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Partial Trisomy for the Long Arm of Chromosome 7. Case Report and Review

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Summary. We reviewed partial trisomy of the long arm of chromosome 7 after a new case was brought to our attention. The clinical differences between the various types of trisomies 7q were evaluated by statistical analysis, and three groups were defined. These groups correspond to the segments q22 or q21→q31, q31→qter, and q32→qter, and would seem to represent three different syndromes, of which one is more serious than the other two.

Introduction

A series of reports describing different segments in relation to partial trisomy 7q have been published since 1972, and the discussions in these studies have dealt with the correlation of these trisomies to one or more syndromes.

In 1974 Berger et al. defined two different partial trisomy 7q syndromes: The first involved bands 7q31→7qter and was characterized by low birth weight, growth and mental retardation, cranial abnormalities, absence of microcephaly, cleft palate, low-set ears, anomalies of muscule tone, and psychomotor retardation; the second syndrome was associated with trisomy of bands 7q21 or 22→q31 and was characterized by narrow palpebral fissures, epicanthus, flattened nasal bridge, absence of microretrognathia and cleft palate, hypotonicity, and growth retardation. Turleau et al. (1976), when describing a new case, questioned this definition of the two syndromes as different entities. Later, Vogel (1977) reviewed the published cases and identified trisomy 7q31→7qter as a clearly differentiated syndrome within the group of partial trisomies 7q, the features being low birth weight, retardation of development, cleft palate, microretrognathia, small nose, hypertelorism, small palpebral fissures, and occasional skeletal anomalies.

More recently, Schmid et al. (1979) found the common features of the trisomies 7q32→7qter to be low birth weight, developmental retardation, high forehead with broadly protruding ossa parietalia, wide and flattened nasal bridge, short neck, deep-seated ears, and a tendency to hypertelorism and epicanthus. They also pointed out the absence of micrognathia and cleft palate as a characteristic which distinguishes it from other trisomies 7q and therefore makes it possible to define the clinical syndrome for the trisomy of the segment 7 (q32→qter).

Thus, from these observations, it seems possible to separate three different chromosome segments which determine three possible clinical syndromes. Later publications (Yunis et al. 1980), however, still refer to only two groups: that of the interstitial trisomies and that of the terminal trisomies.

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In this publication, we hope to bring this subject up to date, and, by using statistical analysis, to evaluate more precisely the significance of the clinical differences of these partial trisomies mentioned above.

Material and Methods

Review of Literature

Data taken from 18 cases were included in our study (Tables 1 and 2). Of these cases, three are interstitial and are concerned with the same segment 7(q22→q31), and the rest are terminal, with various duplicated segments: one of 7(q22→qter), four of 7(q31→qter), nine of 7(q32→qter), and one of 7(q33→qter).

The origins of the trisomies in the reviewed cases, except for cases 13 and 14, could all be traced to apparently balanced parental translocations. Cases 1, 2, and 3 involve partial trisomies 7(q22→q31) produced as a result of parental insertional translocations. The rest of the cases, 4 thru 19, are of terminal trisomies produced by (a) *complex parental translocations,* as in case 17, in which we discovered an additional partial trisomy in the short arm of chromosome 20(p11→pter); (b) *parental inversion,* as occurred in cases 13 and 14, which are the result of a crossing-over into the inverted segment and, additionly, a partial monosomy found in the short arm of the same chromosome, 7(p22→pter); (c) *terminal parental translocation,* as occurred in cases 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, and 19. In these it is very difficult to determine whether an insertional or reciprocal translocation is present. In the latter case it would suppose the existence of an additional monosomy of the telomeric region in the chromosome carrying the trisomic segment.

The majority of the authors commented about this possibility, although they could provide no evidence for it: Carpentier et al. (1972) mentioned possible partial monosomy 12(q24→qter); Alfi et al. (1973), 14qter; Al Saadi and Moghadan (1976), 5(q35→qter); Berger et al. (1977), 9qter; Bass et al. (1973), 21qter; Schmid et al. (1979), 2qter; Schinzel and Tonz (1979), 5(p151→pter); Turleau et al. (1976), 18pter.

