

Clinical Evaluation of Posterior Embryotoxon in One Institution

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Abstract: To elucidate the pathogenesis of posterior embryotoxon, we estimated its incidence in our clinic and evaluated its associated ocular and systemic anomalies. Slit-lamp and gonioscopic examinations were performed on 440 randomly selected patients at Nagoya City University Hospital over a 10-month period. Posterior embryotoxon was detected in 107, 50 bilateral and 57 unilateral, cases (24.3%). Twelve (11.2%) of the 107 cases had open-angle glaucoma. Accompanying ocular anomalies included six cases of sclerocornea, two each of persistent pupillary membrane and familial exudative vitreoretinopathy, and 1 each of melanocytoma of the optic nervehead, choroidal nevus and subconjunctival dermoid cyst. Associated systemic anomalies included three cases of Alagille syndrome, two of congenital biliary atresia, and one each of congenital facial palsy with microtia, congenital adrenal hyperplasia, empty sella syndrome, Hirschsprung disease and Wilson disease. Many of these ocular and systemic anomalies were caused by the maldevelopment of neural crest cells. Patients with posterior embryotoxon should be examined for the possible presence of open-angle glaucoma and for ocular and systemic anomalies related to maldevelopment of neural crest cells. **Jpn J Ophthalmol 1997;41:422-425** © 1997 Japanese Ophthalmological Society

Key Words: Mesenchymal dysgenesis of the anterior ocular segment, neural crest cell, open-angle glaucoma, posterior embryotoxon.

Introduction

In 1920, Axenfeld¹ first described a gray-white circular line on the posterior surface of the cornea near the limbus in an otherwise normal person. He referred to this abnormality as embryotoxon corneae posterius. This gray-white line was later identified histologically as the prominence of Schwalbe's line.²

Embryologically, posterior embryotoxon is categorized as mesenchymal dysgenesis of the anterior ocular segment, a spectrum of developmental disorders that includes congenital glaucoma, Axenfeld-Rieger syndrome, Peters' anomaly and sclerocornea.^{3,4} Posterior embryotoxon is considered to be a relatively mild disorder⁵ and commonly occurs as an isolated defect.^{2,6-8} However, it can also be detected

in association with other ocular and systemic congenital anomalies.^{2,8-11}

To elucidate posterior embryotoxon pathogenically, we estimated its incidence among 440 patients who visited our clinic and examined them for accompanying ocular and systemic anomalies.

Patients and Methods

We performed slit-lamp and gonioscopic examinations on 440 randomly selected patients of 2,148 who visited Nagoya City University Hospital between October 1992 and July 1993. We diagnosed all patients with prominent Schwalbe's line as having posterior embryotoxon.

Results

Posterior embryotoxon was detected in 107 (PE group) of the 440 cases. It was seen bilaterally in 50 cases and unilaterally in 57. The PE group comprised 55 men and 52 women, ranging in age from 1 month

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Figure 1. Prominent Schwalbe's line is visible along nasal and temporal corneal limbus (arrows).



Figure 2. Gonioscopic view of prominent Schwalbe's line (arrow).

to 81 years with an average age of 50.1 ± 22.8 ($\pm SD$) years. In some cases the prominent Schwalbe's line was partially visible close to the corneal limbus by slit-lamp examination (Figure 1), whereas in the remaining cases it could be detected only gonioscopically (Figure 2). Occasionally, the prominent Schwalbe's line was visible all around the corneal limbus (Figure 3). The control group consisted of 333 cases without posterior embryotoxon, 168 men and 165 women, ranging in age from 1 month to 85 years with an average age of 51.4 ± 18.6 years. There was no statistically significant difference between the two groups in sex (chi-squared test) or age (Student's *t*-test).

Open-angle glaucoma comprising primary open-angle glaucoma and normal-tension glaucoma, was found in 12 cases (11.2%), 22 eyes (14.0%), in the PE group, compared to five cases (1.5%), nine eyes (1.4%), in the control group. The incidence of glaucoma was significantly higher in the PE group than in the control group (chi-squared test, $P < 0.01$). However, the extent of prominent Schwalbe's line did not correlate with the presence of glaucoma in either group. Topical medications were effective to control intraocular pressure in all cases of open-angle glaucoma.

In the PE group, accompanying ocular anomalies included six cases (12 eyes) with sclerocornea (Figure 4), two cases (4 eyes) each with persistent pupillary membrane and familial exudative vitreoretinopathy, and one case (1 eye) having melanocytoma of the optic nervehead, choroidal nevus and subconjunctival dermoid cyst (Table 1). Associated systemic anomalies included three cases of Alagille syndrome, two cases of congenital biliary atresia, and one case each of congenital facial palsy with mi-

crotia, congenital adrenal hyperplasia, empty sella syndrome, Hirschsprung disease and Wilson disease (Table 2).

