Primary iris cysts: a review of the literature and report of 62 cases

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SUMMARY The authors present their experience with the evaluation and follow-up of 62 patients with primary cysts of the iris, discuss their clinical and pathological features, and propose a simple classification for these lesions. The results suggest that the great majority of primary iris cysts, particularly those which arise from the iris pigment epithelial layers, are stationary lesions which rarely progress or cause visual complications. This finding is contradictory to the belief of certain authorities who stress that many such lesions lead to severe complications, with blindness and loss of the eye. The natural course of primary epithelial cysts differs from that of secondary iris cysts which follow surgical or nonsurgical trauma. The latter lesions do frequently enlarge and lead to severe complications such as inflammation and glaucoma. The major clinical importance of primary iris cysts lies in their similarity to neoplasms of the iris and ciliary body. It is concluded that the great majority of them are ophthalmic curiosities which require no treatment.

There have been no large studies which define the clinical characteristics and natural course of primary iris cysts. The purpose of this study is to review the clinical data on 62 affected patients who have been examined and followed up by the authors and to describe their clinical features with anterior segment photographs. On the basis of these observations certain misconceptions in the literature regarding primary iris cysts will be challenged and a simple classification of such lesions will be proposed.¹

Patients, materials, and methods

Detailed records were maintained on all patients with iris cysts who were examined at the Oncology Service, Wills Eye Hospital, between 1974 and 1980. Each patient had a thorough history and comprehensive ocular examination, with emphasis on slit-lamp biomicroscopy, gonioscopy, and special transillumination techniques. When possible slit-lamp photographs or goniphotographs were taken to record and follow the natural course of the cysts. When photographs were not possible because of the location of the

lesions, drawings were made on the initial examination and on subsequent examinations.

We attempted to obtain information on referring diagnosis, associated systemic findings, medication history, associated ocular disorders, ocular complications, and natural course of the lesions. Follow-up data were obtained either by periodic examination of the patient or by communication with the referring ophthalmologists. Photomicrographs of the various types of cysts were obtained from pathologists, who allowed us to review representative sections of iris cysts in their files.

Results

During the course of the study it became apparent that iris cysts could be divided into 2 main categories—primary and secondary. The primary cysts did not have a recognisable aetiology, but rather appeared to arise spontaneously. The secondary types were invariably associated with an obvious aetiological factor such as surgical trauma, non-surgical trauma, or the prolonged use of topical miotic drugs. Since secondary iris cysts have received adequate attention in the literature, this report will cover only the primary iris cysts.

On the basis of clinical examination primary cysts

A portion of this material was prepared as a thesis for membership in the American Ophthalmological Society, 1981 (Dr. Shields).

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Table 1 Proposed classification of iris cysts*

1	Primary cysts
	A. Cysts of iris pigment epithelium
	1. Central (pupillary)
	2. Midzonal
	3. Peripheral (iridociliary)
	4. Dislodged
	(a) Anterior chamber
	(b) Vitreous chamber
	B. Cysts of iris stroma
	1. Congenital
	2. Acquired
2	Secondary cysts†
	A. Epithelial
	1. Epithelial downgrowth cysts
	(a) Postsurgical
	(b) Post-traumatic
	2. Pearl cysts
	3. Drug-induced cysts
	B. Cysts secondary to intraocular tumours
	1. Medulloepithelioma
	2. Uveal melanoma
	C. Parasitic cysts

*From Shields JA. Primary cysts of the iris. *Trans Am Ophthalmol Soc* 1981; 79: 771-809.

†Secondary cysts are included in the classification but are not covered in this review.

were divided into epithelial and stromal types. The cysts which arose from the posterior epithelial layer of the iris occurred either at the pupillary margin, in the midzonal portion of the iris, in the peripheral portion of the iris at the base of the ciliary body, or as a dislodged lesion in the anterior or vitreous chambers. Each type appeared to have a different clinical presentation and clinical significance. The cysts which arose within the iris stroma could not be categorised as to anatomical site but could be divided into congenital and acquired types. Table 1 depicts the simple classification of these cysts which will be used to discuss them in the following paragraphs. Table 2 presents the general data on primary iris cysts, which will be considered at this time.

Table 2 Primary cysts of the iris—general data*

Type	No. of patients	Sex		Avg. age at diagnosis	No. patients with unilateral involvement	No. patients with bilateral involvement	Total no. of eyes	No. eyes with solitary cysts	No. eyes with multiple cysts
		M	F						
<i>Pigment epithelial</i>									
Central	3	3	0	—	2	1	4	1	3
Midzonal	5	2	3	42	2	3	8	2	6
Peripheral	45	11	34	31.5	42	3	48	46	2
Dislodged, anterior chamber	4	2	2	45	4	0	4	4	0
Dislodged, vitreous	2	1	1	20.5	2	0	2	2	0
<i>Stromal</i>									
Congenital	1	1	0	2	1	0	1	1	0
Acquired	2	1	1	28	2	0	2	2	0
Total	62	21	41		55	7	69	58	11

*From Shields JA. Primary cysts of the iris. *Trans Am Ophthalmol Soc* 1981; 79: 771-809.

Fig. 1 Anterior segment photograph showing 2 epithelial cysts at pupillary margin (central cysts) (arrow).

CYSTS OF IRIS PIGMENT EPITHELIUM

Cysts which appear to arise within the pigment epithelial layer of the iris are characteristically found in any of 5 locations: (1) the central or pupillary zone of the iris, (2) the midzone of the iris, (3) the peripheral or iridociliary zone of the iris, (4) in the anterior chamber, or (5) in the vitreous chamber. Aspects of each type of cyst will be discussed separately.

