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A PARTIAL SHORT ARM DELETION OF CHROMOSOME 20:46, XY, del(20)(p11)

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Summary We have identified a partial deletion of the short arm of chromosome 20 in a 5-year-old boy from parents having normal phenotype and karyotype. His major anomalies were mild mental retardation, congenital heart disease, chest deformity, spina bifida, kyphoscoliosis, inguinal hernia, and preauricular fistula. The clinical findings were compared with those of two patients reported previously as a partial deletion 20p.

The activity of adenosine deaminase in the patient's red blood cells was within normal range, suggesting that the gene locus for the enzyme, which has been previously assigned to chromosome 20, may not present on p11→pter of chromosome 20.

INTRODUCTION

Reports of F group chromosomal abnormalities have been relatively infrequent. Abnormalities of chromosome 20 which were identified by Q- and/or G-banding techniques have been reported in complete trisomy 20 (Wahlström *et al.*, 1976; Pan *et al.*, 1976), trisomy 20 mosaicism (Pallister *et al.*, 1976), partial trisomy 20p resulting from a translocation (Krmpotic *et al.*, 1971; Francke, 1972; Šubrt and Brychnáč, 1974; Cohen *et al.*, 1975; Taylor *et al.*, 1976), ring 20 (Atkins *et al.*, 1972; Uchida and Lin, 1972; Faed *et al.*, 1972; Herva *et al.*, 1977), and so far only two reports of a partial deletion 20p have been found (Loiodice *et al.*, 1970; Kalousek and Therien, 1976). Other structural changes of F group chromosome have been found in bone marrow cells in association with various haematological disorders, such as polycythemia vera (Reeves *et al.*, 1972).

We present here a case of partial short arm deletion of chromosome 20 and compare our case with two previous cases, and discuss the common features of the clinical findings among these three patients. Using patient's red blood cells, we attempt to determine the gene locus for adenosine deaminase which has been pro-

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visionally assigned to chromosome 20 by somatic cell hybridization techniques (Tischfield *et al.*, 1974).

CASE REPORT

The patient, a full-term male infant, was born on October 1, 1971 when the father was 29 and the mother 23 years old. The family history showed no consanguinity and no affected member with any congenital abnormality. There were no abortions or stillbirths. Both parents and his younger sister are of normal phenotype. The pregnancy and the delivery were uneventful. Birth weight was 2,150 g. For reasons of asphyxia and cyanosis at birth, he was treated in an incubator for 38 days. The neonatal period was complicated by jaundice. At 18 days of age, a heart murmur was detected and broad anterior fontanelle and separation of sagittal sutures were also noted. He was admitted to our pediatric ward at Hirosaki University Hospital on November 17, 1971 with a diagnosis of possible hydrocephalus and congenital heart disease. Karyotypes of the patient were identified as 46,XY, Fp–. He was discharged on March 7, 1972. He experienced an upper respiratory tract infection followed by cyanosis, dyspnea and myotonic convulsion in December 1972. Bilateral inguinal hernia was operated at 2 years and 2 months of age. On January 10, 1977 he was readmitted to our pediatric ward for heart murmur and persistence of weakness and fatigue. At that time, his weight was 11 kg, and length 92 cm. His facial configuration gave an abnormal and idiotic impression (Fig. 1). Clinical examinations revealed antimongoloid slant, epicanthus, saddle nose, malocculusion, high arched palate, enamel hypoplasia of teeth, preauricular fistula, hearing loss, chest deformity, spina bifida, kyphoscoliosis, joint dislocation, enormous toes, thin limbs, swan neck deformity of fingers, coarse hair, and congenital heart disease (pulmonary stenosis and left superior vena cava). Course of his development was as follows: holding up head 6 months, sitting up 1 year, creeping 2 years, standing 3 years, speech 2 years, walking 3 years. According to Suzuki-Binet method IQ was 69 and gross motor was 1 year 11 months, fine motor 3 years 4 months, speech 4 years, and social 3 years. His physical growth and psychomotor development were mildly retarded.

