

SCIENTIFIC REPORT

The Finger iridectomy technique: small incision biopsy of anterior segment tumours

P T Finger, P Latkany, M Kurli, C Iacob

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Aims: To develop a minimally invasive, maximally effective method to biopsy anterior segment tumours.

Methods: A 25 gauge aspiration cutter (vitrector) was used to biopsy anterior segment tumours. The probe was introduced under sodium hyaluronate 1% and through a 1 mm incision. Aspiration (600 mm Hg) cutting (300 cpm) was performed to obtain specimens for cytology and histopathology.

Results: Diagnostic material was obtained in nine of 10 (90%) cases. Diagnoses included iris naevus, iris stroma, malignant melanoma, melanocytoma, epithelial inclusion cyst, and sarcoid granuloma. All corneal wounds were self sealing. One patient developed a transient postoperative increase in intraocular pressure. Within the follow up of this study, no patients suffered intraocular haemorrhage, infection, cataract or vision loss.

Conclusion: The Finger iridectomy technique was a minimally invasive and very effective biopsy technique. Aspiration cutting yielded relatively large pieces of tissue (and cells) used for cytopathological and histopathological evaluation. Small incision surgery allowed for rapid rehabilitation and no significant complications.

Iris, iridociliary, and other anterior segment tumours can be easily accessible for biopsy with subsequent cytological and histopathological evaluation.^{1–6} Typically, specimens have been obtained by fine needle aspiration biopsy (FNAB) or surgical iridectomy through a corneal or limbal incision.^{7,8} Unfortunately, FNAB (utilising a 23–27 gauge sharp needle) often yields few cells and carries the risk of lacerating the lens, iris blood vessels, and the ciliary body with the sharp needle tip and edges. In contrast, surgical iridectomy is a much larger procedure that requires a corneal wound and sutures, with subsequent visual rehabilitation.^{6,9}

Here we describe a new technique for minimally invasive iris biopsy (with less surgical trauma). Under sodium hyaluronate 1% stabilisation, this technique utilises a 25 gauge aspiration cutter to sample iris and iridociliary tumours through a 1 mm (self sealing) clear corneal incision.

METHODS

Privacy and informed consent

Over the past 5 years, 244 anterior segment tumours were managed by one of our authors (PTF) within the framework of the New York Eye Cancer Center. From this group of patients, the last 10 that required biopsy are included in this interventional case report (table 1).

Each was noted to have an anterior segment tumour with either documented growth or a history of growth from the referring physician. Our indications for biopsy are tumour growth (n = 10), diagnosis of atypical tumours (n = 0), or

when management requires or when the patient requests a histopathological diagnosis (n = 10). Growth was defined as enlargement of tumour margins as documented in conference with the referring physician (n = 3), or by serial slit lamp photography and high frequency ultrasound evaluation over time (n = 7).^{1–4,6,7,10} Each patient signed a treatment consent and Health Insurance Portability and Accountability Act of 1996 (HIPAA) form. Each was offered FNAB or surgical iridectomy as an alternative biopsy technique. When applicable, preoperative medical oncology evaluations proved negative for metastatic cancer.

Surgical technique

Preparation

Each patient was medically cleared for local anaesthesia with sedation. In the operating room retrobulbar and facial nerve anaesthetic blocks were administered. The patient's face and eye were prepared with an iodine based topical antibiotic. An eyelid speculum was introduced and the operating microscope adjusted to maximally visualise the anterior segment tumour.

The Finger iridectomy technique (FIT)

A 0.3 forcep was used to stabilise the eye at the limbus. A microvitrectomy (MVR) blade was used to create a stab incision through clear juxtalimbal cornea, into the anterior chamber. A clear corneal incision guaranteed that any liberated cancer cells would exit the patient's body (addressing concerns about tumour seeding).¹¹ In most cases, incisions were made in positions on the same side as the tumour (so as to avoid the need to cross the pupil). Acetylcholine chloride 10 mg/ml (Miochol-E, CibaVision Novartis, Basle, Switzerland) was introduced into the anterior chamber to stabilise the iris and induce miosis. Then sodium hyaluronate 1% (Healon, Advanced Medical Optics, Santa Ana, CA, USA) was used to fill the anterior chamber. Sodium hyaluronate 1% served to maintain the anterior chamber depth (during biopsy), and to position the iris for biopsy (typically away from the natural lens). We have found that Healon was better than no infusion or saline infusion for safely stabilising the anterior chamber.