CENTRAL (PUPILLARY) PIGMENT EPITHELIAL CYSTS

Cysts which occurred at the pupillary margin were present in 3 patients (Table 2). Because of their location, these were termed central cysts. One patient was an infant in whom a bilobed cyst was observed at the 2 o'clock position while the child was being examined for retinoblastoma (Fig. 1). The retinoblastoma occupied the posterior segment of the eye and did not appear to be directly related to the cyst. The second patient was an otherwise normal

Fig. 2A

Fig. 2B

Fig. 2 A. Close-up photograph of multiple epithelial cysts at pupillary margin in the right eye. (Patient referred by Dr Joseph Kennedy, West Islip, NY) B. Left eye. Note that one cyst in each eye has ruptured and its remnants cross the pupillary aperture.

30-year-old man who had a solitary cyst measuring 1.5 mm in diameter located at the 10 o'clock position in the right eye.

The third patient with central epithelial cysts was an 18-year-old male who gave a history of having the lesions since birth. The cysts were bilateral, multiple, and appeared as variable-sized, globular, dark brown structures which lined the pupillary border of the iris and projected into the pupillary aperture (Figs. 2A, B). Although some had ruptured and others appeared confluent, about 8 distinct cysts could be identified in each eye. The ruptured cysts were suspended as linear strands which crossed the pupil vertically and moved with movement of the iris. None of the lesions allowed appreciable transmission of light with transillumination techniques.

MIDZONAL PIGMENT EPITHELIAL CYSTS

Five patients had epithelial cysts which were located predominantly in the midzone of the iris, between the pupillary margin and the iris root (Table 2). These were classified as midzonal epithelial cysts. Two patients were men and 3 were women. Such cysts occurred bilaterally in 3 of the 5 patients and were multiple in all 3 bilateral cases, with an average of 3 cysts per eye. Two patients had a unilateral solitary cyst.

All of the midzonal epithelial cysts had clinical features in common. In contrast to the central cysts, which were visualised without pupillary dilatation, midzonal cysts were not easily visualised until the pupil was dilated. With early pupillary dilatation the cyst could be observed as a rounded dark brown mass just posterior to the pupillary border. With further dilatation the cyst gradually changed from a round to an elongate or fusiform shape, somewhat resembling

a ciliary body melanoma (Fig. 3). With maximal dilatation multiple round or fusiform cysts, not suspected on the initial examination, could often be visualised (Figs. 4A, B). These cysts characteristically had a thin wall which showed slight undulations with movement of the eye. Although they did not transmit light easily, occasional focal areas of pigment loss on the surface allowed light transmission.

One patient presented with severe nongranulomatous iritis in the left eye, which led to the detection of a typical midperipheral cyst (Fig. 5). The cyst disappeared in one week while the patient was being treated with topical corticosteroids and cycloplegics.

PERIPHERAL PIGMENT EPITHELIAL CYSTS

Cysts which were located near the junction between

Fig. 3 Close-up photograph through dilated pupil showing midzonal epithelial cyst in inferotemporal quadrant (arrow).

Fig. 4A

Fig. 4 A. Bilateral, multiple midzonal epithelial cysts in the right eye, showing rounded cysts in temporal area (arrows). B. Left eye showing 2 fusiform cysts temporally (arrows).

Fig. 4B

the iris and ciliary body (iridociliary sulcus) were by far the most common, accounting for 45 of the 62 patients in that series (Table 2). These were classified as peripheral iris (iridociliary) cysts. They were decidedly more common in women than men, with 34 cases in females and 11 cases in males. The age of the patient at the time of diagnosis ranged from 15 to 60 years. Most patients were in their twenties or thirties at the time of diagnosis.

In contrast to central and midzonal cysts peripheral epithelial cysts had a tendency to be unilateral and solitary. Of the 45 cases 42 were unilateral and 3

bilateral. Of the 48 total eyes involved 46 had solitary cysts and 2 had multiple cysts. The 2 eyes with multiple cysts were in the same patient, who was noted to have bilateral multiple lesions during the second trimester of pregnancy.

All peripheral cysts in this series were centred between either the 2 and 4 o'clock meridians or the 8 and 10 o'clock meridians, with an equal distribution between right and left eyes. No lesions of this type were found directly at the 12 o'clock or the 6 o'clock positions. There was a definite tendency for the lesions to occur on the temporal side of the iris. Of the 46 eyes with solitary cysts the lesion was located temporally in 39 cases (85%) and nasally in 7 cases (15%). Of the 39 cysts located on the temporal side the lesion was situated inferotemporally in 33 cases (85%). Thus these lesions were far more common between 7 o'clock and 9 o'clock in the right eye and between 3 o'clock and 5 o'clock in the left eye.

In most cases the peripheral cyst was recognised on routine slit-lamp examination as a very subtle anterior displacement of the iris stroma at or just below the horizontal meridian (Fig. 6A). The elevation could be best appreciated with the slit-lamp by using a vertical slit beam (Fig. 6B). In most instances the overlying iris stroma was intact or only slightly thinned. Even with wide pupillary dilatation such cysts could not be directly visualised by routine slit-lamp techniques. But by obtaining maximal pupillary dilatation, rotating the slit-lamp to the side, using a horizontal light beam, and tilting the bar of the slit-lamp the cyst wall was directly visualised between the iris and ciliary body in 33 of the 48 eyes involved (Fig. 7). With the Goldmann 3-mirror contact lens further to facilitate visualisation of the peripheral portion of the posterior chamber, the cyst could be visualised in 45 of the 48 eyes. The most

Fig. 5 Inferior midzonal epithelial iris cyst in a 35-year-old man. The lesion was diagnosed during an attack of acute nongranulomatous iritis. One week later, after treatment of the iritis, the cyst had almost disappeared.

Fig. 6A

Fig. 6B

Fig. 6 A. Slit-lamp characteristics of a peripheral epithelial iris cyst using diffuse illumination. A very subtle thinning of the iris stroma can barely be visualised (arrow). B. Slit-beam view showing anterior bowing of the iris in the same area (arrow).

obvious abnormality on gonioscopy was a rounded anterior displacement of the peripheral portion of the iris stroma. With slight tilting of the lens the thin-walled cyst could be visualised. In contrast to central and midzonal epithelial cysts the peripheral cysts transmitted light readily, often allowing visualisation of the ciliary processes through both walls of the lesion (Fig. 8). In 3 cases the cyst could not be directly visualised by this technique and the diagnosis remained presumptive. The typical anterior displacement of the iris stroma in the horizontal meridian in young adult women with no evidence of ciliary body

tumour, however, provided strong support for the diagnosis.

