Proteinuria in a patient with the diaphragmatic hernia-hypertelorism-myopia-deafness syndrome: further evidence that the facio-oculo-acoustico-renal syndrome represents the same entity

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Abstract
We present a male infant with hypertelorism, severe myopia and sensorineural deafness, diaphragmatic hernia, and proteinuria. This patient combines features of two distinct genetic conditions, the syndrome of diaphragmatic hernia, exomphalos, absent corpus callosum, hypertelorism, myopia, and sensorineural deafness (MIM 222448), and the facio-oculo-acoustico-renal syndrome (MIM 227290), which is characterised by similar anomalies, with the additional finding of proteinuria, but without diaphragmatic hernia. The present observations further suggest that these syndromes are the variable expression of a single autosomal recessive disorder.

Keywords: myopia; deafness; diaphragmatic hernia; autosomal recessive

Genetic syndromes usually have variable expression, both regarding the severity of certain features and the presence or absence of specific malformations. In the case of rare syndromes, without a diagnostic test, the full spectrum of the disorder is often not known. Given the remarkable overlap in clinical features, it had been previously suggested that the syndrome of diaphragmatic hernia, exomphalos, absent corpus callosum, hypertelorism, myopia, and sensorineural deafness (MIM 222448) and the facio-oculo-acoustico-renal syndrome (MIM 227290) may represent the variable expression of a single entity. In the present report, we describe a child with features previously thought to be distinctive of these two syndromes, confirming that they are in fact a single entity.

Case report
The child, a male, is the first child of healthy, unrelated parents. The pregnancy was complicated by polyhydramnios. At 34 weeks' gestation, a left posterior diaphragmatic hernia was diagnosed, but no additional abnormalities were noted. Karyotype performed on amniotic cells was normal. The child was born at 37 weeks' gestation by caesarian section. Birth weight was 3000 g (50th-75th centile), length 50.5 cm (75th-97th centile), and head circumference 35.5 cm (>90th centile). The diaphragmatic hernia was confirmed and surgically repaired on the first day of life. Clinical examination showed a large anterior fontanelle, facial dysmorphism including hypertelorism with depressed nasal bridge, proptosis, downward slanting palpebral fissures, and a small mouth. The eyelashes were long. The genitalia were small with inguinal testes. There was marked axial hypotonia. Cardiac ultrasound was normal. CT scan and MRI of the brain were normal. Karyotype determined on white blood cells and skin fibroblasts was normal after high resolution G and T banding.

At the age of 6 weeks, extremely high myopia was diagnosed, −30 D and −25 D in the right and left eye, respectively. Funduscopy was normal and no additional eye abnormalities were noted. Electoretinogram and visually evoked potentials were normal. Correction of the myopia resulted in visual stimulation of the infant.

Proteinuria was detected on a routine urine investigation on the second day of life (albustix +++). This was confirmed on all subsequent urine samples. During the second month of life, proteinuria ranging from 90 to 155 mg/day was documented. Renal ultrasound and intravenous pyelogram showed normal
Deafness-myopia syndrome

We report the first patient with features thought to be distinctive of both conditions, that is, both diaphragmatic hernia and proteinuria. This provides strong evidence that both conditions are in fact the variable expression of a single entity. In addition, it is probable that the three brothers described by Ohlsson,\(^6\) with high myopia, sensorineural deafness, and proteinuria (MIM 221200)\(^6\) also represent the same entity.

The common findings present in all patients are exceptionally severe myopia, severe sensorineural hearing loss, and distinct facial dysmorphism with a large fontanelle and hypertelorism. The name facio-oculo-acoustico syndrome may therefore be appropriate to describe this condition. Variable features, described in more than one patient, include diaphragmatic hernia, ocular coloboma, exomphalos, agenesis of the corpus callosum, proteinuria, heart defect, mental retardation, and macrocephaly.

A high concordance of clinical features has been observed in the reported sibships with regard to the presence of, for instance, diaphragmatic hernia or proteinuria. This has certainly added to the previous distinction of two different entities. This could be explained by specific genotype-phenotype correlations, but more cases need to be studied to exclude ascertainment bias. In view of these findings, a careful clinical reassessment of all patients combining high myopia with sensorineural hearing loss is warranted.