Only Schinzel and Tonz (1979) gave evidence of the monosomy, based on the clinical picture of their patient, who presented the typical characteristics of a cri-du-chat syndrome, closely related with the absence of band 5p15.

Case Report

The patient was the first child of phenotypically normal, nonconsanguineous parents, who were 24 and 31 years old at the

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Table 1. Cytogenetic findings in trisomy 7q

Case	Trisomy	Reference
1	q22→q31	Grace et al. (1973)
2	q22→q31	Berger et al. (1974)
3	q22→q31	Serville et al. (1975)
4	q22→qter	Carpentier et al. (1972)
5	q31→qter	Alfi et al. (1973)
6	q31→qter	Vogel et al. (1973)
7	q31→qter	Al Saadi et al. (1976)
8	q31→qter	Berger et al. (1977)
9	q32→qter	Newton et al. (1972)
10	q32→qter	Bass et al. (1973)
11, 12	q32→qter	Moric-Petrovic et al. (1976)
13, 14	q32→qter	Winsor et al. (1978)
15	q32→qter	Schmid et al. (1979)
16	q32→qter	Schinzel and Tonz (1979)
17	q32→qter	Felding and Mitelman (1979)
18	q32→qter	Present report
19	q33→qter	Turleau et al. (1976)

with craniofacial dysmorphia and some prominence of the cranium over the face, hypertelorism, indentations lateral to the eyebrows, flattened nasal bridge, and malformed, but normally seated, ears. The neurological examination revealed definite hypotonia; radiological studies showed that there was kyphoscoliosis of a triple curvature, flattening of the vertebra C3, a hemivertebra D9, and dislocation of the right hip; EEG examinations indicated a slight increase in the slow component. All laboratory tests yielded normal results, except for a high level of glycine.

Cytogenetic studies were carried out by means of peripheral blood lymphocyte cultures prepared according to standard methods; with GTG and CBG banding, the karyotype of the patient proved to be 46,XX,3p$^+$ (Fig. 1). The karyotype of the mother was inconspicuous, whereas that of the father revealed a reciprocal translocation (Fig. 2) between chromosomes 3 and 7, this translocated segment being 7(q32→qter); the patient is therefore trisomic for the bands 7q32→7qter, and her karyotype can be designated as 46,XX,−3 +der t(3;7)(p27;q32), although an additional monosomy for the telomeric region of 3p cannot be ruled out.

Table 2. Clinical findings in trisomy 7q

Features	Case																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Low birth weight	−	−	+	+	+	+	+	−	+	+	−	+	−	+	+	+	+	−	−
Retardation of development	+	+	+		+			+	+	+	+	+	+	+	+	+	+	+	+
Wide-open fontanelle	−	−	−	+	+	+			−	−	+	−	−		−	+		−	−
Hypertelorism	+	+	−	+		+	+	−	−		−	−	−	−	+	+	−	+	−
Epicanthus	+	+	−	−		−		−	−		+	−	+		+	+	−	+	−
Strabismus	+	+	+	−	−	−	−	+	−	−	−	−			+	−	−	−	+
Small palpebral fissures			−	+	+	+		−	−		−	−			−		−	−	−
Low-set ears	+	−	+	+	+	+	+	+	−	+	+	−	−	+	+	+	+	−	+
Ear anomalies	−	−	−	+	+	−	+		−	−	−	−	−	−	+	+	−	+	−
Small nose	+	+	−	−	+		+	−		−	+	+	−		+	+	+	+	−
Cleft palate	−	−	−	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−
Large tongue	−	−	−	+					+		−	+	−	+	−				−
Microretrognathia	−	−	−	+	+	+	+	+	−	+	−	−	−	−	−	−	+	−	−
Frontal bossing	−	+	+	+	−		−	+	−	+	−	−	−		−		−	+	−
Skeletal anomalies	−	−	−	−	+	+		+	+	+	+		+	−	+	+	+	+	−
Kyphoscoliosis	−	−	−	−	−	−	−	−	+	+	−		+	−	+	−	−	+	+
Dislocation of the hip	−	−	−	−	−	−	−	−	+	+	−		−	−	−	−	−	+	−
Hypotonia	−	+	+	+					−	−	+	−	+	−	+	+		+	+
Hypertonia	+	−	−	−	+				−	−	−	+	−	−	−	−	+	−	−
Early postnatal death[a]	−	−	−	+		+	+	+	−	−	−	−	−	−	−	+	−	−	−

[a] Within the first year

time of the child's birth, there being no history of previous abortions. The pregnancy was uneventful, and delivery was at term, the birth weight being 3300 g.