DISLODGED CYSTS—ANTERIOR CHAMBER

In 4 of the 62 cases a typical epithelial cyst was present in the anterior chamber, presumably having become dislodged and having passed from the posterior chamber through the pupil (Table 2). Routine slit-lamp biomicroscopy in these cases showed a pigmented lesion in the peripheral iris, suggesting a pigmented tumour (Fig. 9A). Gonioscopy, however,

Fig. 7 View of peripheral epithelial iris cyst located in the iridociliary sulcus (arrows). The pupil is widely dilated. The lens is to the right of the arrows and the iris is to the left. Note the minimal compression of the lens capsule by the cyst.

Fig. 8 Gonioscopic features of peripheral epithelial iris cyst located in iridociliary sulcus. The black arrow (right) depicts the typical anterior displacement of the iris stroma. The white arrow (left) depicts the cyst behind the iris. Note that the cyst wall is clear, permitting visualisation of the ciliary processes through the cyst.

Fig. 9A

Fig. 9B

Fig. 9 A. Epithelial cyst of iris which dislodged, migrated to the anterior chamber, and became fixed in the angle at 8 o'clock (arrow). B. Goniophotograph of cyst shown in Fig. 9A. Note that the lesion lies anterior to the iris stroma, which is compressed posteriorly by the cyst.

showed the lesion to be lying on the surface of the iris, anterior to the iris stroma (Fig. 9B). In 3 of the 4 cases the dislodged cyst had become fixed in the anterior chamber angle. One was fixed at the 8 o'clock position in the right eye and the other 2 were fixed in the angle at the 6 o'clock position. In one case the anterior chamber cyst was not fixed but was floating freely in the anterior chamber and moved with positioning of the patient's head (Figs. 10A–D). All cases of dislodged cysts in the anterior chamber were unilateral and solitary (Table 2). The lesions characteristically did not transmit light, although small foci of depigmentation occasionally allowed slight transmission. In no case of dislodged cyst in the anterior chamber could the original site of the cyst be identified by routine slit-lamp examination or gonioscopy.

DISLODGED CYSTS—VITREOUS CHAMBER

Dislodged cysts were found in the vitreous chamber in one male and one female patient (Table 2). In both cases the cyst was unilateral and solitary. In both instances the cyst was suspended in the gel of the mid vitreous. It showed slight mobility with movement of the eye but then returned promptly to its original position. These cysts had only minimal pigmentation on their walls and were transparent with both slit-lamp biomicroscopy and ophthalmoscopy, allowing visualisation of the retinal blood vessels through both walls of the cyst (Fig. 11).

Although it is theoretically possible that a dislodged cyst could occur in the posterior chamber, no such cases were encountered in this series.

CYSTS OF THE IRIS STROMA

Three patients had cysts which involved the iris tissue anterior to the pigment epithelium. They were classified as primary epithelial cysts of the iris stroma (Table 2). One occurred in a 2-year-old child in whom a clear cyst, presumably present since birth, was noted to be progressively enlarging over several weeks (Fig. 12). The anterior wall of the cyst was excised and the lesion did not recur. This was classified as a congenital stromal cyst.

Two stromal cysts developed in adults and were classified as acquired primary epithelial cysts of the iris stroma. One was located superiorly in a 24-year-old woman (Fig. 13). It had been first noted 4 years earlier and had supposedly shown very slow enlargement, but the patient remained asymptomatic and the cyst was essentially unchanged during 4 years of follow-up. There was no history of ocular trauma.

The second acquired primary stromal cyst occurred in a 32-year-old man whose cyst was located temporally in the left eye (Fig. 14A). The patient had a history of recurrent, mild ocular trauma from fist fights, but the globe had never been perforated. The cyst had appeared spontaneously and had shown progressive enlargement for 3 years. Because of recurrent ocular inflammation it was aspirated through the limbus with a 25 gauge needle. It became smaller and adhered to the corneal endothelium but did not recur during the 2 years of follow-up after aspiration (Fig. 14B). In contrast to epithelial iris cysts the stromal cysts were larger, had a clear anterior wall, a densely pigmented posterior wall, and contained clear fluid. In one case iris blood

Fig. 10A

Fig. 10C

Fig. 10B

Fig. 10D

Fig. 10 A. Anterior segment view of free-floating cyst in anterior chamber with patient sitting, showing pigmented lesion in angle inferiorly. B. Gonioscopic view of same lesion shown in Fig. 10A. C. Anterior segment view with patient in supine position. The cyst has migrated from the 6 o'clock to the 9 o'clock position. D. Anterior segment view with patient in supine position with neck extended. The cyst has migrated to the 11 o'clock position (arrow).

vessels could be seen on the anterior surface of the lesion (Fig. 12).

REFERRING DIAGNOSIS

A referring diagnosis was received in 59 of the 62 cases of primary iris cyst (Table 3). There were only 3 diagnostic possibilities which were entertained by the referring physician: (1) iris cyst; (2) cyst, rule out melanoma; and (3) melanoma. One of the 3 central epithelial cysts was initially suspected to be a

malignant melanoma. Three of the 4 midzonal epithelial cysts were initially diagnosed as melanoma and one was correctly recognised as an iris cyst. Of the 44 peripheral iridociliary cysts in which a referring diagnosis was received only 8 were initially diagnosed as an iris cyst. Ten patients were referred with the diagnosis of 'cyst, rule out melanoma,' and 26 had a referring diagnosis of iris or ciliary body melanoma. In all, 36 of the 44 cases caused concern that the lesion could be a melanoma. Of the 4 dislodged cysts

Fig. 11 Free-floating epithelial cyst in vitreous just inferonasal to the optic disc. Note that lesion is semitransparent, allowing faint visualisation of the retinal vessels through its walls.

which were present in the anterior chamber 2 were correctly recognised as a cyst and 2 raised suspicion that the lesion could be a melanoma in the anterior chamber angle. The 2 dislodged cysts in the vitreous chamber were easily recognised as cysts and caused no diagnostic problem for the referring ophthalmologist. Of the 3 primary stromal cysts 2 were correctly diagnosed as cystic lesions, but the other was referred specifically to exclude the possibility of melanoma.