Haematological investigations were as follows: haemoglobin was 13.2 g/dl, hematocrit 39.3%, red blood cell $5.12 \times 10^6/mm^3$, white blood cell $8,200/mm^3$ and platelets $23.8 \times 10^4/mm^3$. The preparation of peripheral blood smears revealed normal findings. Normal laboratory findings included urinalysis, serum levels of sodium, potassium, chloride, calcium, inorganic phosphate, total protein, total bilirubin, glucose, blood urea nitrogen, cholesterol, phospholipid, triglyceride, lipoprotein, and serum activity of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, lactic dehydrogenase, gamma-glutamyl transpeptidase and leucine amino peptidase. Thyroid function and kidney function tests showed normal findings. The serum levels of IgG, IgA and IgM were normal.

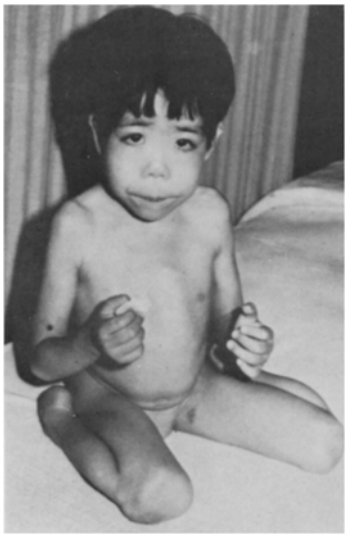

Fig. 1. Facial appearance of the patient at age of 5 years. Note antimongoloid slant, epicanthus, and saddle nose.

For the gene marker studies, the activity of adenosine deaminase of the patient's red blood cells was measured by the modified method of Letnansky and Seelich (1958). The average and standard deviation of the enzyme activity of 15 samples from early childhoods was 68.4 ± 6.6 moles adenosine/g Hb/hr and the enzyme activity of the patient was 78.0 moles adenosine/g Hb/hr which was determined to be within normal range.

CYROGENETIC STUDIES

Chromosomal analyses of the patient and his parents were performed on peripheral lymphocyte cultures using conventional procedures. Lymphocytes were incubated for 72 hours in RPMI 1640 culture media. Fibroblasts were not investigated. Chromosomal analyses have been carried out on two separate occasions. The first examination was made on December 1, 1971 according to the conventional Giemsa staining and the results showed that the modal number of the patient was 46. Twenty cells were karyotyped and the apparent abnormalities were the lack of one F group chromosome and the excess of a chromosome similar to G group. The extra chromosome had no satellites and its short arm was more distinctive than that of the Y chromosome. This chromosome was tentatively interpreted as a F group chromosome in which the short arm was partially deleted.

The second examination was made on December 10, 1975 with the fluorescence technique (Caspersson *et al.*, 1970) and a modified Giemsa banding method of Sumner *et al.* (1971). It became apparent that the extra chromosome of the patient

