Trisomy 16p in a liveborn infant and a review of partial and full trisomy 16

S. H. ROBERTS AND D. P. DUCKETT

From the Cytogenetics Unit, Child Health Laboratories, Department of Child Health, University Hospital of Wales, Heath Park, Cardiff, Wales

SUMMARY An abnormal female infant, who survived for 10 months with almost complete trisomy 16p and monosomy of sub-band 21q22.3, is described. The chromosome anomaly was the result of an unbalanced segregation of a maternal balanced translocation $t(16;21)(p11;q22.3)$. The partial monosomy was considered to have had little or no adverse phenotypic effect. Cases with trisomy of chromosome 16 material are reviewed. It appears that while full trisomy 16 always results in early spontaneous abortion, trisomy 16p or 16q may be compatible with limited postnatal survival.

Trisomy 16, unreported in liveborn cases investigated with banding techniques, has often been shown to be the most common trisomy in surveys of spontaneous abortuses (Carr, 1967; Arakaki and Waxman, 1970a; Kajii *et al.*, 1973; Boué *et al.*, 1975; McConnell and Carr, 1975; Creasy *et al.*, 1976; Lauritsen, 1976). It has been suggested that its lethality is the result of the additional short arm material (Schmickel *et al.*, 1975). We describe here what we consider to be a unique case of almost complete trisomy 16p in a girl who lived for 10 months, and we review cases with trisomy of chromosome 16 material.

Case history

The probanda (Fig. 1, III.2) was born at term by caesarian section because of fetal distress. She was the second born infant of a 23-year-old mother (now gravida 3, para 3) and a 30-year-old father.

At birth the probanda weighed 2125 g, with a head circumference of 31 cm, and no physical signs of prematurity. Her Apgar score was 6 at 1 minute, 8 at 5 minutes, and 9 at 10 minutes. The extremities of her body were blue and respiratory effort was slow and irregular. Oxygen was administered.

On examination, the baby had odd facies with upward slanting palpebral fissures, asymmetrical ears, a hypoplastic mandible, and tongue-tie (Fig. 2 and 3). There was proximal insertion of the thumbs, which were hypoplastic (Fig. 4) and adducted under the fingers during fistling (Fig. 5). The index fingers over-

lapped the middle fingers (Fig. 5), and there was a simian crease on the left hand. Dorsiflexion of the big toes was noted. She had a systolic murmur, loudest at the left sternal border, which was not characterised further. There were only 2 blood vessels in the umbilical cord.

Full radiological examination showed no further abnormality, except for a pelvis that was small in relation to the chronological age. An intravenous pyelogram showed no abnormality. Her electrocardiogram showed slight right axis deviation. Routine

Fig. 1 Pedigree of family.

Fig. 2 Facies of the proposita at 5½ months of age showing upward slanting palpebral fissures and asymmetrical ears.

Fig. 3 Lateral view of the head of the proposita at 5½ months of age showing hypoplastic mandible.

laboratory investigations of the complete blood cell count, red cell osmotic fragility, Hb electrophoresis, serum electrolytes, serum folate, and urine sugars, creatinine, amino acids, and mucopolysaccharides were all within normal limits. On one occasion

Fig. 4 Right hand of the proposita showing proximal insertion of hypoplastic thumb.

Fig. 5 Right hand of the proposita showing the thumb adducted under the fingers and the index finger overlapping the middle finger.

pathogenic *Esch. coli* 0114 was cultured from a rectal swab, but was not subsequently reisolated. No other bacterial or viral pathogens were isolated.

During the first week of life the condition of the baby was poor, complicated by a moderate degree of

respiratory distress and mild hypoglycaemia (blood glucose levels varied between 1.1 and 1.7 mmol/l), jaundice (serum bilirubin levels varied between 147 and 172 $\mu\text{mol/l}$), and hypocalcaemia (serum calcium levels varied between 1.26 and 1.86 mmol/l). At 7 days she had a series of convulsions, each lasting between 30 seconds and 1½ minutes. Calcium gluconate was administered and the attacks did not recur. She was initially fed through a nasogastric tube and, though there was intermittent vomiting, her condition began to improve, so that at 1 month of age she began to feed from the bottle and gradually gained weight. At 7 weeks she was found apnoeic and cyanotic, but recovered after suction of the oropharynx. She remained in hospital for 3 months, by which time she was feeding well despite her developmental retardation (weight 3250 g). The child died unexpectedly at home at the age of 10 months.