Fig. 12 Congenital stromal cyst of iris in a 2-year-old child. The lesion has doubled in size over a few weeks. Note the stretched blood vessels on the surface of the relatively clear cyst. (Compliments of Dr P. Robb McDonald, Philadelphia, and Dr Richard Tignor, Williamsport, PA).

Fig. 13 Acquired stromal cyst of iris in a 24-year-old woman. The lesion is located superiorly and extends from the angle to the pupillary margin.

ASSOCIATED SYSTEMIC FINDINGS

The patients were carefully questioned as to any factors in the past medical history which could be related to the cysts (Table 4). Isolated cases of hypothyroidism, hypertension, and sarcoidosis were revealed, but no relationship to the iris cysts was detected. It is of interest that the only patient with multiple bilateral peripheral cysts was diagnosed as having the ocular lesions during the second trimester of her first pregnancy. Long-term follow-up on this patient is not yet available.

RELATIONSHIP TO MEDICATIONS

The patients were questioned as to any past or present medications (Table 5). Four women of child-bearing age had taken oral contraceptives prior to recognition of the cysts, 5 patients had taken various allergy medications, one was receiving indomethacin for arthritis, and one patient with a unilateral peripheral epithelial cyst had taken 0.5% pilocarpine in both eyes for 6 months because of borderline high intraocular pressures. The cyst did not appear to change in 3 years following cessation of the pilocarpine. In general no relationship between the iris cysts and medications could be substantiated.

ASSOCIATED OCULAR FINDINGS

An attempt was made to detect any current or prior ocular disorders which could possibly be related to the iris cysts (Table 6). One patient had viral conjunctivitis for 3 months before the cyst was diagnosed. Two patients with unilateral peripheral cysts gave a history of mild anterior uveitis in both

Fig. 14A

Fig. 14B

Fig. 14 A. Acquired stromal cyst of iris in 32-year-old man. The cyst is located temporally in the left eye and is encroaching on the pupil. B. Appearance of the lesion shown in Fig. 14A 3 months after aspiration of the cyst.

eyes. Another had mild sarcoid iritis in the eye with the cyst. A 35-year-old man had severe nongranulomatous iritis at the time that a midzonal cyst was diagnosed (Fig. 5). The lesion disappeared in one week following treatment of the iritis. One patient had a Burgmeister's papilla, and another had myelinated nerve fibres in the peripheral retina of the involved eye. Small anterior polar cataracts were present in both eyes of a 40-year-old man with bilateral midzonal epithelial cysts. A 28-year-old man with a dislodged cyst in the anterior chamber had recurrent toxoplasmic retinochoroiditis in the involved eye. Of particular interest was the presence of bullous retinoschisis occurring unilaterally in the same quadrant as a midzonal cyst in a 42-year-old woman. The 3-month-old child with a central cyst had advanced retinoblastoma in the same eye. The eye was treated with irradiation and the cyst remained unchanged after 6 months of follow-up. A young man with a progressive stromal cyst gave a

history of bilateral ocular trauma due to fist fights, but examination revealed no evidence of a prior perforation of the globe (Fig. 14).

OCULAR COMPLICATIONS

Of the 69 eyes with primary iris cysts (Table 2) only 2 had slightly decreased visual acuity which could possibly be attributable to the cysts (Table 7). One peripheral epithelial cyst was present in an eye with 6/12 (20/40) vision which was believed to be due to slight lenticular astigmatism. The patient with the stromal cyst and ocular trauma had a vision of 6/9 (20/30) which was attributable to anterior segment inflammation. In the case of the man who had acute iritis and a midzonal epithelial cyst the slightly decreased vision appeared to be due to the iritis and not due to the cyst. The other 66 involved eyes had normal visual acuity. No patient had increased intra-ocular pressure, corneal oedema, or cataract in the involved eye.

Table 3 Primary cysts of the iris—referring diagnosis*

Type	Number of cases	Number of cases with diagnosis submitted	Cyst(s)	Cyst, rule out melanoma	Melanoma
Central	3	2	1	0	1
Midzonal	5	4	1	0	3
Peripheral	45	44	8	10	26
Dislodged, anterior chamber	4	4	2	1	1
Dislodged, vitreous	2	2	2	0	0
Stromal					
Congenital	1	1	1	0	0
Acquired	2	2	1	1	0
Total	62	59	16	12	31

*From Shields JA. Primary cysts of the iris. *Trans Am Ophthalmol Soc* 1981; 79: 771–809.

Table 4 Systemic findings in patients with primary cysts of the iris*

Age	Sex	Type of cyst	Systemic disease (s)
34	Female	Peripheral	Pneumonia—twice
43	Female	Peripheral	Meningitis, age 13
37	Female	Peripheral	Hypothyroidism
21	Female	Peripheral	Colitis
28	Female	Peripheral	Hypertension
			Hypothyroidism
			sarcoidosis
			(only black patient in series)
47	Female	Peripheral	Laryngeal polyp
25	Female	Peripheral, OU	First trimester of pregnancy
24	Female	Stromal, acquired	Hepatitis, age 21

*From Shields JA. Primary cysts of the iris. *Trans Am Ophthalmol Soc* 1981; 79: 771–809.

Table 5 Medication history in patient with primary cysts of the iris*

Age	Sex	Type of cyst	Medications
43	Female	Peripheral	Penicillin and sulfonamides
19	Female	Peripheral	Oral contraceptives
30	Female	Peripheral	Oral contraceptives
45	Female	Peripheral	Indomethacin
42	Female	Peripheral	Oral contraceptives
19	Male	Peripheral	Pilocarpine 0.5% for 6 months (glaucoma suspect)
24	Female	Stromal	Oral contraceptives

Five patients were taking various medications for allergies.

