Peters-Rieger's Syndrome

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Peters’ anomaly is clinically characterized by congenital opacification of the deeper layers of the central cornea, usually accompanied by the iridocorneal adhesions at the border of the opacity and anterior polar cone-shaped pyramidal cataract. Histopathologically, Descemet’s membrane is missing in the area of corneal opacity. Rieger’s anomaly, also known as mesodermal dysgenesis of the cornea and iris, results from a faulty differentiation of the angle of the anterior chamber. Clinically, there is hypoplasia of the iris, with the anterior stromal layer being most affected. Posterior embryotoxon with iris strands spanning the angle to insert on the Schwalbe’s ring is also a part of the anomaly. Rieger’s anomaly without the prominent Schwalbe’s ring is sometimes called iridogoniodygenesis. The ocular changes may be accompanied by facial, dental, and/or other systemic abnormalities, in which instance the anomaly is referred to as Rieger’s syndrome.

In a recent critical review of the literature, Townsend1 found that the occurrence of Peters’ anomaly in eyes with Rieger’s mesodermal dysgenesis is rare. He commented that there was only one case, unilateral, of such an association which had been confirmed histopathologically. The purpose of this paper is to describe the clinical association of Peters’ and Rieger’s anomalies.

CASE REPORT

A 19-year-old white female was seen in consultation for the evaluation of cataract and poor vision in the right eye. She stated that the right eye had “no” vision in it since birth. There was no past history of any ocular inflammation, infection, or trauma. Family history was noncontributory except that parents had high blood pressure. Other than the occasional headaches, the patient had no systemic problems. She was a product of a seven-month pregnancy and her birth weight was three pounds. There was no history of any maternal infections or febrile episodes during the pregnancy.

Visual acuity was OD: counts fingers at three feet with + 3.50 + 3.00 x 90 and OS: 20/20 with + 0.50 sphere. The left eye was within normal limits in every respect. External examination showed that the right eye was microphthalmic with a corneal diameter of 9.5 mm (Fig. 1). There was distinct facial asymmetry with right maxillary hypoplasia. Also the right shoulder of the patient had a more downwards sloping. The right eye had eccentric fixation in a position of approximately

Fig. 1. OD is microphthalmic. A distinct right maxillary hypoplasia was also present.
12 prism diopters of esotropia and four prism diopters of hypertropia. The ocular rotations appeared normal otherwise. The right pupil was vertically oval (Fig. 2) but was reactive. It also disclosed a Marcus Gunn reflex when tested by a swinging light method. The right cornea had a very faint centrally located opacification through which the details of the anterior chamber could be seen with a relatively stronger focal illumination. Aplanation tonometry reading was OD: 20 mm Hg and OS: 15 mm Hg. Visual fields were normal in the left eye but showed striking contraction, even with a confrontation test, in the right eye.

The most interesting findings were observed in the right eye during slit lamp examination and gonioscopy. A perfectly round opacity was present in the center of the cornea (Fig. 3). The opacification involved the deeper layers of the cornea and was rather irregular in its depth. In the most central area it appeared to have affected the deepest layers of the cornea. The area of opacification was definitely thinner when compared to the clear cornea around it. No iridocorneal adhesions were present in any part of the opacity. The iris showed patchy areas of stromal atrophy; one rounded one at 3:30 o’clock position and another oval one at 7 o’clock position (Fig. 2). However, the most dramatic was a boat-shaped area of the total absence of the anterior stromal layer at 6 o’clock position (Fig. 2). This concentric crescentic area of hypoplasia was located midway along the width of the iris and extended from 4 o’clock to 7 o’clock position.