Necropsy showed no internal congenital malformation, and death was attributed to 'bronchiolitis (sudden death in infancy syndrome)'.

Cytogenetic studies

Chromosome preparations were made from peripheral blood using standard techniques (Moorhead *et al.*, 1960), and GTG banded (Paris Conference, 1971, Supplement, 1975) with a method modified from Seabright (1971). On examination each metaphase spread from the proposita (III.2) had a count of 46 with one chromosome 21 having a long arm nearly twice the length of that of its homologue. Analysis of chromosome preparations from the mother (II.2) showed the presence of a balanced translocation in which the short arm of one chromosome 16 was exchanged with the end of the long arm of one chromosome 21 (Fig. 6). The interchange points appeared to be close to the centromere of chromosome 16 within band 16p11, and at the junction of sub-bands 21q22.2 and 21q22.3 of chromosome 21 (Fig. 7). The karyotype of the mother was therefore designated 46,XX,t(16;21)(p11;q22.3) (Paris Conference, 1971), and that of the proposita was interpreted as 46,XX,der(21),t(16;21)(p11;q22.3)mat.

Fig. 6 GTG-banded karyotype of the mother (II.2) of the proposita showing the reciprocal translocation between chromosomes 16 and 21 (arrows).

Fig. 7 Diagrammatic representation of the normal and derived no. 16 and no. 21 chromosomes. The bands shown are those obtained with the banding technique used by the authors and differ slightly from the Paris Conference (1971).

The probanda was thus trisomic for almost the whole short arm of chromosome 16, and monosomic for sub-band 21q22.3 of chromosome 21.

The karyotypes of the father (II.1) and the maternal grandmother (I.2) of the probanda were normal. After ascertainment, the third pregnancy of the mother of the probanda was monitored. Amniocentesis, followed by cell culture and chromosome analysis, showed the presence of a chromosomally normal female fetus (III.3). This result was confirmed with a lymphocyte culture after the birth of a phenotypically normal female infant.

The brother (III.1) and the maternal grandfather (I.1) of the probanda were both phenotypically normal but were unavailable for cytogenetic investigation.

Discussion

It is well established that trisomy 16 is found in at least 5% of all spontaneous abortuses (Arakaki and Waxman, 1970a; Boué *et al.*, 1975; Creasy *et al.*, 1976; Lauritsen, 1976), which account for 15% of clinically recognisable pregnancies (Reid *et al.*, 1972). This prevalence of trisomy 16 in abortuses, compared with its complete absence from surveys of perinatal and neonatal deaths and stillbirths (Bauld *et al.*, 1974; Machin and Crolla, 1974), and from extensive surveys of newborn infants (reviewed by Hamerton *et al.*, 1975), suggests that trisomy 16 invariably has a lethal effect early in pregnancy. No trisomy 16 conceptus has been reported expelled with a gestation (from first day of LMP to day of abortion minus 2 weeks) greater than 16 weeks, the average gestational age being approximately 10 weeks. These abortuses showed either abnormal or arrested development, the most common phenotypes being severely disorganised embryos, intact empty sacs, and ruptured sacs without cord stumps (Arakaki and Waxman, 1970a,b; Hamerton, 1971; Creasy *et al.*, 1976; Lauritsen, 1976). Only a few macroscopically normal trisomy 16 embryos have been described, the largest of which was 10 mm long (Clendenin and Benirschke, 1963; Creasy *et al.*,

1976; M. Seabright, 1977, personal communication). Trisomy 16 mosaicism has occasionally also been reported in spontaneous abortuses (Arakaki and Waxman 1970a; Ikeuchi and Sasaki, 1975; Creasy *et al.*, 1976).

However, putative reports of full trisomy 16 have been made in abnormal adults (Lewis *et al.*, 1963; Melnyk *et al.*, 1967), and in a case of neonatal death (Taylor, 1971). Reputedly, trisomy 16 mosaicism has been found in living individuals (Schmidt *et al.*, 1963; Backus and Darien, 1968; Arakaki and Waxman, 1969), and in an infant who died in the neonatal period (Konstantinova, cited in Borgaonker and Bolling, 1977). In these cases, chromosomes were identified without the aid of banding techniques. It is probably significant, therefore, that rearrangements involving group or X chromosomes can result in chromosomes indistinguishable from chromosome 16 with conventional staining techniques. Some cases of partial trisomy 9, an abnormality associated with multiple congenital malformations compatible with postnatal survival, can be included in this category (Mason *et al.*, 1975; Penchaszadeh and Coco, 1975; P. J. Gregory, S. H. Roberts, and D. P. Duckett, 1977, unpublished data). These reports of full or mosaic trisomy 16 in liveborn individuals should therefore be regarded with some scepticism.