*From Shields JA. Primary cysts of the iris. *Trans Am Ophthalmol Soc* 1981; 79: 771–809.

NATURAL COURSE

An attempt was made to determine the natural course of the primary cysts of the iris (Table 8). In the 3 patients with central cysts no change in the lesions was demonstrated during follow-up periods of 1, 2, and 5 years respectively. Four of the patients with midzonal cysts also showed no change in the cysts in either eye during an average follow-up of 4 years. As mentioned above, the fifth patient experienced dis-

appearance of a midzonal cyst when treated for acute iritis. Follow-up information was obtained on 39 of the 45 patients with peripheral cysts and 6 patients were lost to follow-up. Among 38 patients with an average follow-up of 38 months 31 cysts remained unchanged, 7 were definitely smaller, and none became larger during the follow-up period. In 4 of the patients the cyst gradually disappeared, with resolution of the anterior displacement of the iris and no further visualisation of the lesion by gonioscopy. Two of the 3 stromal cysts demonstrated enlargement and were managed by surgical excision and aspiration respectively.

PATHOLOGY

When examples of the histopathology of iris cysts were not available from our patients we obtained a few sections from the pathology files of some of our colleagues. We could not obtain histopathological sections of a central (pupillary) iris cyst. The midzonal pigment epithelial cyst extended from the root of the iris to the area of the sphincter muscle on the posterior surface of the iris (Fig. 15). The cyst was lined externally by the pigment epithelium, explaining its failure to transmit light in most instances. The extent and location of these cysts explain why they became visible when the pupil was widely dilated. This was enhanced by the proximity of the lesion to the iris collarette, which allowed the cyst to be everted when the pupil was dilated.

Cysts which arose from the peripheral portion of the iris (iridociliary sulcus) occurred at a location where the nonpigmented epithelium of the ciliary body became continuous with the pigment epithelium of the iris (Fig. 16). Therefore in contrast to central and midzonal cysts, which were lined externally by iris pigment epithelium, the peripheral cysts transmitted light because at least a part of their external surface was lined by nonpigmented epithelium. They were located peripheral to the iris collarette, explaining their failure to evert when the pupil was dilated.

Table 6 Ocular disorders in patients with primary cysts of the iris*

Age	Sex	Type of cyst	Eye(s) with cyst	Ocular disorders
34	Female	Peripheral	OD	Viral conjunctivitis, OD, 3 months before
43	Female	Peripheral	OD	Optic atrophy OS due to meningitis, age 13
27	Male	Peripheral	OS	Corneal foreign body, OS, 2 weeks prior to diagnosis
31	Male	Peripheral	OS	Recurrent iritis, OU
19	Male	Peripheral	OS	Mild optic atrophy, OU Unknown cause
28	Female	Peripheral	OS	Sarcoid uveitis, OS
48	Female	Peripheral	OS	Iritis OU, 15 years prior to diagnosis
28	Female	Peripheral	OD	Burgmeister's papilla, OD
34	Female	Peripheral	OD	Peripheral myelinated nerve fibres, OU
42	Female	Midzonal	OD	Bullous retinoschisis, OD; unilateral, same

Fig. 15 Histopathology of midzonal epithelial iris cyst. Note that the 2 layers of the iris epithelium are separated and the posterior layer is thrown into folds (arrow). Other cysts, not seen clinically, were present in the pars plicata. (Haematoxylin-eosin, $\times 17$.) (Compliments of Dr Todd Makley).

No cases of free-floating anterior chamber or vitreous cysts were obtained for histological study. Primary iris stromal cysts were characterized by stratified epithelium suggestive of surface epithelium. The presence of goblet cells suggested a similarity to conjunctival epithelium. The 2 cases obtained for

histological review in this study showed the lesion to be lined by surface epithelium and to contain goblet cells (Figs. 17, 18).

Discussion

The literature on primary iris cysts is rather scanty because most prior reports cited only a single example or a small series of patients, and no writer had accumulated enough cases to classify the lesions into clinically meaningful categories. A review of published work indicated that such cysts may occur on the pupillary margin, in the posterior epithelial layer of the iris, or as free-floating cysts in the aqueous or vitreous chambers. Finally, in rare instances a cyst may appear to develop in the iris stroma. Our classification (Table 1) was based on a review of the literature combined with our personal observations.

CYSTS OF THE PUPILLARY MARGIN

Very little has been written about primary cysts which

Table 7 Ocular disturbances possibly attributable to the cyst(s) in eyes with primary iris cysts (69 eyes: 62 patients)

Finding	Frequency	Comments
Increased intraocular pressure	0/69	—
Corneal oedema	0/69	—
Cataract	0/69	—
Lenticular astigmatism	1/69	Vision 6/12; minimal distortion of zonules
Iritis	1/69	Vision 6/9; large stromal cyst in eye with recurrent blunt trauma
Total	2/69	Only 2 of 69 eyes had visual disturbance, which was mild in both instances

Table 8 Follow-up data on primary cysts of the iris

Type of cyst	Number of cases	Number with follow-up	Number unchanged	Number smaller	Number larger	Average length of follow-up (months)
Central	3	3	2	0	0	25
Midzonal	5	5	4	1	0	35
Peripheral	45	39	32	7	0	26
Dislodged, anterior chamber	4	4	4	0	0	30
Dislodged, vitreous chamber	2	2	2	0	0	28
Stromal	3	3	1	0*	2*	24

*Two stromal cysts showed progressive enlargement and became smaller after surgical excision and aspiration respectively.

