 and 14 per 1000 liveborn infants.<sup>1,2</sup> Although a large number of aetiological factors have been implicated, few studies have reported the various causes among a cohort of newborn infants. We prospectively studied all infants with neonatal seizures over a two year period by a variety of investigations, including high resolution real time ultrasound, and found intracranial haemorrhage to be an important and relatively frequent finding.

#### Patients and methods

Over a two year period all infants with clinically observed convulsions were carefully investigated. Infants of 35 weeks' gestation and above were included in the study if they had been witnessed to have a convulsion by a member of the medical staff. Seizures occurring at any time from birth to the 28th day of life were considered. Those infants referred from outside the hospital were included if they fulfilled the above criteria.

Initial investigations included blood sugar, serum electrolytes, including calcium, blood cultures, and a real time ultrasound examination of the brain (ATL 300i machine fitted with a multifrequency transducer). In addition the labour ward records were examined for evidence of fetal distress on cardiotachograph recordings and the Apgar scores were noted. For a diagnosis of asphyxia to be made, the infant was required to show some evidence of distress in utero or at birth, and also to show the classic progression of neurological abnormality

associated with this condition.<sup>3</sup> If these criteria were normal or if the infant continued to have convulsions then the following investigations were also performed: TORCH screen (antibody titres for toxoplasmosis, rubella, and herpes; urine microscopy for intracellular inclusion bodies), lumbar puncture, urine for amino acid and organic acid chromatography, and a 'metabolic' screen of urine for reducing substances, pH, ketones, sugar, and glycosaminoglycans.

#### Results

Sixty one infants were studied. Gestation ranged from 35 to 42 weeks (median 40), and the time of the first convulsion ranged from 2 hours to 25 days of age (median 2 days). A cause was evident in 56 (92%) of the infants (Table). The commonest cause was asphyxia (53%) but others were infection (8%) and metabolic (5%), hypoglycaemia (3%), and congenital abnormalities (3%). Three infants were found to have neonatal 'stroke' and nine had intracranial haemorrhage. The varieties of haemorrhage included intraventricular (4 cases), thalamic (2 cases), primary parenchymal, subarachnoid, and subdural associated with a tear of the tentorium (1 case each). Cerebral artery infarction affected the posterior cerebral artery in two cases (Figure) and the middle cerebral in one. Other disorders included maple syrup urine disease, hypernatraemia, and

Table Causes (where determined) of neonatal convulsions in study infants

Asphyxia—Intrapartum	28
Postnatal	4
Infection	5
Metabolic	3
Haemorrhage	9
Stroke	3
Congenital abnormality	2
Hypoglycaemia	2
Hypocalcaemia	0
Unknown	5
Total	61

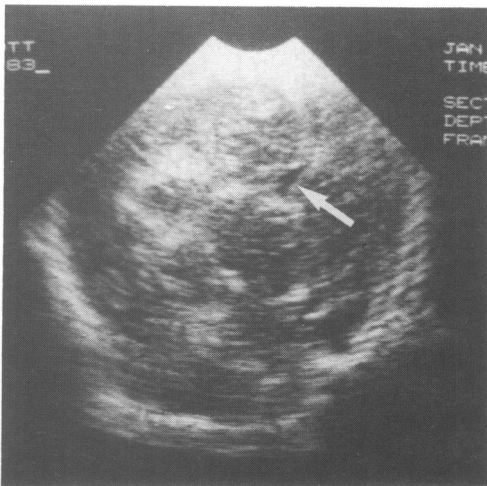


Figure Posterior coronal scan showing slight shift of the midline towards the right with a normal right lateral ventricle (arrowed). There is a diffuse area of increased echodensity obscuring the ventricle on the left side corresponding to the area of infarction.

accidental ergometrine injection at birth. No infants had hypocalcaemia as the primary cause of their seizures. Congenital abnormalities included holoprosencephaly and spina bifida with hydrocephalus. Both infants with hypoglycaemic convulsions had major underlying pathology (congenital heart disease in one and trisomy 9 in the other). Of the five infants in whom no cause could be found, a single seizure occurred in one on the first day of life and in another multiple convulsions developed on day 10. Three babies had seizures on days five or six; these were self limiting and the infants seemed to be neurologically normal between seizures.