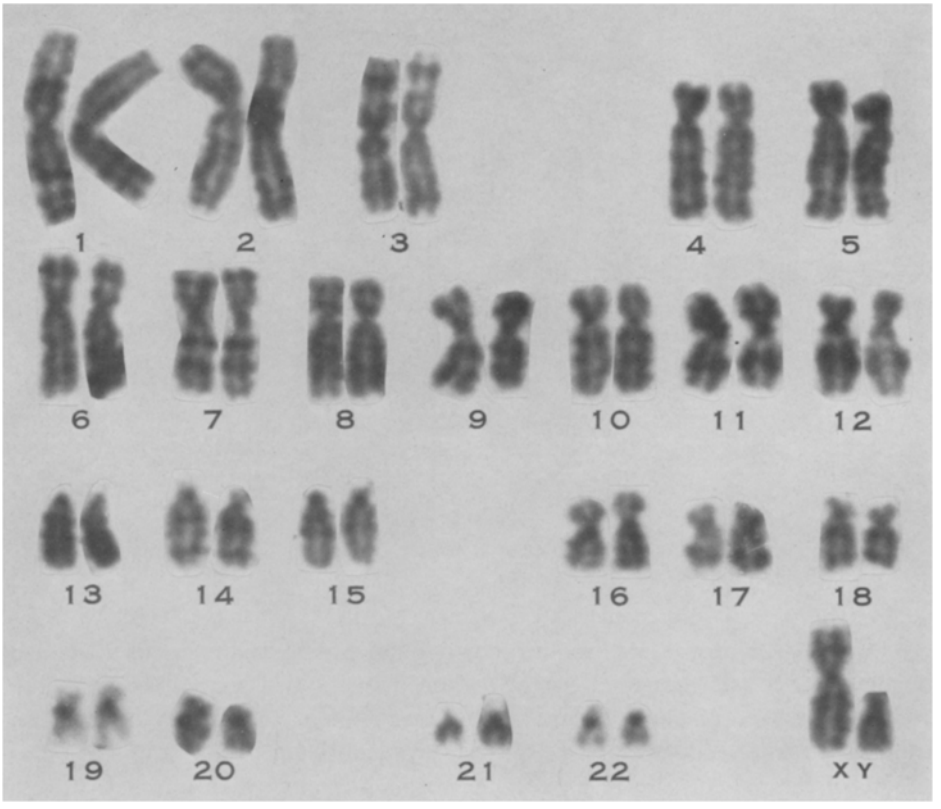

Fig. 2. G-banded karyotype of the patient: 46, XY, del(20) (p11).

was not a member of group G, but the long arm of chromosome 20 with a partial deletion of the short arm. All the other chromosomes of the patient showed a normal banding pattern. The karyotype can, therefore, be represented as: 46,XY, del(20) (p11) or 46,XY, del(20) (qter→p11:) according to the nomenclature by Paris Conference (1971) (Figs. 2 and 3). No abnormalities were found in his parents' karyotypes.

DISCUSSION

To our knowledge, only two cases of a partial short arm deletion of chromosome 20 are reported previously (Loiodice *et al.*, 1970; Kalousek and Therien, 1976). The main clinical features of our case are compared with those of the two reported cases, and are summarized in Table 1.

The features of our case common to the others are congenital heart disease, thoracic vertebral anomaly, and growth and developmental retardation. In the

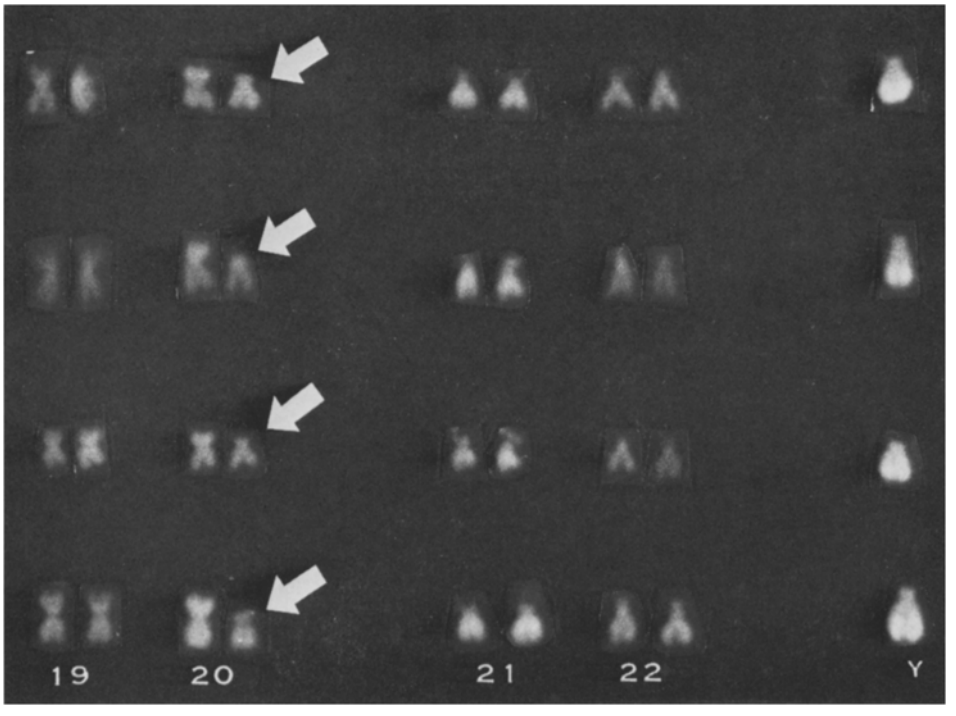

Fig. 3. Q-stained partial karyotypes of the patient. Arrow indicates chromosome 20 with partial deletion of the short arm (20p11→pter).