Fig. 16 Histopathology of peripheral epithelial iris cyst. Note the rounded clear lesion in the region of the iridociliary sulcus. (Haematoxylin-eosin, $\times 17$.) (Compliments of Dr Robert Foos).

occur at the pupillary margin, and such lesions appear to be extremely rare. Fuch in 1931 described 'congenital ectropion uveae,' which appears in reality to have been cysts of the pupillary margin.² Cowan reported 4 patients, all of whom were members of one family.³ Each of his patients had bilateral, multiple, pigmented globular protuberances located at the pupillary margin of the iris. He pointed out the congenital, familial tendency of this condition, stressed the term 'iris flocculi' to describe those cysts which had apparently ruptured spontaneously, and

emphasised the lack of ocular complications associated with such cysts. He supported the theory that they were secondary to a failure of closure of the annular sinus. Berliner⁴ also stressed that iris flocculi formation is definitely hereditary, but not sex-linked. Duke-Elder⁵ reviewed the subject of iris flocculi but he did not stress the cystic nature of this entity.

The pathogenesis of these pupillary margin cysts is obscure. It seems feasible that they occur as a failure of closure of the anterior portion of the primitive optic cup (annular sinus of von Szily). Some authors

Fig. 17 Histopathology of congenital epithelial cyst of the iris stroma showing stratified epithelium similar to that of conjunctiva. (Haematoxylin-eosin, $\times 55$.) (Compliments of Dr W. Richard Green).

Fig. 18 Periodic acid Schiff (PAS) preparation of another congenital epithelial cyst of iris stroma, showing conjunctival epithelium with goblet cells (dark staining cells). (PAS, $\times 163$.) (Compliments of Dr W. Richard Green).

have pointed out their similarity to the pigment processes normally hanging over the pupils of horses and cattle and suggested that they may represent atavistic vestiges.⁴

The pathology of pupillary margin cysts has not been well described in the literature. Berliner quotes Fuch as showing that they consist of 'hyperplasia of the pigment epithelium with no enclosed connective tissue.'⁴

CYSTS OF THE POSTERIOR IRIS EPITHELIUM

Cysts which arise from the posterior epithelial layers of the iris have stimulated considerable interest because of their tendency clinically to resemble malignant melanomas of the ciliary body and iris. In some cases the patient had been mismanaged because the lesion could not be clinically differentiated from a melanoma.

As early as 1897 Zimmerman reported a patient with bilateral involvement.⁶ Although the lesions were suspected to be malignant tumours, they were followed up cautiously and showed no change over a period of 4 years. Bickerton reported a case in which the cyst was suspected of being a malignant melanoma, but since it 'did not respond to treatment with potassium iodide and mercury' it was removed by iridectomy.⁷ Lowenstein and Foster reported the histopathological features of such a cyst, which was found in an eye enucleated for a malignant melanoma of the limbus, but they did not present convincing evidence for a relationship between the 2 lesions.⁸ They provided a brief review of the literature and pointed out that only about 13 cases had been recorded up to 1940. Berliner speculated that such cysts were developmental and due to failure in fusion embryologically of the two posterior epithelial layers of the iris.⁹

Reese, in a study of iris and ciliary body cysts which were discovered on histological examination of eyes, pointed out that he had seen 12 cases clinically which belonged to this group.^{10,11} Vail and Merz described a rather large cyst of this type and reviewed the various theories of pathogenesis.¹² Scheie added 16 cases and stressed the value of gonioscopy in the diagnosis of such lesions.¹³ The patient reported by Makley and King had multiple cysts which so closely resembled a malignant melanoma that the eye was enucleated.¹⁴

The most thorough descriptions of the pathology of cysts of the iris epithelium have been provided by Reese,^{10,11} Hogan and Zimmerman,¹⁵ and more recently by Meyer *et al.*¹⁶ The cysts are formed by a separation of the 2 layers of epithelium anywhere between the pupil and the ciliary body.

The pathogenesis of these cysts is not entirely clear. Vail and Merz speculated that the condition results from traction of the zonules on the ciliary epithelium

during growth of the eye, which allows for faulty apposition between the outer and inner layers of the optic cup in the iridociliary region.¹² In support of this theory of pathogenesis they quote Gartner,^{17,18} who observed anomalous ciliary processes on the peripheral iris which could account for development of zonules with traction in the region of the iridociliary sulcus. Davidson,¹⁹ in a report of 2 cases, also supported this tractional theory. Kozart and Scheie,²⁰ in a histopathological study of canine and human eyes, suggested that the cysts result from a proliferation of cells of the neuroepithelial layer rather than from a separation of the 2 layers.

FREE-FLOATING ANTERIOR CHAMBER CYSTS

Pigmented cysts in the anterior chamber have been recognised for many years. Coats in 1912 reported a case in which the cyst shifted with movement of the patient's head.²¹ Yanoff and Zimmerman described a case in which the involved eye was enucleated because of suspected melanoma and reviewed the literature on the subject.²² Donaldson presented clinical photographs of 2 cases.²³ Fine reported a free-floating cyst in the anterior chamber which interfered with vision and required surgical removal.²⁴

On the basis of the few cases studied histologically these anterior chamber cysts appear to be lined by iris pigment epithelium and to contain clear fluid. In one reported case the cyst was lined by both pigmented and nonpigmented epithelium.²² The case reported by Fine was entirely lined by deeply pigmented epithelium.²⁴

FREE-FLOATING VITREOUS CYSTS

Perhaps because they are so fascinating clinically a number of cases of free-floating vitreous cysts, presumably originating in the iris or ciliary body, have been reported. Few authors, however, have recorded more than one such case. A typical case in a 17-year-old boy was recorded by Tansley in 1899.²⁵ A case of 2 cysts in the vitreous of one eye was recorded by Brewerton, but the clinical description was not clear.²⁶ The cases reported by Shine,²⁷ Scarlett²⁸ and Hurwitz,²⁹ however, were typical. Additional isolated cases were reported by Meding³⁰ and Seech,³¹ both of whom reviewed the literature on the subject. Cassady in 1939 reported a typical case and provided another excellent review of the literature.³² He reported a second case in 1949.³³ In recent years case reports were added by several authors.³⁴⁻³⁸

An interesting relationship between retinitis pigmentosa and vitreous cysts had been pointed out several times. Perera reported a case of bilateral vitreous cysts in a 55-year-old man with retinitis pigmentosa and cited other similar cases.³⁹ It is not likely that these rare cysts are related to the free-

floating cysts which presumably take origin from the epithelium of the iris or ciliary body.