A 25 gauge aspiration biopsy cannula (vitrectomy probe) was inserted into the anterior chamber (fig 1). The aspiration port was rotated as to be (at least partially) occluded by the tumour. Aspiration cutting (Accurus, Alcon, Ft Worth, TX, USA) was typically started on suction of 300 mm Hg and a cutting rate of 600 cuts per minute (cpm). These settings were then adjusted as to maximise the efficiency of the process under direct visualisation (while trying to keep the cut rate as low as possible).

Abbreviations: cpm, cuts per minute; FIT, Finger iridectomy technique; FNAB, fine needle aspiration biopsy; MVR, microvitrectomy; PCIOL, posterior chamber intraocular lens

Table 1 Patient and tumour characteristics

Patient	Age	Sex	Eye	Tumour size (mm)			H	Tumour centre (clock hour)	Ectropion uvea	Sector cataract	Pigment dispersion	Secondary glaucoma	Intrinsic vascularity	Growth	AJCC classification
				L	W	H									
1	34	M	RE	10.1	11.6	4.7	03:00	yes	no	yes	yes	no	h/o growth	NA	
2	74	M	RE	1.7	2.4	1.0	04:00	yes	no	yes	no	no	doc growth	T1a	
3	54	F	RE	5.3	4.1	3.0	07:00	yes	yes	yes	no	no	doc growth	T2	
4	40	M	RE	12.0	10.0	7.8	06:00	no	yes	no	no	no	doc growth	NA	
5	41	M	RE	5.1	4.0	1.2	05:00	no	no	no	no	no	doc growth	T1a	
6	65	F	LE	1.9	3.5	0.9	08:30	yes	no	yes	no	no	doc growth	T1a	
7	76	F	RE	6.7	9.0	6.7	07:30	no	PCIOL	yes	no	no	h/o growth	NA	
8	81	F	LE	1.8	1.5	1.3	06:00	no	PCIOL	no	no	no	h/o growth	TX	
9	71	F	RE	2.0	2.4	0.9	12:00	yes	no	yes	yes	no	doc growth	T1b	
10	61	F	LE	2.4	3.2	1.3	10:30	yes	no	yes	no	no	doc growth	T1a	
Mean															

L, length; W, width; H, height; NA = not applicable; h/o = history of; PCIOL = posterior chamber intraocular lens; doc, documented; AJCC, American Joint Committee on Cancer.

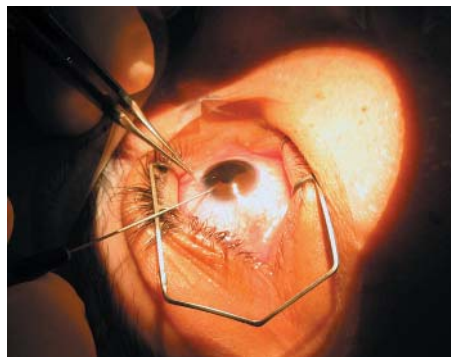


Figure 1 In case 1, the 25 gauge aspiration cutter placed through the clear corneal wound as to approximate a pigmented iridociliary tumour.

Though most cases merely thinned the tumour, more dramatic appearing partial thickness iridectomies were obtained by FIT (fig 2). Each time the cutter was removed from the eye, the cutter portal was placed in solution and the aspirate flushed from the effluent tube into an empty 3 ml syringe (with 0.5 ml of saline). Specimens were immediately sent to the pathology department for cytological evaluation. The biopsy procedure was repeated until the pathologist reported that the specimen was adequate for diagnosis. Two to three biopsies were typically performed in each case. Once an adequate specimen was obtained, the residual sodium hyaluronate 1% was removed from the eye by manual aspiration irrigation with balanced salt solution.

