Ring chromosome 10 and its clinical features

SUMMARY A 2-year-old boy with mental and growth retardation is presented; he has a 46,XY,r(10)(p15q26) chromosome complement. Five previously reported cases of ring chromosome 10 were reviewed and compared with the present case in an attempt to delineate a clinical syndrome. Since the first description, identified by Giemsa banding by Lansky et al,1 four other r(10) patients have been described.2–5 Their common features were mental and growth retardation, low birth weight, microcephaly, stubby nose, hypertelorism, strabismus, wide set nipples, single transverse palmar creases, undescended testes, and hypoplastic scrotum. In some of the cases congenital heart disease was present.

Case report

The proband was born on 5.11.77, the first child of unrelated, healthy parents, after an uneventful term pregnancy and normal delivery. The father was 25 years old and the mother 22 at his birth and there had been no exposure to radiation or drugs. His birth weight was 2540 g (−1.7 SD). At the age of 2 months, he was admitted to hospital because of feeding difficulties and for evaluation of his physical development. He had an episode of febrile convulsions when he was 10 months old, but no abnormalities were found on the electroencephalogram. At the age of 10 months, he was 66.8 cm in height (−3.6 SD), weight was 5.8 kg (−3.9 SD), and head circumference 41 cm (−3.8 SD); he had poor head control.

Clinical features were mental and growth retardation, microcephaly, hypertelorism, internal strabismus, stubby nose, low set ears, long philtrum, bilateral single transverse palmar creases, clinodactyly of the fifth fingers, funnel chest, small penis, undescended testes, and hypoplastic scrotum (fig 1). Dermatoglyphs of the patient showed an increased number of whorls but no other special findings. There was no congenital heart disease.

Routine laboratory examinations of the patient’s blood, serum, and urine showed no abnormalities. Slight retardation of bone maturation was found on x-ray.

Development quotient was estimated as 40% at the age of 15 months by Thumori-Inage’s questionnaire.

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References

The results and chromosome, normal. The patient's peripheral infection lymphoblastoid cells had been replaced by a large dicentric ring or an interlocked double ring, though such alterations were infrequent.

Some cells with normal karyotypes have been found in lymphocytes or fibroblasts of previously reported cases. Because of the normal parental karyotypes, the ring chromosome must have been formed in the early zygote.

Parental age was not always high at the birth of these patients. All the pregnancies went to term but the infants were small for dates, indicating antenatal immaturity. Growth retardation was severe and all cases were under 3 SD for weight, height, and head circumference. Mental retardation was also common.

No specific findings were found to help make a clinical diagnosis of r(10) syndrome, but the common features were mental and growth retardation, low birth weight, microcephaly, stubby nose, hypertelorism, strabismus, wide set nipples, single transverse palmar creases, undescended testes, and hypoplastic scrotum. In some cases congenital heart disease was present. In two instances the break points were in p14 and p15q25, and the others and the present case had breaks in band p15q26. Cases in which a larger part of the chromosome was lost had more severe anomalies such as congenital heart disease.

Other occasional findings were choroidal aplasia, coloboma choroidea, and abnormality of the urinary tract. Two cases had episodes of febrile convulsions in infancy.

**Discussion**

The clinical features associated with ring chromosome 10 depend on the position of the breakpoints and on the mosaicism resulting from the unstable nature of the ring at cell division. In the present case, the ring chromosome had sometimes been changed into a large dicentric ring or an interlocked double ring, though such alterations were infrequent.

CYTOGENETIC STUDIES

Chromosome analysis was performed on peripheral blood lymphocytes stimulated with phytohaemagglutinin. One hundred metaphases were analysed and 94 cells had 46 chromosomes. In 91 of these, one chromosome 10 was replaced by a ring chromosome. Three cells showed a large dicentric ring. Five metaphases had 45 chromosomes lacking the ring chromosome, and one had 47 chromosomes with interlocked double rings.

A lymphoblastoid cell line was established from the patient's peripheral blood by Epstein-Barr virus infection in vitro. After one month of culture, the lymphoblastoid cells were analysed. Cultured skin fibroblasts were also analysed after three passages. The results are listed in the table.

