Discussion

It is believed that the occurrence of females with a triple X karyotype is probably higher than previously suspected. Thus, the woman in our case was discovered after she had given birth to a child with Turner’s syndrome. There was nothing about her menstrual history and physical appearance that would have indicated that she possessed an extra X chromosome. While a number of triple X females have given birth, the offspring had been chromosomally normal, until Singer et al (1972) reported a triple X case and a Down’s syndrome offspring. The case of the present report is the second example of a triple X female producing a child with a chromosomal abnormality, and to our knowledge the first case of Turner’s syndrome offspring.

In order to afford an explanation for this association we accept the presence of some genetic control over non-disjunction in familial cases possessing mosaixploidy. Another explanation that could be considered is a chance occurrence; however, it is impossible at present to show which one of these two explanations is correct.

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Confirmation of trisomy 22 by trypsin-giemsa staining*

Summary. A small-for-dates male infant with mental retardation, microcephaly, malformed ears, preauricular sinuses, epicanthal folds, micrognathia, congenital heart disease, micropenis, and micropolygyria of the parietal and occipital lobes of the cerebral cortex was shown to have a 47,XY,+22 karyotype by trypsin-giemsa banding. Review of reported cases confirms that there may be distinctive trisomy 22 syndrome.

Before the advent of banding techniques it was assumed that an extra G group chromosome without signs of the Down syndrome indicated trisomy for chromosome No. 22 (Hsu et al, 1971). Attempts have been made to delineate a clinical syndrome. Banding techniques have shown several examples of partial trisomy 15 (Watson and Gordon, 1974) and four cases with trisomy 22 (Bass, Crandall, and

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Case reports

This male infant was born to a 27-year-old gravida 6, para 6, mother and a 42-year-old father. The family history was negative for abortions, stillbirths, or congenital malformations. The only medications taken during pregnancy were iron and vitamins. At the time of his birth he weighed 1960 g, with a length of 46.4 cm, and a head circumference of 29.8 cm; all below the third centile. Physical examination revealed a small-for-dates male infant with the following congenital anomalies: micrognathia, bilateral preauricular sinuses, low-placed poorly formed ears, and absence of the uvula. There were epicanthal folds with small eye openings. The penis was small, approximately 15 mm long and 4 mm in diameter. The testes were undescended but could be palpated in the inguinal canal. The scrotum was partially bifid and the folds almost met above the penis. There was a grade 2–3/6 midsystolic ejection murmur heard over the left upper sternal border.

Routine laboratory studies included normal CBC, electrolytes, BUN, and urinalysis. The blood group was B, Rh positive and the direct Coombs was negative. The IgM was 23 mg/dl.

Fig. 1.

Fig. 2.
A chest x-ray film and a nasogram were both normal. Because of persistent feeding difficulty, an oesophago-
gram was done. It showed significant oesophageal
reflux. Both an intravenous pyelogram and a cystoure-
throgram were normal.

The child was followed on an outpatient basis for a
period of three months, after which time the parents
stopped bringing him to the clinic. At three months the
head circumference was 35.5 cm, length was 51 cm, and
weight was 2880 g, all below the third centile.

At the time of his death (age 191 days) the patient
weighed 2600 g, head circumference was 38 cm, and
length was 54 cm. Necropsy (Fig. 1) confirmed the ex-
ternal multiple congenital anomalies already described as
well as a patent fenestrated foramen ovale and micro-
polygyria of the parietal and occipital lobes of the cere-
bral cortex. The cause of death was pneumococcal
septicaemia and pneumococcal meningitis.