report of Loiodice *et al.* (1970), the patient's phenotypically mormal father had a similar chromosomal abnormality. As have been pointed by Kalousek and Therien (1976) the report by Loiodice *et al.* (1970) lacked detailed cytogenetic description and documentation of the diagnosed deletion of the short arm of chromosome 20. It was hence deduced that the karyotype to the patient's father might be a translocation between the short arm of chromosome 20 and some other chromosome. The patient described by Kalousek and Therien (1976) had the same chromosomal abnormality to our patient who had a karyotype of deletion 20p11.

Ring chromosomes are also recognized as a type of deletion in which there is a minute loss from the terminal ends of both chromosome arms. Two cases of non-mosaic ring chromosome 20 have been described by Atkins *et al.* (1972) and Herva *et al.* (1977), and two mosaic cases by Uchida and Lin (1972) and Faed *et al.* (1972). All of the four cases have common clinical features including behaviour problems, low grade mental deficiency and epilepsy. Epilepsy has not been observed in the above mentioned three patients with a partial 20p deletion.

Developmental retardation and vertebral anomaly have been observed in various cases with complete trisomy 20 (Pan *et al.*, 1976) as well as trisomy 20 with mosa-

Table 1. Comparison of main clinical features in 3 cases of deletion of short arm of chromosome 20.

	Loiodice *et al.*	Kalousek and Therien	Present case
Sex (Age)	Male (5 days)	Female (11 months)	Male (5 years)
Birth weight (g)	2,350	2,570	2,150
Growth and development	Retardation	Retardation	Retardation
Face	not stated	Flat	Normal
Eyes	not stated	Normal	Anti-mongoloid slant Epicanthus
Nose	Deviation of the nasal septum	Low nose bridge	Saddle
Mouth	not stated	Small, long philtrum	Malocculusion Enamel hypoplasia—teeth
Palate	not stated	Normal	High arched
Ears	not stated	Small ears with thick and overfolded herix	Hearing loss
Chin	not stated	Short	Normal
Neck	not stated	Short	Normal
Skeleton	Wide pituitary fossa	Absent pair of ribs	Chest deformity
	Rib fusion	Butterfly-shaped thoracic vertebral bodies	Joint dislocation
	Kyphosis		Kyphoscoliosis
	Hemispondyless		Spina bifida
	Neonatal osteoscoliosis		
Fingers and toes	not stated	Talipes equinovarus	Enormous toes
		Deep plantar furrows	Swan neck deformity of fingers
CHD	Right ventricular hypertrophy	Mitral atresia	Pulmonary stenosis
		Common ventricle	Left superior vena cava
	Right axis deviation	Infundibular pulmonary stenosis	
		Left pulmonary branch stenosis	
Others	Right kryptorchidism	Redundant skin on the neck	Inguinal hernia
	Phlebitis	Mid-ileal atresia with a microcolon	Coarse hair

icism (Pallister *et al.*, 1976) and partial trisomy 20p (Krmpotic *et al.*, 1971; Šubrt and Brychnáč, 1974; Taylor *et al.*, 1976). It seems that vertebral anomaly, *i.e.* kyphoscoliosis, may be correlated with anomaly of chromosome 20. Further cases with 20p— will provide a better clinical delineation of this abnormality.

The gene locus for adenosine deaminase has been assigned to chromosome 20 by somatic cell hybridization techniques (Tischfield *et al.*, 1974). However, it is yet unknown whether this gene locus is located on the long arm or short arm of chromosome 20. Taylor *et al.* (1976) have reported that adenosine deaminase

activity was not affected in two patients with partial trisomy 20p derived from a t(18; 20) translocation. In the present study adenosine deaminase activity of the patient was within normal range. These facts suggest that the gene locus for the enzyme is not located on the deleted part of the short arm of chromosome 20, but presumably on the long arm or the proximal part of the short arm, *i.e.* 20p11→qter.

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