The lens showed a centrally located reduplicated anterior polar cataract which was protruding into the anterior chamber in the form of a cone-shaped pyramid (Fig. 4). An isolated group of thick strands of the remnants of the pupillary membrane was attached to it at 4 o’clock position, like the moorings of a docked boat (Fig. 4). These strands dangled in the anterior chamber with the oscillations of pupillary movement. Gonioscopy disclosed the brownish strands of iris stroma bridging across the angle to form attachment to Schwalbe’s ring (Fig. 5). The angle of the anterior chamber of the left eye was wide open and had no iris strands

Fig. 2. Pupil is vertically oval due to the hypoplasia of the iris at 6 o’clock position. There are patches of atrophy at 3:30 o’clock and 7 o’clock (dotted markings) positions. Also notice the boat-shaped area of total absence of anterior stromal layer at 6 o’clock and anterior polar cataract.

Fig. 3. Biomicroscopic photograph showing the congenital central disc-shaped corneal opacity. Corneal epithelium and superficial stroma were clear and in more central area opacity involved the deepest layers of the cornea. No iridocorneal adhesions or signs of inflammation were present.

Fig. 4. The anterior polar cataract is projecting into the anterior chamber like a cone-shaped pyramid on gonioscopy. Notice the thick strands of the remnants of the pupillary membrane.

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Fig. 5. Notice the pigmented strands of the iris stroma bridging across the angle of anterior chamber. No such findings were present in normal left eye.

Fig. 6. Optic disc is tilted downwards and is much smaller than normal. Also, the macula, which lacks a foveal reflex, is displaced inferiorly.

bridging across it. Ophthalmoscopy showed that the optic disc of the right eye was tilted and the macula was inferiorly displaced (Fig. 6). Along with dysversion, the optic disc also appeared hypoplastic. No foveal or circumfoveal reflexes were seen in the macular area and its hypoplasia was suspected.

COMMENTS

From time to time, various concepts of the development of Peters' anomaly have been considered. The inflammatory concept explains the defect on the basis of perinatal keratitis. The mesodermal concept attributed the anomaly originally to the failure of splitting of the mesoderm of the anterior chamber to form iris and corneal stroma. Collins and Seefelder objected to this theory on the basis that there is no splitting in the mesoderm to form iris and corneal stroma and suggested that the basic defect was a primary failure of differentiation of the corneal endothelium. Seefelder emphasized that separate waves of mesoderm grow in from the periphery to form the corneal endothelium and iris stroma along with the pupillary membrane.

The ectodermal concept holds that a faulty separation of the lens from the surface ectoderm is responsible for the changes. The ectodermal concept appears to be the most popular. Rieger's anomaly is considered basically to be a mesodermal defect resulting from a primary aberration in the development of the postendothelial mesoderm. Hagedroon objected to this concept and suggested that the primary defect was in the ectodermal mesostroma. It is possible that Peters' anomaly and Rieger's anomaly are just two different expressions of the same defective process involving both the ectoderm and mesoderm of the anterior segment of the eye. At least the clinical findings of the case reported here do appear to support this assumption.

A large number of rare developmental abnormalities of the anterior segment of the eye, resembling one another in many respects, have created great confusion in their terminology and clear clinical understanding. This feeling is confirmed by two excellent reviews of this subject. Several efforts have been made to clear this confusion. All of these have been directed towards the grouping of all the entities under one heading; none is universally accepted. Alkemade suggested the term "mesodermal dysgenesis of the iris and cornea" which ignores the ectodermal components involved. It was improved upon by Cross and Maumenee who proposed the term "mesoectodermal dysgenesis." This, however, fails to reveal the extent of the clinical expression of the abnormality in a particular affected individual. Reese and
Ellsworth applied the now well-known term of "anterior chamber cleavage syndrome." This is unacceptable on the grounds that there is no "cleavage" as such in the embryogenesis of the anterior chamber. I feel that there is really no need for clumping and see no harm in holding on to well established eponyms for strictly clinical purposes until a definite etiologic and embryologic basis is available. For any clinical descriptions of these entities I suggest the following classification.

1. **Posterior Embryotoxon:** Prominent Schwalbe's ring.

2. **Axenfeld's Anomaly:** Prominent Schwalbe's ring with iris processes attached to it.