At the age of 10 months, the child showed psychomotor retardation and was unable to maintain a sitting position or recognize her parents, although she could hold objects in her hands. Her general appearance indicated neurological illness,

Statistical Analysis

Statistical methods were applied to the information gathered from the nineteen reported cases in order to arrive at a more rigorous definition of the importance of the differences between the clinical characteristics present in the various types of partial trisomies. Thus, the information was put into three groups:

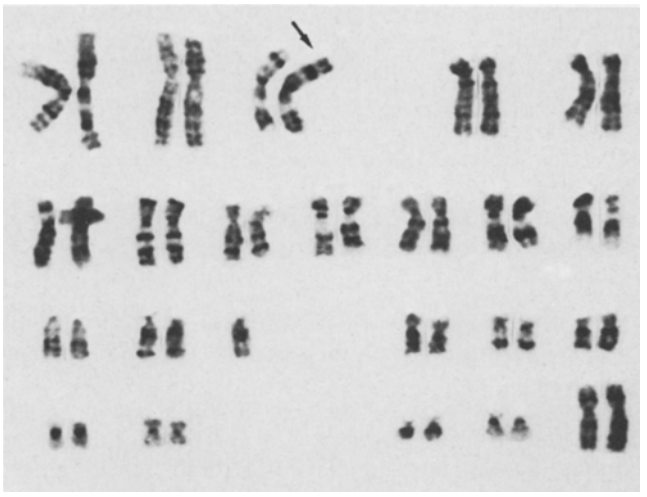

Fig. 1. Karyotype of the patient (G-banding)

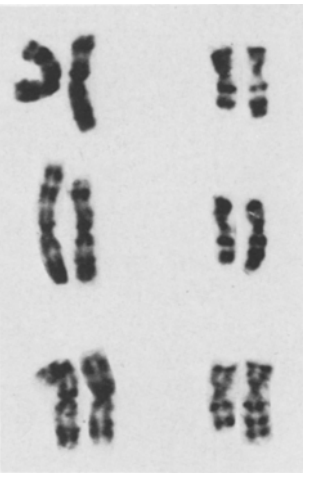

Fig. 2. Partial karyotype revealing the balanced paternal translocation

Table 3. Statistical analysis

Features	P1	P2	P3	W_{1-2}	t_{1-2}	W_{1-3}	t_{1-3}	W_{2-3}	t_{2-3}
Low birth weight	1/3	3/4	7/11	0'6	1'110 (ns)	0'45	0'978 (ns)	0'15	0'363 (ns)
Retardation of development	3/3	2/2	11/11	0	0 (ns)	0	0 (ns)	0	0 (ns)
Wide-open fontanelle	0/3	2/2	2/9	>2	>3'098 (ns)	0'7	0'058 (ns)	1'5	2'714*
Hypertelorism	2/3	2/3	3/10	0	0 (ns)	0'5	0'038 (ns)	0'5	1'074 (ns)
Epicanthus	2/3	0/2	5/9	1'35	2'091 (ns)	0'15	0'013 (ns)	1'2	2'171 (ns)
Strabismus	3/3	1/4	2/9	1'5	2'777*	1'5	3'182**	0'05	0'079 (ns)
Small palpebral fissures	0/1	2/3	0/7	1'35	1'653 (ns)	0	0 (ns)	1'33	2'726*
Low-set ears	2/3	4/4	7/11	0'9	1'666 (ns)	0'03	0'065 (ns)	0'9	2'180*
Ear anomalies	0/3	2/3	3/11	1'35	2'338 (ns)	0'75	0'054 (ns)	0'6	1'303 (ns)
Small nose	2/3	2/3	6/9	0	0 (ns)	0	0 (ns)	0	0 (ns)
Cleft palate	0/3	4/4	0/11	>2	>3'703*	0	0 (ns)	>2	>4'844**
Large tongue	0/3	0/0	3/7	0	0 (ns)	1	2'049 (ns)	1	0 (ns)
Microretrognathia	0/3	4/4	2/11	>2	>3'464*	0'6	1'302 (ns)	1'6	3'875**
Frontal bossing	2/3	1/3	2/9	0'5	0'866 (ns)	0'65	1'379 (ns)	0'15	0'318 (ns)
Skeletal anomalies	0/3	3/3	8/10	>2	>3'464*	1'55	3'330**	0'67	1'439 (ns)
Kyphoscoliosis	0/3	0/4	6/10	0	0 (ns)	1'25	2'685**	1'27	3'036*
Dislocation of the hip	0/3	0/4	3/10	0	0 (ns)	0'7	1'504 (ns)	0'8	1'912 (ns)
Hypotonia	2/3	0/0	6/10	1'35	0 (ns)	0'09	0'193 (ns)	1'27	0 (ns)
Hypertonia	1/3	1/1	2/11	1'4	1'714 (ns)	0'25	0'543 (ns)	1'6	2'081 (ns)
Early postnatal death	0/3	3/3	1/11	>2	>3'464*	0'4	0'868 (ns)	1'8	3'908**