No eyes examined in our study fulfilled the diagnostic criteria for microphthalmos reported by Majima.⁵

Discussion

The incidence of posterior embryotoxon has varied among reports of previous clinical investigations. Forsius et al⁶ detected posterior embryotoxon in 161 (32.3%) of 498 eyes, and Schobess et al⁷ in 130 (13.0%) of 1000 cases. Burian et al² identified posterior embryotoxon in 72 (12.0%) of 600 eyes histologically. In the present study, posterior embryotoxon was found in 107 (24.3%) of 440 cases, and in 157

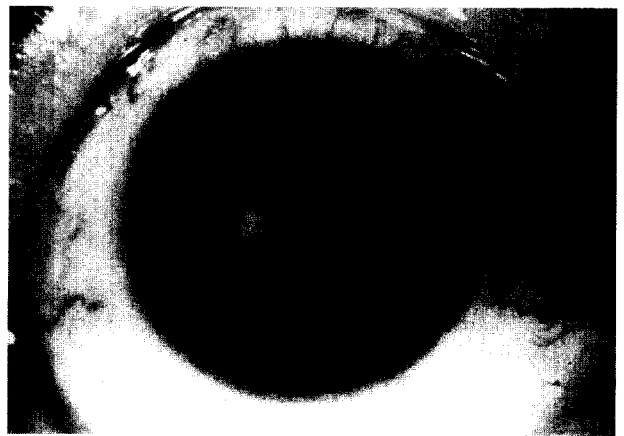


Figure 3. Prominent Schwalbe's line is seen around corneal limbus.

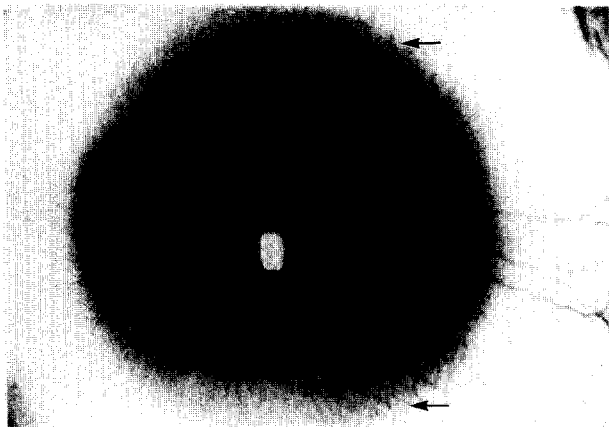


Figure 4. Case of posterior embryotoxon associated with sclerocornea showing indistinct sclerocorneal border (arrows).

(17.8%) of 880 eyes. Consequently, our investigation reveals that the incidence of posterior embryotoxon is also quite high in Japan.

Since we found significantly higher incidence of open-angle glaucoma in the PE group than in the control group, patients with posterior embryotoxon should be examined for the presence of glaucoma. Embryologically, posterior embryotoxon is one of the mesenchymal dysgenesis of the anterior ocular segment caused by the abnormal migration of neural crest cells.^{3,4} As the trabecular meshwork is also derived from the neural crest,¹²⁻¹⁴ it stands to reason that patients with posterior embryotoxon are predisposed to open-angle glaucoma.

We evaluated associated ocular and systemic anomalies pathogenically. Sclerocornea is also one of the mesenchymal dysgenesis disorders of the anterior ocular segment.^{3,4} Since pupillary membrane,¹³ primary vitreous^{15,16} and uveal melanocytes^{12,14} are of neural crest origin, it is conceivable that persistent pupillary membrane, familial exudative vitreoretinopathy, melanocytoma of the optic nervehead and choroidal nevus arise from the maldevelopment of

Table 1. Accompanying Ocular Anomalies in PE Group

Ocular Anomaly	Number of Cases	Number of Eyes
Sclerocornea	6	12
Persistent pupillary membrane	2	4
Familial exudative vitreoretinopathy	2	4
Melanocytoma of the optic nervehead	1	1
Choroidal nevus	1	1
Subconjunctival dermoid cyst	1	1

Table 2. Associated Systemic Anomalies in PE Group

Systemic Anomaly	Number of Cases
Alagille syndrome	3
Congenital biliary atresia	2
Congenital facial palsy with microtia	1
Congenital adrenal hyperplasia	1
Empty sella syndrome	1
Hirschsprung disease	1
Wilson disease	1

neural crest cells. Furthermore, subconjunctival dermoid cyst is considered to be associated with a neural crest disorder.¹⁴ In addition, the fact that facial nerve, craniofacial bone and cartilage, adrenal medulla and meninges are of neural crest origin^{14,17} suggests that congenital facial palsy, microtia, congenital adrenal hyperplasia and empty sella syndrome are related to the maldevelopment of neural crest cells. It has been proposed that Alagille syndrome¹¹ and Hirschsprung disease¹⁷ correspond to neurocristopathy, a unifying concept for a group of nonrandomly occurring anomalies caused by neural crest disorders. Thus, abnormal development of neural crest cells seems to be responsible for many associated ocular and systemic anomalies.

Ophthalmologists should be especially aware of posterior embryotoxon because of its possible association with open-angle glaucoma, and both ocular and systemic anomalies in the tissues derived from neural crest cells.

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