Chromosome analysis of cultured leucocytes of the
patient showed 47 chromosomes with an extra member of
the G group. The extra chromosome had the pattern of
a No. 22 with the trypsin-giemsa technique (Seabright,
1971) (Fig. 2). One of the 22's appears smaller than the
other two. Measurements of arm length ratios of chro-
mosome No. 22 (q/p + q)) in numerous mitoses re-
vealed that in approximately 50% of the cells there was a
smaller No. 22 and that in 50% of the cells all three 22's
appeared to be the same size. The banding pattern of
the other chromosomes was normal. Cultured leuco-
cytes of both parents produced normal karyotypes with
routine preparations and with trypsin-giemsa banding.
Because of technical difficulties we were unable to obtain
evidence from fluorescent satellites to determine in
which parent the non-disjunction event had occurred.

Discussion

Attempts to establish trisomy 22 as a clinical en-
tity have been hampered by the inability of the stan-
dard giemsa chromosome staining technique to dis-
tinguish between chromosomes 21 and 22. In
spite of this difficulty, 13 patients with similar clin-
cal and cytogenetic findings have been summarized and
presented as comprising a syndrome (Hsu et al,
1971). Six additional cases have since been re-
ported (Goodman et al, 1971; Walbaum et al, 1970; Bass
et al, 1973; Hirschhorn et al, 1973; Penchaszadeh
and Coco, 1975) with three confirmed by fluo-
rescent and trypsin-giemsa banding (Bass et al,
1973; Penchaszadeh and Coco, 1975) and one con-
firmed by trypsin-giemsa banding (Hirschhorn et al,
1973). We cannot eliminate the possibility that our
patient has two cell lines: one cell line with com-
plete trisomy 22 and one cell line with a partial
deletion of the long arm of the extra chromosome
No. 22.

There are a number of clinical features which are
common to most of the reported cases of trisomy 22
(Table). Walbaum's patient (1970) was excluded

from the tabulation because the clinical features were
not consistent with the other reported cases. These
include mental retardation, growth retardation,
microcephaly, micrognathia, preauricular skin
tags, appendages or sinuses, low-set or malformed
ears, congenital heart disease, deformed lower ex-
tremities, and cleft palate. Our patient had most of
these features as well as epicanthal folds, small eye
openings, absent uvula, micropenis, undescended
testes, and micropolygyria of the parietal and occipital
lobes.

The clinical features of the 16 previously re-
ported patients and this patient provide evidence for
the existence of a trisomy 22 syndrome. The iden-
tification of additional banded karyotypes of
patients with trisomy 22 will permit a clearer deli-
nation of the features of this chromosome anomaly
without confounding by other abnormalities such as
partial trisomy 15 or other abnormal chromo-
somes with similar morphology.

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Genetics, 36, 375–379.

**TABLE**

<table>
<thead>
<tr>
<th>Feature</th>
<th>No. with Feature/ No. Reporting</th>
<th>Our Patient</th>
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</thead>
<tbody>
<tr>
<td>Males</td>
<td>5/18</td>
<td>-</td>
</tr>
<tr>
<td>Females</td>
<td>13/18</td>
<td>-</td>
</tr>
<tr>
<td>Increased maternal age (&gt;35)</td>
<td>6/17</td>
<td>+</td>
</tr>
<tr>
<td>Increased paternal age (&gt;35)</td>
<td>6/17</td>
<td>+</td>
</tr>
<tr>
<td>Mental retardation</td>
<td>14/14</td>
<td>+</td>
</tr>
<tr>
<td>Growth retardation</td>
<td>14/14</td>
<td>+</td>
</tr>
<tr>
<td>Microcephaly</td>
<td>14/15</td>
<td>+</td>
</tr>
<tr>
<td>Low-set and/or malformed ears</td>
<td>14/16</td>
<td>+</td>
</tr>
<tr>
<td>Micrognathia</td>
<td>13/17</td>
<td>+</td>
</tr>
<tr>
<td>Preauricular skin tags, appendages or sinuses</td>
<td>11/17</td>
<td>+</td>
</tr>
<tr>
<td>Cleft palate</td>
<td>11/18</td>
<td>-</td>
</tr>
<tr>
<td>Deformed lower extremities</td>
<td>9/16</td>
<td>-</td>
</tr>
<tr>
<td>Congenital heart disease</td>
<td>10/17</td>
<td>-</td>
</tr>
<tr>
<td>Cubitus valgus</td>
<td>4/6</td>
<td>-</td>
</tr>
<tr>
<td>Finger-like or malopposed thumbs</td>
<td>5/8</td>
<td>-</td>
</tr>
<tr>
<td>Abnormal and/or low-set nipples</td>
<td>4/7</td>
<td>-</td>
</tr>
</tbody>
</table>