Closure

The corneal wound was found to be self sealing in all cases. At the end of surgery, an antibiotic steroid solution was injected beneath the conjunctiva, one drop of timolol maleate 0.5% and antibiotic steroid ointment was placed on the eye, then it was patched and shielded. Patients were discharged (on the same day) on topical steroid, antibiotic, and agents to maintain intraocular pressure control.

Pathology

Cytospin technique

A cytospin technique was used to optimise the biopsy yield. Cytospin slides were cleaned with alcohol and assembled

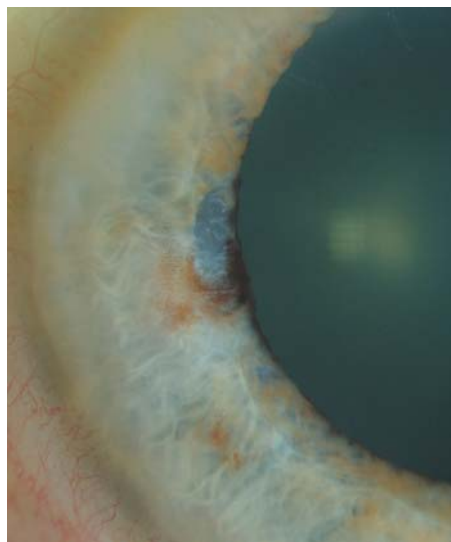


Figure 2 In case 6, a partial thickness, lamellar iridectomy biopsy was created using the Finger iridectomy technique (FIT).

Table 2 Results of biopsy

Patient No	FNAB	FIT	Surgical biopsy	Pathological diagnosis	Pre-biopsy vision	Post-biopsy vision	Treatment
1	not done	yes	yes	Melanocytoma	20	20	Observation
2	not done	yes	no	Malignant melanoma	20	20	103Pd Plaque therapy*
3	not done	yes	no	Malignant melanoma	20	20	103Pd Plaque therapy*
4	negative	negative	yes	Sarcoid granuloma	60	40	Steroid
5	not done	yes	no	Naevus	20	20	Observation
6	not done	yes	no	Malignant melanoma	20	20	Iridectomy
7	not done	yes	no	Epithelial cyst	63	50	Cystectomy
8	not done	yes	no	Normal iris	HM	HM	Observation
9	not done	yes	no	Malignant melanoma	FC	FC	Iridectomy
10	not done	yes	no	Naevus	20	20	Observation

¹⁰³Pd, palladium-103 (see Finger *et al.*¹²); vision, 20/X; FNAB, fine needle aspiration biopsy; FIT, Finger iridectomy technique; FC, finger counting; HM, hand movements.

with a slide filter card and sample delivery chamber, secured by a metal clip. Approximately 0.5 ml of fluid sample (3–5 drops) were added to the chamber together with an equal amount of cytopsin collection fluid (cytopsin slides, filter cards, sample chambers, metal clips, and collection fluid (all from Thermo-Shandon, Pittsburgh, PA, USA). After spinning at 1800 rpm for 2 minutes, the slides were removed from the cytopsin chamber, further fixed in cytology fixative (70% alcohol/formalin), and stained with the standard haematoxylin and eosin methods.

If pieces of biopsy specimen could be visualised in the 3 ml syringe or cytopsin collection fluid, the paraffin embedded cell block technique offers the advantage of multiple sections that can be used for histochemical and immunohistochemical stains. In this series, we tended to be biased towards the use of cytology because of our previous experience with the low cellular yields that were typically provided by FNAB and our desire to preserve every possible cell for diagnosis.

RESULTS

Since August 2003, 10 tumours were biopsied (table 2). This minimally invasive iridectomy technique was found capable of yielding adequate specimens in 90% (9/10) of cases. Interestingly, the biopsy of what proved to be a sarcoid granuloma could not be accomplished by either FNAB or aspiration biopsy. In this case (No 4), a corneal section with open biopsy was required (table 2). One patient (No 1) developed a transient postoperative pressure spike related to the sodium hyaluronate 1%. In the other nine patients, no other acute postoperative or short term follow up complications could be related to this surgical technique.

