Prenatal diagnosis of de novo proximal interstitial deletion of 14q associated with cebocephaly

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Abstract
We report on the prenatal diagnosis of a case of cebocephaly, alobar holoprosencephaly, and microcephaly associated with a de novo proximal interstitial deletion of the long arm of chromosome 14: del(14)(q13q21.1) or (q13q21.2). This is the third case of holoprosencephaly in association with a deletion in this region. The present report concerns the association between prenatal craniofacial development, a holoprosencephaly locus, and the chromosomal segment 14q13.

Keywords: cebocephaly, alobar holoprosencephaly; human chromosome 14; chromosome deletion

Isolated de novo proximal interstitial deletions of 14q are rare. We present a case of a de novo proximal interstitial deletion of chromosome 14 with the karyotype 46,XY,del(14)(q13q21.1) or (q13q21.2) in a fetus with cebocephaly, alobar holoprosencephaly (HPE), and microcephaly. Comparison of this proband's phenotype with seven previously reported patients associated with proximal interstitial deletion of 14q suggests that the chromosomal segment 14q13 is possibly associated with fetal craniofacial development and holoprosencephaly.

Case report
A 29 year old primigravida came to our clinic for confirmation of fetal craniofacial malformations during the late second trimester. Ultrasonography at 26 weeks' gestation showed a single fetus with microcephaly, alobar HPE, centrally fused thalami surrounded by a single ventricle, hypotelorism, and a single nostril. A tentative diagnosis of cebocephaly was made. Cordocentesis of the fetus showed an interstitial deletion of a small segment within bands 14q13 and 14q21. The karyotype was 46,XY,del(14)(q13q21.1) or (q13q21.2) (fig 1). Whole chromosome painting using a digoxigenin labelled whole painting probe for chromosome 14 in fluorescence in situ hybridisation excluded the possibility of translocation or insertion. Chromosome studies on the parents showed a 46,XY karyotype in the father and 46,XX karyotype in the mother. The parents were Chinese, non-consanguineous, and healthy. The paternal age was 28 years. There was no family history of diabetes mellitus or congenital malformations. Maternal urine throughout the pregnancy did not contain glucose. The mother denied any exposure to alcohol, teratogenic agents, irradiation, or infectious diseases during this pregnancy. She elected to terminate the pregnancy at 27 gestational weeks. A male infant was delivered with a weight of 1006 g and a length of 36.5 cm. On gross examination, the infant showed microcephaly, cebocephaly, ocular hypertelorism, a single nostril, low set ears, micrognathia, a short neck, and cryptorchidism (fig 2). At necropsy, the proband was found to have microcephaly, alobar HPE, arhinencephaly, agenesis of the corpus callosum, a single ventricle of the brain, left testicular agenesis, right undescended testis, and right adrenal hypoplasia. Other internal organs such as liver, lungs, kidneys, and heart were normal.

Discussion
HPE is associated with teratogens, familial factors with autosomal dominant and recessive inheritance, and chromosomal anomalies. Cyto genetic abnormalities have been reported in 50% of all HPE patients. The specific chromosome aberrations include trisomy 13, trisomy 18, triploidy, del(13q), dup(13q), del(18p), del(7)(q36), dup(3)(p24-pter), del(2)(p21), and del(21)(q22.3). At least four putative loci for HPE have been identified through the analysis of chromosomal rearrangements in HPE patients: HPE 1 on chromosome 21q22.3; HPE 2 on 2p21; HPE 3 on 7q36-qter; and HPE 4 on 18pter-q11. Recently, the human Sonic Hedgehog (SHH) gene has been identified as HPE 3. Mutations
in the SHH gene causing HPE have been reported. Other chromosomal abnormalities described in HPE include trisomy 21, iso- chromosome 18q, del(X)(q22), del(11)(q21) mosaicism, dup(1q), and del(14)(q11.1q13) or (q11.2q21).

Seven previous 14q deletion case reports have described a variety of proximal interstitial deletions encompassing band 14q13. Kodoma et al. reported two sibs with proximal interstitial deletion of chromosome 14, del(14) (q12q13.3). Clinical features of the two sisters included failure to thrive, severe mental retardation, microcephaly, round face, hypertelorism, micrognathia, and high arched palate. Grammatico et al. presented the first case of deletion 14q11.2q13 with clinical phenotypic findings of microcephaly, right plagiocephaly, bilateral cryptorchidism, and left hip subluxation. Shapira et al. described investigations in one patient with novel proximal deletion 14q11.2q21.1 and in another patient with deletion 14q12q22. The two patients shared phenotypic similarities of failure to thrive, micrognathia, and hypoplasia of the corpus callosum, which can be part of the holoprosen-
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