**CLINICAL FEATURES OF TRISOMY 22**

This table lists the clinical features associated with trisomy 22.
Inclusion of satellites in an 18/21 translocation chromosome shown by ammoniacal-silver staining (sat-banding) in case of partial trisomy 18*

Summary. A male infant with a partial trisomy 18 and a 46,XY,−21,t(18;21)(18qter→18q12:21p13→21qter) chromosome complement is described. The translocation chromosome is of special interest because it includes the satellites of chromosome 21. This was shown by differential satellite staining with the ammoniacal-silver technique.

The first case of partial trisomy 18 involving a translocation (with a D group chromosome) was reported in 1962 by Brodie and Dallaire. Since that time numerous cases have been reported involving translocation of 18q material with B group chromosomes (Gagnon et al, 1963; Valdmanis et al, 1967; Freiman and Wilton, 1967; Albery et al, 1968; France and Butler, 1969; Eriksson et al, 1971; Rudd and Lamarche, 1971); with C group chromosomes (Orye and van Caster, 1972), D group (Hecht et al, 1963), and with E group chromosomes (Rohde, Lee, and Sapin, 1963; Jenkins, Weed, and Sandstrom, 1974).

The case presented here is that of an infant whose features suggest trisomy 18 (Fig. 1A, B), and who has a translocation of 18q material to the short arms of a chromosome 21. The case appears to be unique in that we are not aware of another such translocation and that the 18q material seems to be attached to the 21 satellites. This was shown by using a special satellite staining technique.

Case report

The propositus was the third child born to a healthy 34-year-old mother and a 38-year-old father. The birth was characterized by a vertex presentation and low Apgar scores; birthweight was 2405 g. The infant was fed by gavage in the immediate newborn period. At 15 days of age he developed congestive heart failure, and a large defect in the interventricular wall was identified by angiocardiography. Since then the patient has been under control with digitalis. At age 2 months seizures developed, which could be controlled with phenobarbital, 15 mg twice per day. Casts were applied because of congenital bilateral equinovarus deformity. The patient was referred to this unit at 7 months of age for evaluation because of his anomalies and developmental retardation. At this time his weight was 5208 g, length 60.5 cm, and head circumference 41.25 cm (all much below the 3rd centile). The skull was elongated, a swirl pattern was noted at the midline over the parietal prominence, and hirsutism was present on the forehead. Other noteworthy features included: slight upward slant of the palpebral fissures, micrognathia, high-arched palate, tongue with a bilobulated appearance marked by what appeared to be a median raphe, and anteverted nostrils. Each ear had a very small lobe. The neck was short and there was redundant skin on the nape. A dimple was present at the cubital head area on the left wrist. Radial deviation of the left hand was noted. Dermatoglyphic analysis revealed an arch pattern on all 10 fingers, and multisotted areas of undefined pattern on the palms and soles. The toenails were hypoplastic. There was unilateral (left) cryptorchidism and first degree hypospadias with a small penis. A small umbilical and large inguinal hernia were noted on the left side.

An intravenous pyelogram showed duplication of the left collecting system. Audiological assessment indicated perception of high-intensity stimuli; an otological examination was normal. An electroencephalogram showed a mild but definite abnormality caused by left central temporal spike activity.

Cytogenetic studies

A chromosome analysis from peripheral blood was initiated at the time of examination because of the abnormalities just described. The chromosome complement was found to contain a Gp+ chromosome in all