(ns) = nonsignificant; * = significant, $P = 0.05$; ** = significant, $P = 0.01$
' = .; e.g., 1'110 = 1.110

group 1, interstitial trisomies; group 2, trisomies of the segment q31 → qter, and group 3, trisomies of the segment q32 → qter. In each group the proportion of a given clinical feature in the total sample was obtained (see P_1, P_2, P_3 in Table 3), and then the proportions of the groups were compared.

To set up comparisons between groups we have used the Lawshebaker nomogram to calculate the w coefficients (Downie and Health 1971). Then these w coefficients were compared by using Student's test, as given by the equation

$$t = \mathrm{w} \sqrt{\frac{2 N_i N_j}{N_i + N_j}} \qquad (i = 1,2,3,) \quad (j = 1,2,3,)$$

Results

The difference in proportions between groups 1 and 2 is significant for the following features (see Table 3): strabismus, cleft palate, microretrognathia, skeletal anomalies, and early postnatal death; between groups 1 and 3: strabismus, skeletal anomalies and kyphoscoliosis; and between groups 2 and 3: wide-open fontanelle, small palpebral fissures, low-set ears, cleft palate, microretrognathia, kyphoscoliosis, and early postnatal death.

Table 4. Clinical features according to the triplicate segment

Tris 7(q22→q31)	Tris 7(q31→qter)	Tris 7(q32→qter)
Retardation of development	Low birth weight	Low birth weight
Hypertelorism	Retardation of development	Retardation of development
Epicanthus	Wide-open fontanelle	Low-set ears
Strabismus	Hypertelorism	Small nose
Low-set ears	Low-set ears	Skeletal anomalies
Small palpebral fissures	Ear anomalies	Kyphoscoliosis
Frontal bossing	Small palpebral fissures	Hypotonicity
Hypotonicity	Small nose	No microretrognathia
No skeletal anomalies	Cleft palate	No cleft palate
No microretrognathia	Microretrognathia	No early postnatal death
No cleft palate	Skeletal anomalies	
No early postnatal death	Early postnatal death	

In other words, one can say that trisomy of the segment 7q31→7qter has the following distinctive features with respect to the other trisomies: microretrognathia, cleft palate, skeletal anomalies, and early postnatal death. Such characteristics are not found in trisomy of the segment 7q21→7q33, but strabismus is present. With trisomy of the segment 7q32→7qter kyphoscoliosis occurs, and as in trisomies of the interstitial segments, there is no evidence of cleft palate, microretrognathia, and death within the year.

Discussion and Conclusion

These results indicate three clearly defined groups within partial trisomies of the long arm of chromosome 7, corresponding to segments q21 or 22→q31, q31→qter, and q32→qter, which would possibly determine three different clinical syndromes, one of which is more serious than the other two (Table 4).

It is interesting to note that all the patients with trisomy of 7q31→7qter described in the literature to date died soon after birth, while those with the other types of trisomy lived well over 1 year, except one patient who in addition had deletion 5p, with serious anomalies common to this syndrome, and died on the 26th day.