Cytological and histopathological analysis

Most of the iris tumours in this series were melanotic (table 2). In the cases diagnosed as iris naevus, cells were small, moderately pigmented, and ovoid with bland uniform nucleoli. In the cases diagnosed as malignant melanoma, a number of melanocytic cells were naevoid, intermediate size, and spindle shaped. But, other relatively large epithelial cells with wrinkled nuclear contour, conspicuous nucleoli, and intranuclear inclusions were diagnostic of malignant melanoma (fig 3B). Unique to this FIT biopsy technique, relatively large clumps (0.4–0.5 mm) of tissue were available to evaluate cellular density and arrangement (fig 3).

Case 1

A 34 year old man presented with a history of an enlarging pigmented iridociliary tumour with extrascleral extension. Ophthalmic examination revealed increased pigmentation of 4 clock hours of the iris anterior to a 4.7 mm high ciliary body tumour (table 1). A biopsy utilising the FIT technique

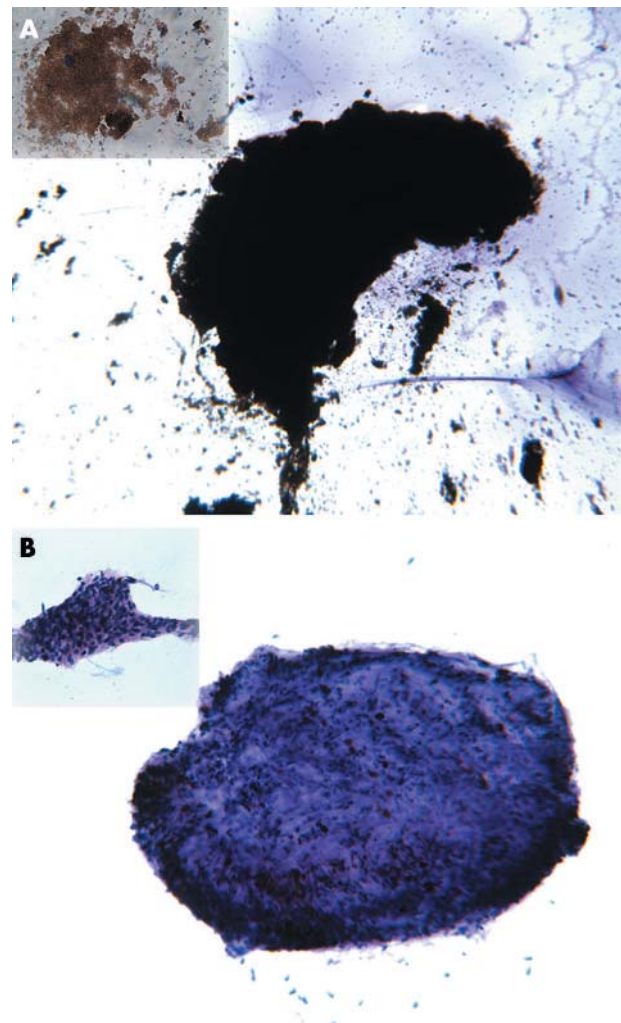


Figure 3 (A) In case 1, a group of multiple, markedly pigmented iris melanocytes in which individual cells are barely discernible. The inset shows a single cell with a small, round, and normochromatic nucleus surrounded by abundant cytoplasm with numerous melanosomes consistent with melanocytoma. Pigment outside the cell boundaries is an artefact of centrifugation. (B) In case 6, large, densely cellular fragment containing several hundreds of mostly spindle cells with high nucleus to cytoplasm ratio and focal melanin pigmentation. The inset reveals hyperchromatic, elongated nuclei with irregular contours, nuclear grooves, and moderate pleomorphism consistent with malignant melanoma.

yielded copious benign and heavily pigmented cells and tissue diagnostic of melanocytoma (fig 3A).