### Discussion

Two recently reported studies found no definite cause for neonatal convulsions in 29%<sup>1</sup> and 69%<sup>4</sup> of term infants. The latter study of Goldberg reported that 52% of all infants born at term and admitted over a 10 year period had so called 'fifth-day fits'. As there is no satisfactory explanation for these seizures it seems more appropriate for the present to refer to them as being of unknown origin. Only three infants in our study would fall into this category.

Intracranial haemorrhage or neonatal stroke seems, in our study, to have a common and important association with neonatal seizures, accounting for 20% of the total cases. We cannot be certain that haemorrhage was the cause of the

seizure in all cases but it is very unlikely that the convulsion caused the intracranial bleed. It is possible that a more fundamental insult caused both seizures and haemorrhage. Nevertheless intracranial haemorrhage seems to be a useful marker for such cerebral injuries and a prognosis may be given on the basis of this condition.

There have been four studies in the past 10 years reporting the incidence of different causes of neonatal fits.<sup>1-4-6</sup> Three do not report intracranial haemorrhage to be a cause in any cases and the fourth<sup>4</sup> detected haemorrhage as the cause of seizures in only 2.5% of cases. None of these studies seemed to use any form of imaging technique. In a recent study Fenichel and colleagues<sup>7</sup> reported 22 term infants with intracranial haemorrhage, of whom 18 (82%) developed seizures in the neonatal period. In addition, a French study described eight infants with neonatal stroke, and seizures occurred in all.<sup>8</sup> It is likely that both intracranial haemorrhage and neonatal stroke occur frequently in newborn term infants and present very commonly with seizures.

In summary, we have shown that haemorrhagic or infarctive lesions of the neonatal brain are a relatively common cause of neonatal seizures. Real time ultrasound is a very reliable method of diagnosing these conditions<sup>9</sup> and this investigation should be part of the routine screen of all infants with seizures.

Dr J Q Trounce is supported by the Spastics Society.

### References

- Eriksson M, Zetterstrom R. Neonatal convulsions. Incidence and causes in the Stockholm area. *Acta Paediatr Scand* 1979;**68**:807-11.
- Brown JK, Cockburn F, Forfar JO. Clinical and chemical correlates in convulsions of the newborn. *Lancet* 1972;*i*:135-9.
- Levene MI, Kornberg J, Williams THC. The incidence and severity of post-asphyxial encephalopathy in full-term infants. *Early Hum Dev* 1985;**11**:21-6.
- Goldberg HJ. Neonatal convulsions—a 10 year review. *Arch Dis Child* 1983;**58**:976-8.
- Watanabe K, Kuroyanagi M, Hara K, Miyazaki S. Neonatal seizures and subsequent epilepsy. *Brain Dev* 1982;**4**:341-6.
- Dennis J. Neonatal convulsions: aetiology, late neonatal status and long-term outcome. *Dev Med Child Neurol* 1978;**20**:143-58.
- Fenichel GM, Webster DL, Wong WKT. Intracranial hemorrhage in the term newborn. *Arch Neurol* 1984;**41**:30-4.
- Billard C, Dulac O, Diebler C. Ramollissement cérébral ischémique du nouveau-né. Une étiologie possible des états de mal convulsifs néonataux. *Arch Fr Pédiatr* 1982;**39**:677-83.
- Levene MI, Williams JL, Fawer C-L. *Ultrasound of the infant brain. Clinics in developmental medicine no 92.* Oxford: Blackwell Scientific Publications, 1985.

Correspondence to Dr M I Levene, Department of Child Health, Leicester Royal Infirmary, PO Box 65, Leicester LE2 7LX.

Received 20 October 1985.