Ultrasound Biomicroscopy for Delineation of Iris Melanoma

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Conflict declaration

The authors have no conflicts of interest to declare.
Case Presentation

• A 40 year old Caucasian male presents to the eye clinic with a darkly pigmented infratemporal lesion in his right eye.

• The corrected visual acuity in both eyes was 6/6, intraocular pressure measured 15 mmHg and 16 mmHg in the right and left eye respectively, and both pupils were equal and reactive.

• Slit lamp biomicroscopy was performed.
Slit lamp biomicroscopy showed a well demarcated and heavily pigmented lesion in the peripheral iris between 6-8 o’clock.
Case Continued

• In order to differentiate a benign nevus from a malignant growth, both ultrasound biomicroscopy (UBM) as well as fine needle aspiration (FNA) biopsy were performed...
Left image: Low power view of the cellular aspirate demonstrating satisfactory yield.
Right image: High magnification showing Spindle cell with a large nucleus and prominent nucleoli. Large melanosomes confirm Spindle B melanoma cells.
BAP1 Gene Mutation

• FNA confirmed melanoma with inactivation of the BAP1 gene, increasing the probability of metastasis.

• An exome sequence study of uveal melanoma cases revealed the BAP1 inactivation to be present in 26/31 (84%) of metastasizing tumors.

• Detection of BAP1 gene mutation indicates prompt treatment and surveillance.
Ultrasound biomicroscopic appearance of a normal eye. The cornea (C), sclera (S), anterior chamber (AC), posterior chamber (PC), iris (I), ciliary body (CB), lens capsule (LC), and lens (L) can be identified. The scleral spur (black arrow) is an important landmark to assess the morphologic relationships among the anterior segment structures.
UBM revealed a significant mass lesion involving the iris and extending posteriorly. No ciliary body or choroidal involvement is seen.
Zoomed-in image showing solid mass is derived from the iris stroma itself, allowing classification of the uveal melanoma as definite iris melanoma.
Differentiation on UBM

• Iris melanoma:
  – High/medium reflectivity
  – **Loss of posterior iris plane**
  – Possible cavitation

• Iris nevus
  – High/medium reflectivity
  – **Normal integrity of posterior iris plane**
  – Anterior convex bowing of iris
Left image: Iris melanoma – medium/high reflectivity, loss of posterior plane, cavitation.
Right image: Peripheral iris nevus – medium/high reflectivity, normal posterior iris plane, tenting of iris.

Treatment

• The patient was treated with brachytherapy using a I-125 plaque.

• As the area of treatment involves a safety margin beyond the borders of the tumor, the effects of brachytherapy on visual prognosis is often dependent on the proximity of the tumor from the fundus. Given the peripheral placement of the tumor, the patient had a favorable prognosis.
Follow-Up

Follow up UBM three years later illustrated successful radiotherapy with reduced tumor dimensions.
Zoomed-in UBM image comparison of tumor prior to and after radiotherapy.
Case Conclusion

Following treatment the patient developed a cataract, the most common complication at 83%, and is scheduled for cataract surgery.

Patient is healthy and well without significant impairment to vision, and is currently under periodic monitoring for tumor advancement or metastasis.
Iris Melanoma

- Uveal melanomas are the most common primary intraocular tumor in adults (annual incidence of 5.1 per million) of which iris melanomas account for 3-10%.

- Iris melanomas have a favorable prognosis due to their lower rates of visual morbidity and metastasis, and 5 year mortality rate of 2-3%.

- Risk factors for metastasis include: patient age at diagnosis, elevated intraocular pressure, large tumor size, ciliary body involvement, BAP1 gene mutation, and prior surgical treatment of tumor.
Advantages of UBM in anterior segment tumor imaging

- UBM supplements findings visible in conventional methods (e.g., slit lamp examination) by imaging structures previously not visible, including the ciliary body and zonules.

- In differentiating solid masses from cystic lesions, UBM can visualize the degree of penetration of iris root and ciliary face, and can measure lesion size, a predominant indicator of malignancy, with greater accuracy through more clearly demarcated tumor boundaries.

- Relative to conventional ultrasound, high frequency UBM provides higher resolution cross-sectional images to clearly depict tumor dimensions, surface, and internal reflectivity.
UBM in differentiation of nevus, iris melanoma, and ciliary body involvement

- UBM is a crucial augmentation to standard monitoring techniques, as both diameter and thickness can accurately be measured to document growth, the most reliably indicator of malignancy.

- The abnormality of the posterior iris surface is a finding that is almost exclusively present in iris melanomas and absent in nevi.

- Involvement of the ciliary body is illustrated on UBM by a reduced reflectivity of the iris mass, and nevi seldom involve the ciliary body.

- The clear visualization and resulting precise definition of tumor boundaries permits for more conservative therapeutic margins, mitigating radiation exposure to adjacent structures and preserving vision.
Take-Home Message

• Clinicians should have a low threshold to refer or work up cases of pigmented eye uveal lesions due to their similarity in appearance of nevus and melanoma, and UBM acts as an effective modality to elucidate a diagnosis in these ambiguous cases.

• Uveal melanomas with BAP1 inactivation are associated with higher rates of fatal metastasis even after enucleation, and prompt treatment and surveillance are indicated.

• Use of FNA biopsy in conjunction with UBM will help to consolidate a diagnosis and guide appropriate intervention. With specifically iris melanoma, UBM will allow for a more accurate diagnosis, which in most cases will translate to a more conservative management and improved patient outcomes.
References