Iris and iridociliary melanoma: concepts in diagnosis and management
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Appendix
Appendix 1

Leiden University Medical Center, Leiden
Department of Ophthalmology

Guidelines for the diagnosis and treatment of iris melanoma

Doctor: ........................................... Date: ............................................

Most Important clinical risk factors:

1. Patient has symptoms           Yes / No
2. Basal diameter of tumor > 3mm. Yes / No
3. Abnormal tumor vessels         Yes / No
4. Pigment dispersion             Yes / No
5. IOP > 21 mmHg                  Yes / No

6. Ectropion Uveae                Yes / No
7. Extension to anterior chamber angle Yes / No
8. Secondary cataract             Yes / No

Prognostic Factors:

9. Satellite lesions              Yes / No
10. Tapioca appearance            Yes / No
11. Decreased iris motility       Yes / No
12. Age > 48 years                Yes / No

Examination:

1. Fluorescein Angiography of Anterior Segment:
   a. Fluorescence completely blocked Yes / No
   b. Geographic vasculature           Yes / No
   c. Early leakage                    Yes / No
   d. Late leakage                     Yes / No
   e. Abnormal vessels                 Yes / No

2. Ultrasound biomicroscopy (UBM)
   i. Characteristics of iris melanoma Yes / No
   ii. Ciliary body extension          Yes / No
Factors 1 – 5 Yes: 77.7% chance of having Iris melanoma; Prompt treatment
Factors 1 – 5 No: 2.3% chance of having iris melanoma; Observation
Factors: 4+6+7+8 Yes: 74.1% chance of tumor growth in 5 years
Factors: 4+6+7+8 No: 1.1% chance of tumor growth in 5 years
a + b Yes: Signs of benign tumor
c + d + e Yes: Signs of malignant tumor
i + ii Yes: Signs of iris melanoma


Appendix 2

Ultrasound biomicroscopy (UBM) characteristics for the diagnosis of iris melanoma
Doctor: …………………………… Date: ……………………………

UBM Characteristics favoring the diagnosis of iris melanoma:
1. Largest basal tumor dimension > 3mm Yes / No
2. Tumor thickness > 1mm Yes / No
3. Irregular tumor structure Yes / No
4. Indistinct tumor boundary with irregular outline Yes / No
5. Secondary iris pigment epithelium cysts Yes / No
6. Non-intact posterior iris pigment epithelium Yes / No
7. Low internal reflectivity Yes / No
8. Ciliary body extension Yes / No
9. Tumor extension to anterior chamber angle Yes / No

Based on UBM schedule developed by Dr. A.M. Verbeek
University Medical Center, St. Radboud, Nijmegen.

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Appendix 3

Leiden University Medical Center
Department of Ophthalmology

New modified guidelines for the diagnosis and treatment of iris melanoma

Doctor: ........................................ Date: ...........................................

Clinical Risk factors:
1. Symptoms Yes / No
2. Basal diameter of tumor > 3mm. Yes / No
3. IOP > 21 mmHg Yes / No
4. Secondary cataract Yes / No
5. Age > 48 years Yes / No

Clinical risk factors 1- 5 Yes: 99.31% probability of having melanoma
Clinical risk factors 1- 5 No: 0.69% probability of having melanoma

UBM Characteristics:
1. Tumor thickness > 1mm. Yes / No
2. Basal tumor diameter > 3mm. Yes / No
3. Low reflectivity Yes / No
4. Anterior chamber angle extension Yes / No
5. Secondary iris cysts Yes / No

UBM characteristics 1- 5 Yes: 99.76% probability of having melanoma
UBM characteristics 1- 5 No: 0.24% probability of having melanoma

For the other possible combinations of positive and negative factors, probability of having melanoma can be computed on the basis of formula given in next pages.