A surgical iridectomy confirmed the diagnosis (table 2). In this case, the FIT specimen was characterised by the presence of large benign appearing melanocytes and markedly pigmented iris epithelial cells (fig 3A). Subsequent histopathology revealed densely packed large cells with abundant melanin laden cytoplasm. Nuclei were bland, ovoid, and uniform with only occasional small basophilic nucleoli. No eosinophilic nucleoli or nuclear folds were apparent.

Case 6

This representative case involved a 65 year old woman who initially presented in June 2002 with a relatively small (AJCC-T1a), variably pigmented iris tumour with intrinsic vascularity and ectropion uveae in her left eye. Over 2 years, serial observation had revealed expansion of the ectropion uveae and increased tapioca coloured tumour visible on the iris surface (table 1). This case was complicated by Salzmann's corneal dystrophy (of the nasal quadrants); therefore a superior approach was employed (fig 2). FIT resulted in a lamellar iridectomy biopsy that was found to be diagnostic for malignant iris melanoma (fig 3B).

Complications

Since the first biopsy was performed (April 2003), no patient has lost vision as a result of this minimally invasive iridectomy procedure (table 2). One patient developed transient (<48 hours) ocular hypertension. The patient with the large iridociliary melanocytoma developed controllable intraocular pressure elevation after both FIT and surgical iridectomy.

Postoperative evaluations have revealed no wound leaks, hyphaema, endophthalmitis, cataract, or secondary refractive errors. These findings have largely been attributed to our use of a small incision, lack of irrigation, and small series of patients. All surgeries were performed in the ambulatory setting. Patients were re-examined at least within 24 hours, 1 week, 1 month, and 3 months after surgery.

DISCUSSION

Anterior segment tumours are typically accessible to biopsy through the cornea.⁸⁻¹² Biopsy techniques have included standard iridectomy, iridocyclectomy, transcorneal tumour biopsy and fine needle aspiration (FNAB).⁶ There is agreement that a transcorneal approach reduces concerns about tumour seeding.¹¹ Fine needle aspiration biopsy has been performed with sharp or blunt needles (D Bardenstein, personal communication). Most centres use sharp 22 gauge or 25 gauge needles introduced through clear cornea to poke or scrape the tumour. Cells are aspirated through the needle, extension tubing, and into a 5 ml or 10 ml syringe for subsequent cytological evaluation.

Vitreous cutters have also been employed to perform iridectomy.¹³⁻¹⁴ Ghanem *et al* used a cutter during phacoemulsification in patients with iridoschisis.¹³ Fastenberg and Bechrakis used a vitreous cutter based system for biopsy of indeterminate intraocular tumours (some of which were located in the iris).¹⁰⁻¹⁴

The FIT is different from these techniques; it is a minimally invasive approach utilising a 25 gauge aspiration cutter probe

to perform localised iridectomy through a 1 mm incision (under sodium hyaluronate 1%). Unlike the Ghanem technique there is no scleral phacoemulsification incision, or irrigation. Similarly, Bechrakis employed a relatively large aspiration cutter (20 gauge) and a 21 gauge infusion cannula (to maintain anterior chamber depth). Their corneal incisions were reported to require closure with 10-0 nylon sutures. Clearly, irrigation can make harvesting iris tumour fragments more difficult.

In this series, a pathological diagnosis was achieved in nine of 10 (90%) cases. No patients lost vision and only one intraocular pressure spike could be attributed to the FIT. This study introduces the concept of using a 25 gauge aspiration cutter to perform minimally invasive biopsies of anterior segment tumours (for example, iris and iridociliary tumours) through a solitary 1 mm incision (under sodium hyaluronate 1%).

Authors' affiliations

P T Finger, M Kurli, The New York Eye Cancer Center, New York, USA
 P T Finger, P Latkany, M Kurli, C Jacob, The New York Eye and Ear Infirmary, New York, USA
 P T Finger, P Latkany, New York University School of Medicine, New York, USA

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Correspondence to: Paul T Finger, MD, FACS, The New York Eye Cancer Center, 115 East 61st Street, New York City, NY 10021, USA; pfinger@eyecancer.com

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