In 1976, Turleau et al. reported a case of trisomy 7(q33→qter) with clinical features more similar to those of the syndrome of interstitial trisomies than to those of distal segment trisomies, which Berger et al. described in 1974. This caused him to doubt that these two syndromes are distinct entities. The case Turleau et al. described involved a much more distal segment than those reported by Berger et al. and would be put into the group of trisomies q32→qter, which had not yet been established as a group at that time.

Besides the great variety of uncertain associations of trisomies and monosomies, the similarity in the clinical traits leads us to think that the alterations presented by the patients are due in the majority of cases to partial trisomies at different segments of chromosome 7. In Table 3 we attempted to summarize the findings that would seem to be characteristic of each of the groups.

References

Alfi OS, Donnel GN, Kramer SL (1973) Partial trisomy of the long arm of chromosome No. 7. J Med Genet 10:187–189

Al Saadi A, Moghadan HA (1976) Partial trisomy of the long arm of chromosome 7. Clin Genet 9:250–254

Bass HN, Crandall BF, Marcy SM (1973) Two different chromosome abnormalities resulting from a translocation carrier father. J Pediat 83:1034–1038

Berger R, Derre J, Opitz MA (1974) Les trisomies partielles du bras long du chromosome 7. Nouv Presse Med 3:1801–1804

Berger R, Turc C, Wachter H, Begue G (1977) Partial 7q trisomy. Clin Genet 11:39–42

Carpentier S, Rethore M-O, Lejeune J (1972) Trisomie partielle 7q par translocation familiale t(7;12)(q_{22};q_{24}). Ann Genet (Paris) 15: 283–286

Downie NM, Heath RW (1971) Métodos estadísticos aplicados, Del Castillo (ed). Madrid

Felding I, Mitelman F (1979) A child with partial trisomy 7 and 20 inherited from the mother. Hereditas 91:91–95

Grace E, Sutherland GR, Bain AD (1972) Familial insertional translocation. Lancet II:231

Grace E, Sutherland GR, Stark GO, Bain AD (1973) Partial trisomy of 7q resulting from a familial translocation. Ann Genet (Paris) 16:51–54

Lejeune J, Rethore MO, Berger R, Abonyi D, Dutrillaux B, See G (1968) Trisomie C partielle par translocation familiale t(Cq−;Cq+). Ann Genet (Paris) 11:171–175

Moric-Petrovic S, Laca Z, Krajgher A (1976) Translocation réciproque dans la famille de deux proposants avec une trisomie partielle du chromosome 7q. Ann Genet (Paris) 19:133–136

Newton MS, Cunningham C, Jacob PA, Price WH, Fraser IA (1972) Chromosome survey of a hospital for the mentally subnormal. Part II: Autosomal abnormalities. Clin Genet 3:226–248

Schinzel A, Tonz O (1979) Partial trisomy 7q and probable partial monosomy of 5p in the son of a mother with a reciprocal translocation between 5p and 7q. Hum Genet 53:121–124

Schmid M, Wolf J, Nestler H, Krone W (1979) Partial trisomy for the long arm of chromosome 7 due to familial balanced translocation. Hum Genet 49:283–289

Serville F, Broustet A, Sandler B, Bourdeau M-J, Leloup M (1975) Trisomie 7q partielle. Ann Genet (Paris) 18:67–70

Turleau C, Rossier A, Montis G de, Roubin M, Chavin-Colin F, Grouchy J de (1976) Trisomie partielle 7q. Un ou deux syndromes? A propos d'une nouvelle observation. Ann Genet (Paris) 19:37–42

Vogel W, Siebers J-W, Reinwein H (1973) Partial trisomy 7q. Ann Genet (Paris) 16:277–280

Vogel W (1977) Partial duplication 7q. In: Yunis J (ed) New chromosomal syndromes. Academic Press, New York San Francisco London, pp 185–195

Winsor EJT, Palmer CG, Ellis PM, Hunter JLP, Ferguson-Smith MA (1978) Meiotic analysis of a pericentric inversion, inv(7)(p22q32), in the father of a child with a duplication deletion of chromosome 7. Cytogenet Cell Genet 20:169–184

Yunis E, Ramirez E, Uribe JG (1980) Full trisomy 7 and Potter syndrome. Hum Genet 54:13–18

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