Trisomy of 16p material (Hamerton, 1971; Hasegawa *et al.*, 1973) and of 16q material (Kim *et al.*, 1974) has also been implicated in spontaneous abortions. Similarly, in the present case, there is possibility that the 3 spontaneous abortuses of the maternal grandmother (I.2) were trisomic for 16p as a result of an unbalanced segregation in the maternal grandfather (I.1).

However, there are a few reports, in addition to the child described here, of postnatal survival in infants with trisomy of 16p or 16q material (Table). All these cases had multiple congenital abnormalities, coupled with a birthweight below 2500 g, and with one exception (Stern and Murch, 1975) they were dead within 1 year. A few similarities can be seen between

the present case and the previously reported cases with trisomy of 16p material (Table: 1, 2, 3, and 4). These common features include a hypoplastic mandible and abnormalities of the auricles (Pergament *et al.*, 1970; Schmickel *et al.*, 1975; Stern and Murch, 1975), flexion deformities of the fingers (Schmickel *et al.*, 1975; Stern and Murch, 1975), and dorsiflexion of the big toes and a single umbilical artery (Stern and Murch, 1975). The 3 cases previously reported were males with cryptorchidism. Phenotypic discrepancies may be explained by the almost complete trisomy of 16p in the present case, compared with the more partial trisomy 16p in the other reports, and by the

other chromosomal imbalances, resulting from the attendant rearrangements, which differ in each instance.

The proposita described here was monosomic for the terminal sub-band 21q22.3 of chromosome 21. Lejeune *et al.* (1964) first postulated that partial monosomy of the chromosome responsible for Down's syndrome would result in a phenotype in some respects antithetical to mongolism. Cases with 'anti-mongolism' (Reisman *et al.*, 1966) and 21q deletion comprise the G-deletion syndrome 1 of Warren and Rimoin (1970), reviewed by Gericke *et al.*, (1975). Some abnormalities, including developmental retar-

Table Comparison of liveborn cases with partial trisomy 16

Author	Cytogenetic findings	Pregnancy (wk)	Birthweight (g)	Length of life	Facies	Other clinical features
(1) Present case	46,XX,der(21),t(16;21)(p11;q22.3)mat:— almost complete trisomy 16p; monosomy of sub-band 21q22.3	38	2125	10 months	Asymmetry of ears; upward slanting palpebral fissures; hypoplastic mandible	Thumbs proximally inserted, hypoplastic, and adducted under fingers during fistling; index fingers overlapped 3rd fingers; simian crease on left hand; dorsiflexion of big toes; small pelvis; single umbilical artery
(2) Stern and Murch (1975)	47,XY,+der(18),t(16;18)(p12;q11)mat:— partial trisomy 16p(distal); trisomy 18p; partial trisomy 18q(proximal)	35½	1700	Alive at 3 years	Microcephalic; small palpebral fissures; auricles low-set and malformed; hypoplastic mandible	Cleft soft palate; index fingers overlapped 3rd, and 5th overlapped 4th fingers; rocker-bottom feet; dorsiflexion of big toes; pseudohermaphroditism; bilateral cryptorchidism; single umbilical artery; child grossly retarded and spastic at 3 years
(3) Pergament <i>et al.</i> (1970)	76% of cells were 46,XY,-16,+r(16):— partial monosomy 16p and q; 17% of cells were 45,XY,-16:— monosomy 16; 4% of cells were 46,XY,-16,+dic r(16):— partial monosomy 16p and q; partial trisomy 16p and q	40	1800	7½ months	Hypertelorism; epicanthic folds; low-set ears; beak-shaped nose; hypoplastic mandible	Slit-like openings of the external auditory canals; 5th toes overlapped 4th toes; hypoparathyroidism; bilateral cryptorchidism; general demineralisation of skeleton
(4) Schmickel <i>et al.</i> (1975)	47,XY,+der(16),t(15p+;16p-)mat:— trisomy 16q; probable partial trisomy 16p (proximal)	40	1860	7 weeks	Asymmetry of skull; small palpebral fissures with antimongoloid slants; small round ears with little cartilage; hypoplastic mandible	Clinodactyly of 2nd and 5th fingers; metatarsus adductus deformity; retarded calcaneus; fusion of sacral vertebral bodies; systolic murmur due to ventricular septal defect; bilateral cryptorchidism
(5) Eriksson <i>et al.</i> (1971)	46,XY,der(18),t(16;18)(q1;q2)pat:— partial trisomy 16q(distal); partial monosomy 18q(distal)	38	2270	14 days	Hypertelorism; low-set, malformed ears; slight prognathia	Bilateral clinodactyly; grossly malformed heart and persistent ductus arteriosus; incisural and cerebellar herniation of brain; single umbilical artery
(6) Francke (1972)	46,XX,der(22),t(16;22)(q2;q1)pat:— partial trisomy 16q(distal)	Premature	Low	Died during first year	Prominent forehead; flat nasal bridge	Large persistent ductus arteriosus; generalised hypotonia
(7) Machin and Crolla (1974)	46,XX,der(21),t(16;21)(q21;p11)mat:— partial trisomy 16q(distal)	38	2054	Died in neonatal period	Not stated	Multiple malformations