IRIS STROMAL CYSTS

Primary cysts which develop in the iris stroma are rather rare. This type of cyst characteristically occurs unilaterally in infants or young children. The case reported by Butler was on a 1-month-old child,⁴⁰ that of Guerry and Weisinger was in a 3-year-old child,⁴¹ that of Klein and Tanner in a 4-month-old child,⁴² that of Roy and Hanna in a 2-month-old child,⁴³ and the case of Mullaney and Fitzpatrick in a 6-month-old child.⁴⁴ The 2 patients reported by Naumann and Green were in a 3-month-old and a 15-month-old child respectively.⁴⁵

In rare instances cysts apparently of this type have occurred in adults.⁴⁶ The case reported by Laval, which occurred in a 57-year-old man, may have been of this type.⁴⁷ A similar case was reported by Wilson in a 36-year-old man.⁴⁸ One of the 4 cases reported by Cleasby was apparently of this type. It occurred in a 7-year-old child but may have been present since birth.⁴⁹ An analysis of reported cases fails to detect any major clinical differences between those present at birth and those which appeared in adulthood. Two of the 3 patients in our series were adults at the time of diagnosis.

PRIOR CONCEPTS OF NATURAL COURSE AND COMPLICATIONS

A number of authors have discussed the natural course and complications of primary cysts of the iris, particularly those which arise from the posterior epithelial layer. As recently as 1974 Duke-Elder made the following statement: 'Although they may remain stable for a long time, the tendency is for them to grow slowly and steadily, ultimately bringing on secondary glaucoma and loss of vision.' He continues, 'as a rule, their evolution may be divided into three stages: (1) a symptom-free period, when no discomfort or visual disturbances arise; (2) an irritative period when an iridocyclitis may develop; (3) a period of raised tension which results in absolute glaucoma, vision being completely destroyed and excision of the eye usually being necessary because of pain.' Finally, he stressed, 'It is important, therefore, as soon as the diagnosis is made, to arrange for adequate treatment when the cyst is yet small, especially if it is seen to be growing in size, since the only ultimate result which can legitimately be expected, if events are allowed to take their course, is loss of the eye.'⁵⁰ In none of our cases did such complications develop.

Garron,⁵¹ in reporting a case in which the involved eye was enucleated because of suspected melanoma stated, 'most cases are first observed after the onset of glaucoma. Usually the cysts have by then grown to

a considerable size and the eye is removed because of absolute glaucoma or because malignant melanoma is suspected.' The involved eye in his case had an intraocular pressure of 34 mmHg. Chandler and Braconier reported 3 patients with multiple cysts who developed acute angle-closure glaucoma.⁵² This contrasts with our series, where none of the cases had secondary glaucoma.

CONCLUSIONS

During the course of our study it gradually became apparent that many of the aforementioned statements from the literature, particularly with regard to the natural course and complications of these lesions, were not well substantiated. These misconceptions were perhaps due to the tendency of physicians to report those cases which produced complications or which were managed by enucleation because of suspected melanoma. Although we are unable to link the occurrence of primary iris cysts to systemic disease, ocular disease, or medications, our study has clearly shown that the great majority of primary iris cysts, particularly those which arise from the iris pigment epithelial layer, are stationary lesions which rarely progress or cause visual complications. The natural course of primary epithelial cysts differs from that of secondary iris cysts which follow surgical or nonsurgical trauma. The latter lesions can sometimes enlarge and lead to complications such as inflammation and glaucoma.

The major clinical importance of primary iris cysts lies in their similarity to neoplasms of the iris and ciliary body. Clinical features and certain transillumination techniques, which are helpful in the diagnosis, are beyond the scope of this paper but are discussed in a recent textbook on intraocular tumours.⁵³

It is concluded that the great majority of primary iris cysts are ophthalmic curiosities which require no treatment.

Fig. 12 was provided by Dr P. Robb McDonald, Fig. 15 by Dr Torrance Makley, Fig. 16 by Dr Robert Foos, and Figs. 17 and 18 by Dr W. Richard Green.

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References

- 1 Shields JA. Primary cysts of the iris. *Trans Am Ophthalmol Soc* 1981; **79**: 771-809.
- 2 Fuch A. Contribution to the anatomy of congenital ectropion uveae (fluocculi iridis). *Am J Ophthalmol* 1931; **14**: 865-8.
- 3 Cowan A. Congenital and familial cysts and flocculi of the iris. *Am J Ophthalmol* 1936; **19**: 287-91.
- 4 Berliner ML. *Biomicroscopy of the eye*. New York: Hoeber, 1949: 2: 784.