3. **Rieger's Anomaly:** Hypoplasia of the iris stroma and iris strands bridging across the angle, with or without prominent Schwalbe's line.

4. **Peters' Anomaly:** Central corneal opacity of deeper stroma, with or without iridocorneal adhesions, and anterior polar lens opacity.

5. **Peters-Rieger’s Syndrome:** Central corneal opacity, hypoplasia of the iris stroma, anterior polar cataract, iris strands across the anterior chamber angle. The iridocorneal adhesions and prominent Schwalbe's ring may be present or absent. The case reported here fits into this category.

6. **Sclerocornea.**

7. Any additional clinical features may be included with the clinical diagnosis, e.g., Peters' anomaly with glaucoma, Rieger's anomaly with cataract, sclerocornea with central clear window, etc. I find it very helpful in practice. Waring et al. have recently suggested a more detailed and extensive stepladder classification of these anomalies based on anatomic features and modified from Reese and Ellsworth.

As the term Peters-Rieger's syndrome has not been previously used in literature, it might be criticized for adding to the already existing confusion. Therefore, I must add that the above classification is strictly a simpler method of notation of clinical diagnosis until the existing discrepancies in the etiologic and embryologic processes are resolved. In other words, a congenital central disc-shaped deep corneal opacity may be labelled Peters' anomaly if it is accompanied by an anterior polar cataract until the absence or the presence of Descemet's membrane or old inflammation is confirmed by histopathologic studies. The clinical recognition of these anomalies is important from several points of view other than heredity. The eyes with these malformation may have or may develop glaucoma in the future.

Henkind and Friedman reported presenile cataracts in patients with mesodermal dysgenesis of the angle of the anterior chamber. I have observed one patient with Rieger's anomaly and cataract and another with sclerocornea and cataract. If the eye is otherwise normal, a patient may be benefitted by early corneal transplant and/or cataract removal to avoid amblyopia. Associated ocular anomalies of the posterior segment of eye include retinal dysplasia, persistent hyperplastic primary vitreous, aplasia and atrophy of the optic nerve, microphthalmos, subluxation or coloboma of the lens, total posterior coloboma of retinal pigment epithelium and choroid.

Pupillary abnormalities, abnormalities of the corneal size, ectropion of pigment epithelium of iris, persistent pupillary membrane, aniridia, anterior staphyloma, strabismus, and high refractive errors have also been recorded. Ganglionic neuroretinal hypoplasia (hypoplasia of optic nerve), dysversion of the optic disc, ectopia of the macula and possible hypoplasia of macula are interesting additional ocular features of the case reported here. As far as I could learn, these have not been reported before in cases of mesoectodermal dysgenesis.

Systemic abnormalities which have been reported in association with Rieger's anomaly include dental anomalies, maxillary hypoplasia, broad flat nasal root, malformations of the limbs and spine, congenital heart disease, middle ear deafness, cerebellar hypoplasia, Marfan's syndrome, mental retardation, and trisomy-21 (mongolism). Peters' anomaly may be associated with mental retardation, Lowe syndrome, 13-15 trisomy, congenital heart disease, hyaline membrane disease,
and cleft palate and lip.17 Finally, the Rieger’s anomaly is considered to be a bilateral abnormality in most cases. The case reported here proves that this is not true in all cases.

SUMMARY

The joint occurrence of Peters’ anomaly, congenital central deep corneal opacity with an anterior cone-shaped polar cataract, and Rieger’s anomaly, hypoplasia of iris stroma, dyscoria, and iridocorneal adhesions in the angle of the anterior chamber, is described. The term Peters-Rieger’s syndrome is proposed for this clinical association. Associated ocular anomalies which apparently have not been previously mentioned in the literature were dysversion of the optic disc, ganglionic neuroretinal hypoplasia (hypoplasia of the optic nerve), and downward ectopia of the macula. Other associated ocular and systemic anomalies of Peters-Rieger’s syndrome are also mentioned.

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REFERENCES