Based on the results of study described in chapter 2 of this thesis (October 2011).
**Formula for computing probability of having iris melanoma on the basis of clinical risk factors:**

\[
\frac{1}{1 + \exp(-6.496 + 1.965 \times \text{complaints} + 3.007 \times \text{diameter} + 3.145 \times \text{IOP} + 2.666 \times \text{Secondary cataract} - 1.33 \times \text{age})}
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>No 1</td>
</tr>
<tr>
<td></td>
<td>Yes 0</td>
</tr>
<tr>
<td>Diameter &gt; 3mm</td>
<td>No 1</td>
</tr>
<tr>
<td></td>
<td>Yes 0</td>
</tr>
<tr>
<td>IOP &gt; 21mmhg.</td>
<td>No 1</td>
</tr>
<tr>
<td></td>
<td>Yes 0</td>
</tr>
<tr>
<td>Secondary cataract</td>
<td>No 1</td>
</tr>
<tr>
<td></td>
<td>Yes 0</td>
</tr>
<tr>
<td>Age &gt; 48</td>
<td>No 1</td>
</tr>
<tr>
<td></td>
<td>Yes 0</td>
</tr>
</tbody>
</table>

**Risk factor**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>complaints</td>
<td>-1.965</td>
</tr>
<tr>
<td>Diameter</td>
<td>-3.007</td>
</tr>
<tr>
<td>IOP</td>
<td>-3.415</td>
</tr>
<tr>
<td>Secondary cataract</td>
<td>-2.666</td>
</tr>
<tr>
<td>Age</td>
<td>1.330</td>
</tr>
<tr>
<td>Constant</td>
<td>6.496</td>
</tr>
</tbody>
</table>

For example, if a patient has symptoms and the diameter of lesion is > 3mm: then these two factors has parameter coding ‘0’ for Yes. All other factors are ‘1’ for No, as given in coding table. Then above formula becomes:

\[
\frac{1}{1 + \exp(-6.496 + 0 + 3.007 \times 1 + 3.145 \times 1 + 2.666 \times 1 - 1.33 \times 1)} = 0.88
\]

It means that probability of having melanoma is 88%
Formula for computing probability of having iris melanoma on the basis of UBM characteristics:

\[
\frac{1}{1+\exp(-7.001 + 3.377 \times \text{thickness} + 1.753 \times \text{diameter} + 1.607 \times \text{iris cysts} + 2.093 \times \text{reflectivity} + 4.175 \times \text{AC extension})}
\]

<table>
<thead>
<tr>
<th>Parameter coding</th>
<th>AC angle extension</th>
<th>Thickness</th>
<th>Diameter</th>
<th>Iris cysts</th>
<th>Reflectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1</td>
<td>&lt; 1mm</td>
<td>&lt; 3mm</td>
<td>No</td>
<td>High</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>&gt; 1mm</td>
<td>&gt; 3mm</td>
<td>Yes</td>
<td>Low</td>
</tr>
</tbody>
</table>

Risk Factor | B  
--- | ---
Thickness   | -3.377  
Diameter    | -1.753  
Iris cysts  | -1.607  
Reflectivity| -2.093  
AC angle extension | -4.175  
Constant    | 7.001  

For example, if a patient has thickness > 1mm and diameter of lesion > 3mm, on UBM, then these two factors has parameter coding ‘0’ for Yes and all other factors are ‘1’ for No, as given in coding table.

Above formula then becomes:

\[
\frac{1}{1+\exp(-7.001 + 0 + 0 + 1.607 \times 1 + 2.093 \times 1 + 4.175 \times 1)} = 0.77
\]

It means that probability of having melanoma is 77%
Appendix: Figures

Figure 1  Ruthenium CIA plaque designed for iris melanoma
Figure 2  Few study patients with iris melanoma treated with Ruthenium plaque therapy. Left side 3 pictures showing tumor before treatment, Right side the same tumors after the treatment
Figure 3  **A**: One study patient having iris melanoma in inferotemporal quadrant of right eye before treatment **B**: Same iris melanoma one year after treatment with Ru-106. **C**: After 3 years patient showed recurrent tumor and extrascleral extension. **D**: Histology of irradiated area showing viable cells. The chamber angle is closed by fibrosis and covered with a thin layer of vital un-pigmented melanoma cells. (original magnification: x10) **E**: Histology showing melanoma cells on the iris surface, in the opposite chamber angle, in the trabecular meshwork and extrascleral extension. (original magnification: x2.5).
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Another milestone in my life: PhD Ophthalmology, which owes recognition, after Almighty Allah (the most merciful, the most beneficial), to many whose help, guidance and encouragement made it happen. I am indebted to all of them for reasons best known to them.