Two further cases of unbalanced segregation of translocations involving chromosome 16, 47,XX,+der(14),t(14;16)(q11;q24)mat (Young *et al.*, 1976), and 46,XX,der(9),t(9;16)(p2;q2)mat (Alfi *et al.*, 1973), were not included because the translocations were only presumed to be reciprocal resulting in trisomy of the 16q telomere.

dation and a hypoplastic mandible, which have been commonly found as part of this syndrome, were present in the proposita. However, the manifestation of Down's syndrome is now considered to be dependent only on the trisomy of sub-band 21q22.1 (Habadank and Kampe, 1975; Sinet *et al.*, 1976). Further, Lewandowski and Yunis (1975) suggest that this sub-band must be deleted for the clinical features of G-deletion syndrome 1 to occur. It is therefore probable, in this case, that the monosomy of 21q22.3 had little or no deleterious effect, and that the phenotypic abnormalities could be exclusively attributed to the trisomy of 16p. This view is reinforced by the report of a family in which 6 phenotypically normal members were monosomic for all but the most proximal part of band 21q22 (Habadank and Kampe, 1975).

In conclusion, there are as yet insufficient data to delineate a phenotype for trisomy 16p. It is difficult to distinguish the effects of trisomy 16p material from those of the other chromosomal imbalances in the previously reported cases. However, it is evident that, in contrast to the suggestion of Schmickel *et al.* (1975), trisomy 16p does not inevitably lead to spontaneous abortion. Both trisomy 16p and 16q cause congenital abnormalities, but these may be consistent with intrauterine life and a limited degree of postnatal survival. Moreover, since full trisomy 16 is apparently incompatible with all but the most rudimentary development, it must be the combined effects of the additional short and long arms that impart such lethality to this condition.

The authors wish to thank Professor K. W. Dumars, Professor K. M. Laurence, and Mr P. J. Gregory for their critical evaluation of the manuscript; Dr E. R. V. Jones for referring the case; and Mr T. J. Cooke, Mr R. J. Beard, and Mr N. J. Stark for technical assistance.