G banding confirmed the karyotype 46,XY,r(10) (p15q26) (fig 2). The parental chromosomes were normal.

**Figure 2** Partial karyotype 46,XY,r(10)(p15q26) (G banded).

**Table** Karyogram of the patient.

<table>
<thead>
<tr>
<th></th>
<th>46,XY,r(10)</th>
<th>45,XY,−10</th>
<th>45,XY,r(10)*</th>
<th>Interlocked ring</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHA stimulated T lymphocytes</td>
<td>91</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>EB virus infected B cell line</td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Cultured skin fibroblasts</td>
<td>32</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>38</td>
</tr>
</tbody>
</table>

*Large ring 10.

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**Tetrasomy 18p: tentative delineation of a syndrome**

**Summary** A patient is described with multiple congenital anomalies and probable tetrasomy 18p resulting from an extra i(18p) in an otherwise normal karyotype. Review of ten previously reported i(18p) cases allowed the tentative characterisation of a tetrasomy 18p syndrome.

Many cases of extra marker chromosomes have been reported, including familial and ‘de novo’ events. In the inherited cases the extra chromosome appears not to be causally related to the phenotype of the probands. The de novo cases present a variety of clinical pictures depending on the different origins of the markers.

With the improvement of chromosome banding techniques, efforts have been made to identify these extra chromosomes more precisely. This paper reports a case of multiple congenital anomalies associated with an extra marker, identified as an isochromosome of the short arm of chromosome 18.

**Case report**

The patient is the only male child of unrelated, healthy parents. The mother was 20 and the father 22 years old at the time of his birth. Undiagnosed anomalies were found in four paternal relatives of the proband: an aunt, two stillborn first cousins, and a first cousin once removed. The proband was born at term after an uncomplicated pregnancy and a normal delivery. The length at birth was 48 cm, weight 2800 g, and head circumference 33 cm. Neonatally he had a short period of jaundice and sucked poorly. He had three episodes of febrile tonic-clonic seizures when 6 months old. Psychomotor development was retarded: he sat at 14 months of age, could stand with support, and had no speech. Physical examination at the age of 14 months showed: height 79 cm, head circumference 42.5 cm (below the 2nd centile), brachicephaly, flat occiput, prominent forehead, low hair line, facial hypoplasia on the right, a right ear with rudimentary helix and antihelix and wide concha, high arched palate, horizontal palpebral fissures, slightly flat nose, bilaterally adducted thumbs, short halluces, and clinodactyly of the 5th toes. Neurological examination showed mild hypertonia of the left limbs and ankle clonus on the left. Skull x-rays were normal. Serum immunoglobulin levels (IgA, IgG, and IgM) and urine analysis for amino-acids were normal. Dermatoglyphic patterns are summarised in table 1. The Walker index was −2.08.

**Cytogenetic studies**

Chromosome analyses were done on cultured peripheral lymphocytes. Q and C banding were performed according to Caspersson et al. and Sumner, respectively. Ag–NOR staining was by the technique of Bloom and Goodpasture. There were 47 chromosomes among 100 cells analysed. The extra chromosome was metacentric, smaller than the G group chromosomes, without satellites, and was not seen to participate in satellite associations. Q banding (fig 1) showed a symmetrical staining pattern in its arms. The size of the arms and their fluorescence intensity were comparable to those of the short arm of chromosome 18. After C banding (fig 2) a single centromeric band was observed and its size was similar to that of chromosome 18. Ag-stained NORs were not present in either arm (fig 3). These observations led us to believe that the extra marker chromosome is most

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**TABLE 1 Dermatoglyphic patterns of the proband.**

<table>
<thead>
<tr>
<th>Digits</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>a-b ridge count</th>
<th>adl angle</th>
<th>Palmar area</th>
<th>Holhual area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>L9</td>
<td>L7</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>47</td>
<td>101°</td>
<td>L0</td>
<td>L0</td>
</tr>
<tr>
<td>Right</td>
<td>W</td>
<td>L5</td>
<td>L8</td>
<td>W</td>
<td>W</td>
<td>53</td>
<td>87°</td>
<td>L0</td>
<td>L0</td>
</tr>
</tbody>
</table>

*No pattern was found in the remaining palmar areas.
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