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List of Publications
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**Ruthenium plaque radiation for iris and iridociliary melanomas: development of dry eyes?**
Razzaq L, de Keizer RJ

**Ruthenium plaque radiation therapy for iris and iridociliary melanomas**
Razzaq L, Keunen JEE, Schalij-Delfos N, Creutzberg CL, Ketelaars M, de Keizer RJ

**Iris melanoma in a child treated with iridectomy and a phakic iris repair implant lens: a case report of 8 years postoperative follow-up**
de Keizer RJ, Razzaq L, Tassignon MJ, Verbeek AM

**Anterior segment imaging of iris melanocytic lesions**
Razzaq L, Van der Spek KE, Luyten GPM, de Keizer RJ

**Transscleral excision of supravueal mesectodermal iridociliary leiomyoma Without postoperative iris defect: Correlation with UBM, MRI and histopathology**
Razzaq L, Semenova EA, Marinkovic M, de Keizer RJ, Van Duinen SG, Luyten GPM.
*Accepted in Arch of Ophthalmol.* 2011 Feb.

**Clinical and pathologic characteristics of biopsy proven iris melanoma: A multicenter international study**
*Arch of Ophthalmol.* Published online September 12, 2011.

**Guidelines for diagnosis and treatment decision of suspected iris and iridociliary melanomas based on clinical risk factors and ultrasound biomicroscopic characteristics**
Razzaq L, Keunen JEE, van Zwet EW, Luyten GPM, de Keizer RJ.
*Submitted.*
LIST OF PUBLICATIONS

Corneal endothelial cell density after Ruthenium plaque radiation therapy for iris melanoma patients
Razzaq L, Jager MJ, Luyten GPM, Marinkovic M, de Keizer RJ
Submitted.

Fuchs adenoma of the choroid simulating a choroidal hemangioma
Razzaq L, Marinkovic M, Swart W, van Duinen SG, Luyten GPM.
Submitted.

Incidence of retinoblastoma in the Netherlands 1950 - 2010: A shift in the proportion of hereditary retinoblastoma
Bosscha MI, Razzaq L, Dommering CJ, van Leeuwen FE, Moll AC
Submitted.

Changes in contrast sensitivity functions and visual acuity in patients with pre-senile and senile cataract
Razzaq L, Afzal F.
Dissertation accepted by College of Physicians and Surgeons, Karachi, Pakistan.
2009 Aug.

The BRAF, GNAQ and GNA11 mutations in iris melanomas and histopathological correlation
Razzaq L, Versluis M, Jager MJ, Luyten GPM, de Keizer RJW, van der Velden PA.
Manuscript in preparation.
Curriculum Vitae
Curriculum Vitae

The author of this thesis, Lubna Razzaq, was born on September 29th, 1975 in Islamabad, Pakistan. She completed her secondary school education at the Federal School and College Islamabad, standing first in her college and 5th in the Federal Board of secondary education in 1993. She received her Bachelors in Medicine and Bachelors in Surgery (MBBS) degree in 1999 from Rawalpindi Medical College, Rawalpindi, Pakistan, securing the position among the top ten of 250 students. While attending the eye ward during her medical school, she observed how small procedures, such as cataract surgery, bring big changes in one’s life; she therefore opted for Ophthalmology as her future field. She passed her Fellowship part 1 Ophthalmology examination in 2000. In 2001, after passing the Federal Public Service Commission Examination, she became Registrar in Ophthalmology. Initially, she worked at the Jinnah Postgraduate Medical Center, Karachi (2001-2002) and then at the Pakistan Institute of Medical Sciences, Islamabad, Pakistan (2003-2007), where she completed her ophthalmic training. In December 2007, she began her PhD study on ocular melanomas under the supervision of Professor Dr. Gré P.M. Luyten and Prof. Dr. Rob J.W. de Keizer at Leiden University Medical Center, the Netherlands. During her research, she also had the opportunity to increase her clinical knowledge and skills in Ocular Oncology. Meanwhile, she passed the Fellowship of the Royal College of Surgeons in Ophthalmology, Edinburgh, United Kingdom, Part 1 & 2 in 2009 and Part B (7 of 8 sections) in June 2011. The results of her PhD research are presented in this thesis. After finishing her PhD, she is going to start working as clinical ophthalmologist. Besides working in Ophthalmology, she is the wife of Burhan-ud-din Qureshi and the mother of two sons, Mohid and Mahad.