References

- Alfi, O., Donnell, G. N., Crandall, B. F., Derencsenyi, A., and Menon, R. (1973). Deletion of the short arm of chromosome # 9 (46,9p-): a new deletion syndrome. *Annales de Génétique*, **16**, 17-22.
- Arakaki, D. T., and Waxman, S. H. (1969). Trisomy-16 in a mosaic carrier father and his aborted foetus. *Journal of Medical Genetics*, **6**, 85-88.
- Arakaki, D. T., and Waxman, S. H. (1970a). Chromosome abnormalities in early spontaneous abortions. *Journal of Medical Genetics*, **7**, 118-124.
- Arakaki, D. T., and Waxman, S. H. (1970b). Effect of gestational and maternal age in early abortion. *Obstetrics and Gynecology*, **35**, 264-269.
- Backus, J. A., and Darien, G. G. (1968). Group E triple cell line mosaicism with Sprengel's deformity and other asymmetrical congenital abnormalities. Report of a case. *American Journal of Clinical Pathology*, **49**, 527-534.
- Bauld, R., Sutherland, G. R., and Bain, A. D. (1974). Chromosome studies in investigation of stillbirths and neonatal deaths. *Archives of Disease in Childhood*, **49**, 782-788.
- Borgaonker, D. S., and Bolling, D. R. (1977). *Repository of Chromosomal Variants and Anomalies in Man*, Fourth listing, p. 171. Johns Hopkins University School of Medicine, Baltimore.
- Boué, J., Boué, A., and Lazar, P. (1975). The epidemiology of human spontaneous abortions with chromosomal anomalies. In: *Biology and Pathology of Aging Gametes. International Symposium, Seattle, 1973*. Ed. by R. J. Blandeau. pp. 330-348. Karger, Basel.
- Carr, D. H. (1967). Chromosome anomalies as a cause of spontaneous abortion. *American Journal of Obstetrics and Gynecology*, **97**, 283-293.
- Clendenin, T. M., and Benirschke, K. (1963). Chromosome studies on spontaneous abortions. *Laboratory Investigation*, **12**, 1281-1292.
- Creasy, M. R., Crolla, J. A., and Alberman, E. D. (1976). A cytogenetic study of human spontaneous abortions using banding techniques. *Human Genetics*, **31**, 177-196.
- Eriksson, B., Fraccaro, M., Hultén, M., Lindsten, J., Thoren, C., and Tiepolo, L. (1971). Structural abnormalities of chromosome 18. II. Two familial translocations, B/18 and 16/18, ascertained through unbalanced forms. *Annales de Génétique*, **14**, 281-290.
- Francke, U. (1972). Quinacrine mustard fluorescence of human chromosomes: characterization of unusual translocations. *American Journal of Human Genetics*, **24**, 189-213.
- Gericke, G. S., Steyn, M. F., Retief, A. E., Thom, J. C., and van Niekerk, W. A. (1975). Clinical and cytogenetic aspects of the 21 deletion syndrome. *South African Medical Journal*, **49**, 959-964.
- Habadank, M., and Kampe, G. (1975). Familial translocation (t(3p+;21q+) associated with both Down's and Sturge-Weber's syndrome in unbalanced state. *Humangenetik*, **29**, 207-216.
- Hamerton, J. L. (1971). Clinical cytogenetics. In *Human Cytogenetics*, Vol. 2. Academic Press, New York.
- Hamerton, J. L., Canning, N., Ray, M., and Smith, S. (1975). A cytogenetic survey of 14,069 newborn infants. I. Incidence of chromosome abnormalities. *Clinical Genetics*, **8**, 223-243.
- Hasegawa, T., Pfeiffer, R. A., Metz, F., and Schild, W. (1973). Balanced translocation t(15q;16p+) as a cause of habitual abortions. *Geburtshilfe und Frauenheilkunde*, **33**, 541-544.
- Ikeuchi, T., and Sasaki, M. (1975). An abortion with a normal/trisomy 16 mosaicism: instability of trisomic cells *in vitro*. *Humangenetik*, **30**, 167-171.
- Kajiji, T., Ohama, K., Niikawa, N., Ferrier, A., and Avirachan, S. (1973). Banding analysis of abnormal karyotypes in spontaneous abortion. *American Journal of Human Genetics*, **25**, 539-547.
- Kim, M. A., Majewski, F., and Haberlandt, W. F. (1974). Balancierte Translokation rcp(3p+;16q-) bei einer Mutter als mögliche Ursache multipler Tot- oder Frühgeburten. *Archiv für Genetik*, **47**, 129-135.
- Lauritsen, J. G. (1976). Aetiology of spontaneous abortion. A cytogenetic and epidemiological study of 288 abortions and their parents. *Acta Obstetrica et Gynecologica Scandinavica*, **Suppl. 52**.
- Lejeune, J., Berger, R., Rethoré, M. O., Archambault, L., Jérôme, H., Thieffry, S., Aicardi, J., Broyer, M., Lafourcade, J., Cruveiller, J., and Turpin, R. (1964). Monosomie partielle pour un petit acrocentrique. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, **259**, 4187-4190.
- Lewandowski, R. C., and Yunis, J. J. (1975). New chromosomal syndromes. *American Journal of Diseases of Children*, **129**, 515-529.
- Lewis, F. J. W., Hyman, J. M., McTaggart, M., and Poulding, R. H. (1963). Trisomy of autosome 16. *Nature*, **199**, 404.
- McConnell, H. D., and Carr, D. H. (1975). Recent advances in the cytogenetic study of human spontaneous abortions. *Obstetrics and Gynecology*, **45**, 547-552.
- Machin, G. A., and Crolla, J. A. (1974). Chromosome constitution of 500 infants dying during the perinatal period. *Humangenetik*, **23**, 183-198.
- Mason, M. K., Spencer, D. A., and Rutter, A. (1975). A case of partial (9p) trisomy in a family with a balanced translocation 46,XX,t(1p+9q-). *Journal of Medical Genetics*, **12**, 310-314.