- 5 Duke-Elder S. *System of ophthalmology*. St Louis: Mosby, 1974; 3: (2), 600–6.
- 6 Zimmerman MW. A case of bilateral pigmented tumors, probably cysts of the ciliary bodies. *Ophthalmic Rev* 1897; 19: 129–30.
- 7 Bickerton ML. Cyst of iris. *Trans Ophthalmol Soc UK* 1907; 27: 83–4.
- 8 Loewenstein A, Foster J. Malignant melanoma of limbus and spontaneous cyst of pigmented layer of iris in same sector. *Arch Ophthalmol* 1933; 16: 51.
- 9 Berliner ML. *Biomicroscopy of the eye*. New York: Hoeber, 1949; 2: 936.
- 10 Reese AB. Spontaneous cysts of the ciliary body simulating neoplasms. *Trans Am Ophthalmol Soc* 1949; 47: 138–46.
- 11 Reese AB. Spontaneous cysts of the ciliary body simulating neoplasms. *Am J Ophthalmol* 1950; 33: 1738–46.
- 12 Vail D, Merz EH. Embryonic intraepithelial cyst of the ciliary processes. *Trans Am Ophthalmol Soc* 1951; 49: 167–83.
- 13 Scheie HG. Gonioscopy in the diagnosis of tumors of the iris and ciliary body with emphasis on intraepithelial cysts. *Trans Am Ophthalmol Soc* 1953; 51: 313–31.
- 14 Makley TA, King GL. Multiple cysts of the iris and ciliary body simulating a malignant melanoma. *Trans Am Acad Ophthalmol Otolaryngol* 1958; 62: 441–3.
- 15 Hogan MJ, Zimmerman LE. *Ophthalmic pathology: an atlas and textbook*. Philadelphia: Saunders, 1962: 369.
- 16 Meyer KT, Erlik N, Foos RY. Cysts of the iris epithelium. Scientific poster at 1980 Annual Meeting of the American Academy of Ophthalmology, Chicago, IL, 2–7 November 1980.
- 17 Gartner S. Anomalous processes of the ciliary type of the posterior surface of the iris. *Am J Ophthalmol* 1942; 25: 854–7.
- 18 Gartner S. Displacement of ciliary processes to the posterior surface of the iris. *Am J Ophthalmol* 1942; 25: 858–60.
- 19 Davidson SI. Spontaneous cysts of the ciliary body. *Br J Ophthalmol* 1960; 44: 461–6.
- 20 Kozart DM, Scheie HG. Spontaneous cysts of the ciliary epithelium. *Trans Am Acad Ophthalmol Otolaryngol* 1970; 74: 534–7.
- 21 Coats G. Pigmented cyst lying free in the anterior chamber. *Trans Ophthalmol Soc UK* 1912; 32: 189–94.
- 22 Yanoff M, Zimmerman LE. Pseudomelanoma of anterior chamber caused by implantation of iris pigment epithelium. *Arch Ophthalmol* 1965; 74: 302–5.
- 23 Donaldson DD. Free-floating cysts. *Arch Ophthalmol* 1967; 78: 400–1.
- 24 Fine BS. Free-floating pigmented cyst in the anterior chamber: a clinicohistopathologic report. *Am J Ophthalmol* 1969; 67: 493–500.
- 25 Tansley JO. Cyst of the vitreous. *Trans Am Ophthalmol Soc* 1899; 9: 507–9.
- 26 Brewerton EW. Cysts in the vitreous. *Trans Ophthalmol Soc UK* 1913; 33: 93–4.
- 27 Shine. Cyst of the vitreous. *Arch Ophthalmol* 1913; 42: 398.
- 28 Scarlett HW. Cyst of the vitreous: report and presentation of a case. *Trans Am Ophthalmol Soc* 1929; 27: 154–6.
- 29 Hurwitz CE. Cyst in the vitreous: report of a case. *Arch Ophthalmol* 1933; 9: 825–8.
- 30 Meding CB. Free cyst floating in the vitreous. *Arch Ophthalmol* 1934; 11: 973–5.
- 31 Seech SG. Congenital cyst in the vitreous. *Arch Ophthalmol* 1934; 11: 947–9.
- 32 Cassady JV. Congenital cyst of the vitreous. *Arch Ophthalmol* 1939; 21: 45–50.
- 33 Cassady JV. Congenital cyst of the vitreous. *Arch Ophthalmol* 1949; 41: 734–5.
- 34 Feman SS, Straatsma BR. Cyst of the posterior vitreous. *Arch Ophthalmol* 1974; 91: 328–9.
- 35 Bullock JD. Developmental vitreous cysts. *Arch Ophthalmol* 1974; 91: 83–4.
- 36 Elkington AR, Watson DM. Mobile vitreous cysts. *Br J Ophthalmol* 1974; 58: 103–4.
- 37 Awan KJ. Multiple free-floating vitreous cysts with congenital nystagmus and esotropia. *J Pediatr Ophthalmol* 1975; 12: 48–53.
- 38 Wolter JR, Martonyi CL, Smith C. A free-floating vitreous cyst in the otherwise normal eye of a young man. *J Pediatr Ophthalmol* 1975; 12: 243–5.
- 39 Perera CA. Bilateral cyst of the vitreous: report of a case. *Arch Ophthalmol* 1936; 16: 1015–7.
- 40 Butler TH. A case of cyst of the iris. *Trans Ophthalmol Soc UK* 1921; 41: 452–5.
- 41 Guerry D, Weisinger H. Spontaneous cyst of the iris stroma. *Am J Ophthalmol* 1957; 44: 106–7.
- 42 Klein BA, Tanner GS. Congenital epithelial cyst of the iris stroma. *Am J Ophthalmol* 1963; 55: 291–5.
- 43 Roy FH, Hanna C. Spontaneous congenital iris cyst. *Am J Ophthalmol* 1971; 72: 97–108.
- 44 Mullaney J, Fitzpatrick C. Idiopathic cyst of the iris stroma. *Am J Ophthalmol* 1973; 76: 64–8.
- 45 Naumann G, Green WR. Spontaneous nonpigmented iris cysts. *Arch Ophthalmol* 1967; 78: 496–500.
- 46 Rush JA, Weinstein GW, Meriwether WA. Spontaneous non-pigmented iris cysts. *Arch Ophthalmol* 1982; 100: 304–5.
- 47 Laval J. Spontaneous cyst of the iris. *Am J Ophthalmol* 1974; 30: 55–7.
- 48 Wilson W. Iris cyst treated by electrolysis. *Br J Ophthalmol* 1964; 48: 45–9.
- 49 Cleasby GW. Photocoagulation of iris-ciliary body epithelial cysts. *Trans Am Acad Ophthalmol Otolaryngol* 1971; 75: 638–42.
- 50 Duke-Elder S. *System of ophthalmology*. St Louis: Mosby, 1974; 9: 754–75.
- 51 Garron LK. Cysts of the iris, ciliary body, and retina that simulate malignant melanoma with retinal detachment. *Trans Pac Coast Ophthalmol Soc* 1953; 34: 125–36.
- 52 Chandler PA, Braconier HE. Spontaneous intraepithelial cysts of the iris and ciliary body with glaucoma. *Am J Ophthalmol* 1958; 45: 64–74.
- 53 Shields JA. Diagnosis and management of intraocular tumors. St Louis: Mosby, 1983: chapter 5.