대한병리학회지: 제 36 권 제 5 호 2002
The Korean Journal of Pathology. 2002; 36: 338-40

Partial Trisomy 13 (Patau Syndrome)
- An Autopsy Report -

Kyung Chan Choi · Hyung Sik Shin
Young Euy Park · Jung Lae Seo[1]
Sung Won Lee[1] · Eu Sun Ro[1]
Yong Pil Kim[2]

Departments of Pathology and [1]Obstetrics and Gynecology, College of Medicine Hallym University, Chuncheon; Department of [2]Obstetrics and Gynecology, Pohang Christian Hospital, Pohang, Korea

Received : January 30, 2002
Accepted : August 3, 2002

Corresponding Author
Kyung Chan Choi, M.D.
Department of Pathology, Chuncheon Sacred Heart Hospital, Hallym University, 153 Kyo-dong, Chuncheon 200-073, Korea
Tel: 033-252-9970
Fax: 033-256-4161
E-mail: kcchoi@hallym.ac.k

Trisomy 13 (Patau syndrome) is rare and usually fatal if contracted within the first six months of life. We report a case of a male fetus with the typical features of Patau syndrome. He was terminated in a 27-year-old mother at the gestational age of 32^{+4} weeks. In chromsomal analysis by GTG banding technique, the karyotype of the fetus was 46,XY,rec(13)dup(13q)inv(13)(p13q21.3)(=partial trisomy 13q); and his mother's karyotype was 46,XX, inv(13)(p13q21.3)(=pericentric inversion). His father had normal karyotype, 46,XY. Ultrasonography showed fluid-nature content, which was occupying the entire intracranium, but preserving the brain stem and cerebellum. Postmortem examination disclosed holoprosencephaly, hydrocephalus, a single nostril, bilateral anophthalmia, ventricular septal defect, and a single umbilical artery.

Key Words : Autopsy-Trisomy-Holoprosencephaly-Karyotyping

Trisomy 13 was first described in 1960 by Patau, who linked chromosomal defect with a variety of congenital malformations.[1] These include those of the central nervous system (mental deficiency, motor seizures, deafness, moderate microcephaly and microphthalmia), cleft lips with or without cleft palate, cardiac malformations in 80% of cases (ventricular septal defect, patent ductus arteriosus, cardiomyopathy and dextroposition), and polydactyly hands and, sometimes, feet. It is one of the three main autosomal trisomies compatible with life, the others being trisomies 21 and 18.[2] We report a rare case of partial trisomy 13.

CASE REPORT

A male fetus was terminated in a 27-year-old female at the gestational period of 32^{+4} weeks. Antenatal ultrasonic examination revealed a cystic brain with a relatively preserved brain stem and cerebellum. Tests for hepatitis B surface antigen and syphilis were negative, and the mother's blood group was AB, Rh-positive. The placenta weighed 600 g. The fetus's heart rate was 80/minute, and its heartbeat was very weak. The Apgar scores were 2 at 1 minute and 0 at 5 minutes. An external examination showed a hydropic neonate, weighing 2,000 g and having a crown-heel length of 46 cm. The head, measuring 29 cm in circumference, appeared large in comparison to the rest of the body. Both eyebrows were attached. Cyanosis was found in the lip, face and nail beds. The fetal skin was pale. There was a single nostril and bilateral anophthalmia (Fig. 1A). The abdomen was distended, measuring 23 cm in circumference. Postmortem radiograph was unremarkable.

On a gross examination of the internal organs, the heart revealed a ventricular septal defect and patent ductus arteriosus. The distended abdominal cavity was filled with amber fluid. The brain weighed 109g and measured $11 \times 7 \times 2$ cm. Holo-

prosencephaly, (type 1, cyclopia) indicating the failure of separation of prosencephalon, and hydrocephalus were found (Fig. 1B). Other internal organs including the lungs, thymus, spleen, gastrointestinal tract, liver, pancreas, kidneys, adrenal glands and urinary bladder were unremarkable. Histologically, cerebellar folia displayed a polymicrogyria pattern with further division. Choroid plexus epithelium was found. The umbilical cord showed a single umbilical artery. The liver, lung, spleen, and kidney were congested.

Chromosomal analysis of peripheral blood lymphocytes after birth showed 46,XY,rec(13)dup(13q)inv(13)(p13q21.3)(=partial trisomy 13q) in the neonate (Fig. 2A) and 46,XX,inv(13)(p13q21.3)(=pericentric inversion) in its mother (Fig. 2B), while its father had normal karyotype.

DISCUSSION

The classical features of Patau syndrome, or trisomy 13, are defects of the auricles, eyes (microphthalmia, iris coloboma, strabismus, etc), and mouth (cleft lip, palate or both), holoprosencephaly sequence (including arrhinencephaly, cebocephaly, and others), hemangiomas, polydactyly, hyperconvex fingernails, scalp defects, and heart defects. They are usually severe enough to ensure death within months of birth.[3]

The incidence of trisomy 13 is about 1 in 15,000 births. It is



Fig. 1. (A) Gross examination shows enlarged head, short neck, one nostril and anophthalmia. (B) Holoprosencephaly and hydrocephalus are seen in the coronal sections of brain.