- Melnik, J., Thompson, H., and Hecht, F. (1967). Cytogenetic studies in an apparent trisomy 16 (47,XY,16+). (Abst.) Sixth Conference of Mammalian Cytology and Somatic Cell Genetics, 5-9 November, 1967, Pacific Grove, California. In *Mammalian Chromosome Newsletter*, 1968, 9, 39-40.
- Moorhead, P. S., Nowell, P. C., Mellman, W. J., Battips, D. M., and Hungerford, D. A. (1960). Chromosome preparations of leukocytes cultured from human peripheral blood. *Experimental Cell Research*, 20, 613-616.
- Paris Conference (1971). Standardization in human cytogenetics. *Birth Defects: Original Article Series*, 8, No. 7, 1972. The National Foundation—March of Dimes, New York.
- Paris Conference (1975). Standardization in human cytogenetics. *Birth Defects: Original Article Series*, 11, No. 9, 1975 (Suppl.). The National Foundation—March of Dimes, New York.
- Penchaszadeh, V. B., and Coco, R. (1975). Partial 9 trisomy by 3:1 segregation of balanced maternal translocation (7q+;9q-). *Journal of Medical Genetics*, 12, 301-305.
- Pergament, E., Pietra, G. C., Kadotani, T., Sato, H., and Berlow, S. (1970). A ring chromosome no. 16 in an infant with primary hypoparathyroidism. *Journal of Pediatrics*, 76, 745-751.
- Reid, D. E., Ryan, K. J., and Benirische, K. (1972). *Principles and Management of Human Reproduction*, p. 255. Saunders, Philadelphia, London, Toronto.
- Reisman, L. E., Kasahara, S., Chung, C. Y., Darnell, A., and Hall, B. (1966). Anti-mongolism: studies in an infant with a partial monosomy of the 21 chromosome. *Lancet*, 1, 394-397.
- Schmickel, R., Poznanski, A., and Himebaugh, J. (1975). 16q trisomy in a family with a balanced 15/16 translocation. *Birth Defects: Original Article Series*, 11, No. 5, 229-236. The National Foundation—March of Dimes, New York.
- Schmidt, B. J., Beçak, W., Beçak, M. L., Soibelman, I., Queiroz, A. da S., Lorga, A. P., Secaf, F., Antonio, C. F., and Carvalho, A. de A. (1963). Metaphyseal dysostosis. Review of literature; study of a case with cytogenetic analysis. *Journal of Pediatrics*, 63, 106-112.
- Seabright, M. (1971). A rapid banding technique for human chromosomes. *Lancet*, 2, 971-972.
- Sinet, P., Couturier, J., Dutrillaux, B., Poissonnier, M., Raoul, O., Rethoré, M., Allard, D., Lejeune, J., and Jérôme, H. (1976). Trisomie 21 et superoxyde dismutase—1(IPO-A): tentative de localisation sur la sous bande 21q22.1. *Experimental Cell Research*, 97, 47-55.
- Stern, L. M., and Murch, A. R. (1975). Pseudohermaphroditism with clinical features of trisomy 18 in an infant trisomic for parts of chromosomes 16 and 18: 47,XY,der(18),t(16;18)-(p12;q11)mat. *Journal of Medical Genetics*, 12, 305-307.
- Taylor, A. I. (1971). Trisomy of chromosome 16 in a neonate, 47,XY,?16+. *Journal of Medical Genetics*, 8, 123-125.
- Warren, R. J., and Rimoin, D. L. (1970). The G deletion syndromes. *Journal of Pediatrics*, 77, 658-663.
- Young, S. R., Donovan, D. M., Greer, H. A., Burch, K., and Potter, D. C. (1976). Tertiary trisomy, 47,XX, + 14q-, resulting from maternal balanced translocation 46,XX,t(14;16)(q11;q24). *Human Genetics*, 33, 331-334.

Requests for reprints to Mr S. H. Roberts, Child Health Laboratories, Department of Child Health, Welsh National School of Medicine, Heath Park, Cardiff CF4 4XN.