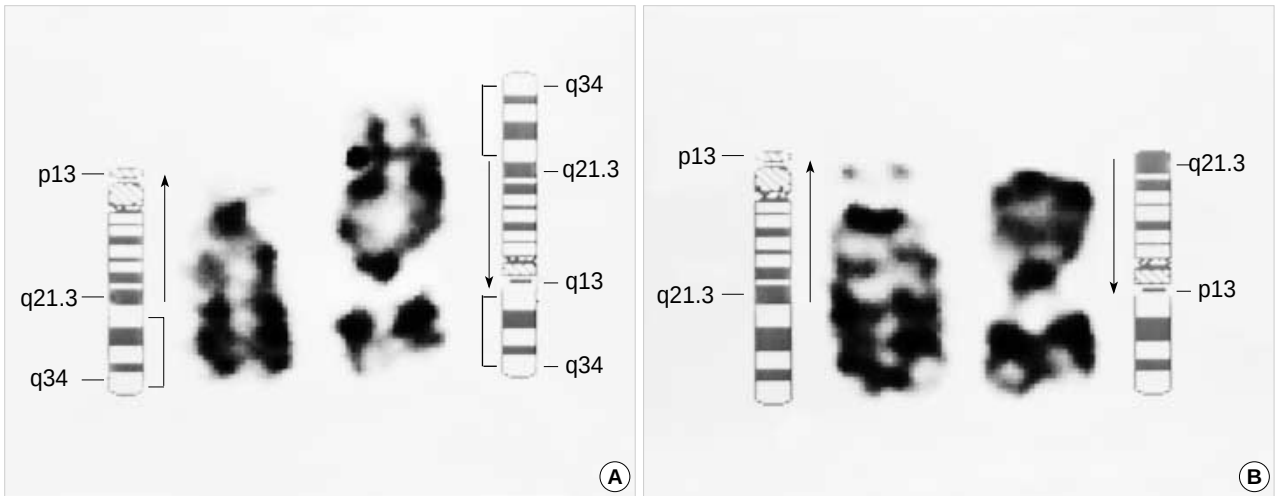


Fig. 2. Kayrotype results are 46, XY, rec (13) dup (13q) inv (13)(p13q21.3)(=partial trisomy 13q) in the male neonate (A) and 46, XX, inv (13)(p13q21.3)(=pericentric inversion) in his mothe (B).

Table 1. Clinical manifestations in patient with full and partial trisomy 13

	Full trisomy 13	Partial trisomy 13
Microcephaly	+	+
Low-set ears	+	(+)
Cleft palate	+	–
Cleft lip	+	–
Congenital heart disease	+	(+)
Cryptorchidism	(+)	–
Polydactyly	+	(+)
Fetal hemoglobin elevation	(+)	(+)

( ): not obligatory.

estimated that the frequency of trisomy 13 is 100 times higher in spontaneous abortions than in liveborns.[4] Magenis *et al.*[3] reported that 28% of the few surviving liveborns died in the first week after birth, 44% within the first month and 86% within their first year. The median survival of children with trisomy 13 was given as 89.2 days. Only one adult, aged 33, is known to be still alive; the longevity is presumed to be due to absence of severe cerebral and cardiovascular abnormalities.

It is assumed that the triplication of a chromosome that carries a high number of genes causes serious interference within a multigene-system and that the phenotype of a particular trisomy is more likely created by a pattern of the indirect effects of the gene imbalance than by the direct effect of gene actions. Partial duplications for proximal segments (13 q11→q14) alone show some features of Patau syndrome: including strabismus, depressed nasal bridge, stubby nose, cleft lip/palate, clinodactyly, increased polymorphonuclear (PMN) projections of the segmented neutrophils, and persistence of Hb F. Patients with distal 13q duplications (13q14→qter) typically show other features overlapping those of full trisomy 13. In this case, distal 13q duplication (inv, q21.3) may induce a defect of dividing into both hemisphere. Some studies suggest that both proximal and distal duplications are needed for full manifestations of Patau syndrome. Thus, a clear phenotype-karyotype correlation has not been established. Possible explanations for this study of the defect include: (1) partial duplications of 13 are usually associated with aneuploidis for other chromosomal segments, (2) gene interactions, (3) imprinting effects, (4) interchromosomal effects (Table 1).[5]

Naor *et al.*[6] stated that besides genetic factors causing malformations in children with trisomy 13, unknown exogenous agents must be taken into account as possible mechanisms. Boyd *et al.*[7] reported the increased occurrence of pre-eclampsia in mothers of children with trisomy 13 (5/14) in comparison with mothers of children with trisomy 21 and 18 and mothers of children without chromosomal anomalies (0/28). It still remains to be proven whether a chromosomal anomaly in the child has any influence on the development of pre-eclampsia. No clinical evidence of pre-eclampsia was present in our case.

REFERENCES

1. Patau K, Smith DW, Therman E, Inhorn SI, Wagner HP. Multiple congenital anomaly caused by an extra chromosome. Lancet 1960; 1: 760.
2. Boue J, Boue A, Lazou P. Retrospective and prospective epidemiological studies of 1500 karyotyped spontaneous human abortions. Teratology 1975; 12: 11-26.
3. Magenis ER, Hecht F, Milham S. Trisomy-13(D) syndrome: studies on parental age, sex ratio, and survival. J Pediatr 1968; 73: 222-8.
4. Hook EB. Rates of 47, +13 and 46 translocations D/13 Patau syndrome in live births and comparison with rates in fetal deaths and at amniocentesis. Am J Hum Genet 1980; 32: 849-58.
5. Gropp A, Putz B, Zimmermann U. In: Group A. Benirschke K. Development biology and pathology. Berlin, Heidelberg, New York: Springer Verlag, 1986; 177-91.
6. Naor N, Amir Y, Cohen T, Davidson S. Trisomy 13 in monozygotic twins discordant for major congenital anomalies. J Med Genet 1987; 24: 500-4.
7. Boyd PA. Lindenbaum RH, Redman C. Pre-eclampsia and trisomy 13: a possible association. Lancet 1987; 2: 425-7.