University of Huddersfield Repository

Wakely, Laura, Rahman, Rubina and Stephenson, John

A comparison of several methods of macular hole measurement using OCT and their value in predicting anatomical and visual outcomes

Original Citation


This version is available at http://eprints.hud.ac.uk/11990/

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

http://eprints.hud.ac.uk/
A comparison of several methods of macular hole measurement using OCT and their value in predicting anatomical and visual outcomes

Miss Laura Wakely, Vitreoretinal ASTO, York Hospital
Ms. Rubina Rahman, Consultant Vitreoretinal surgeon, Calderdale Royal Hospital, Halifax
Dr. John Stephenson, University of Huddersfield

BEAVRS 10th November 2011
Background

a = base diameter
b = minimum linear dimension (MLD)\(^1\)
e = maximal hole height
f = macular hole inner opening

Hole Form Factor (HFF)$^2$

Determine extent of Base diameter (a) and MLD (b)
Hole Form Factor = (c + d) / a
No correlation found between HFF and postop gain in lines

Macular Hole Index (MHI)\(^3\)

\[ \text{MHI} = \frac{e}{a} \]

MHI was associated with postoperative vision

Tractional Hole Index (THI)\(^4\)

\[\text{THI} = \frac{e}{b}\]

THI correlated significantly with postop vision

Basic measurements
- Base diameter (a)
- Minimum linear dimension (b)
- Hole height (e)
- Macular hole inner opening (f)

Derived indices
- Hole Form Factor (c+d/a)
- Macular Hole Index (e/a)
- Tractional Hole Index (e/b)
Study

• Prospective consecutive case series study of 50 eyes from 50 patients, May ‘09 – Jan ‘11
• Idiopathic Stage II (n=8), Stage III (n=38) or Stage IV (n=4) macular hole
• 23-gauge vitrectomy, phaco + IOL, ILM peel with Brilliant Blue G staining and endotamponade with 20% SF$_6$
• No special posturing
• One pseudophake, no significant cataract
Outcome measures

• Anatomical success:
  Complete circumferential hole rim reattachment without foveal neurosensory retinal defect demonstrated on OCT

• Visual success:
  Gain of two or more Snellen lines at up to a year postop

• Discharged at 3 months if 6/12 achieved, or at 1 year postop

• All patients whose macular holes had failed to close were successfully closed with further surgery
Results

• 84% (42/50 eyes) achieved macular hole closure
• 76% (38 eyes) achieved ≥2 lines improvement in Snellen acuity
• Binary logistic regression analyses:
  – anatomical success (hole closure Y / N)
  – visual success (2 lines gained Y / N)
## Assessment of variables associated with anatomical success

<table>
<thead>
<tr>
<th>Parameter</th>
<th>p-value</th>
<th>Odds ratio</th>
<th>95% CI for odds ratio</th>
<th>Area under ROC curve</th>
<th>95% CI for area under ROC curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.642</td>
<td>0.975</td>
<td>(0.877, 1.084)</td>
<td>0.539</td>
<td>(0.317, 0.760)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male - reference category</td>
<td>0.616</td>
<td>0.643</td>
<td>(0.114, 3.610)</td>
<td>0.546</td>
<td>(0.331, 0.760)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial length (mm)</td>
<td>0.473</td>
<td>0.789</td>
<td>(0.412, 1.510)</td>
<td>0.555</td>
<td>(0.330, 0.780)</td>
</tr>
<tr>
<td>Base diameter (µm)</td>
<td><strong>0.005</strong></td>
<td><strong>0.992</strong></td>
<td><strong>(0.987, 0.998)</strong></td>
<td><strong>0.929</strong></td>
<td><strong>(0.848, 1.000)</strong></td>
</tr>
<tr>
<td>MH inner opening (µm)</td>
<td><strong>0.002</strong></td>
<td><strong>0.984</strong></td>
<td><strong>(0.973, 0.994)</strong></td>
<td><strong>0.943</strong></td>
<td><strong>(0.873, 1.000)</strong></td>
</tr>
<tr>
<td>Min Linear Dimension (µm)</td>
<td><strong>0.002</strong></td>
<td><strong>0.990</strong></td>
<td><strong>(0.984, 0.997)</strong></td>
<td><strong>0.859</strong></td>
<td><strong>(0.735, 0.982)</strong></td>
</tr>
<tr>
<td>Hole height (µm)</td>
<td>0.104</td>
<td>0.992</td>
<td>(0.981, 1.002)</td>
<td>0.679</td>
<td>(0.436, 0.922)</td>
</tr>
<tr>
<td>Macular Hole Index</td>
<td><strong>0.006</strong></td>
<td><strong>7.390^1</strong></td>
<td><em>(1.757, 31.09)^1</em></td>
<td><strong>0.909</strong></td>
<td><strong>(0.821, 0.998)</strong></td>
</tr>
<tr>
<td>Tractional Hole Index</td>
<td>0.065</td>
<td>1.279^1</td>
<td>(0.985, 1.660)^1</td>
<td>0.708</td>
<td>(0.517, 0.899)</td>
</tr>
</tbody>
</table>

* Indicates statistical significance at p < 0.05.
## Assessment of variables associated with visual success

<table>
<thead>
<tr>
<th>Parameter</th>
<th>p-value</th>
<th>Odds ratio</th>
<th>95% CI for odds ratio</th>
<th>Area under ROC curve</th>
<th>95% CI for area under ROC curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.378</td>
<td>0.959</td>
<td>(0.873, 1.053)</td>
<td>0.565</td>
<td>(0.391, 0.738)</td>
</tr>
<tr>
<td>Sex</td>
<td>0.954</td>
<td>1.042</td>
<td>(0.261, 4.155)</td>
<td>0.505</td>
<td>(0.314, 0.619)</td>
</tr>
<tr>
<td>Male - reference category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial length (mm)</td>
<td>0.703</td>
<td>0.892</td>
<td>(0.495, 1.607)</td>
<td>0.542</td>
<td>(0.359, 0.724)</td>
</tr>
<tr>
<td>Base diameter (µm)</td>
<td>0.013</td>
<td>0.996</td>
<td>(0.993, 0.999)</td>
<td>0.776</td>
<td>(0.605, 0.947)</td>
</tr>
<tr>
<td>MH inner opening (µm)</td>
<td>0.013</td>
<td>0.993</td>
<td>(0.987, 0.998)</td>
<td>0.761</td>
<td>(0.591, 0.931)</td>
</tr>
<tr>
<td>Min Linear Dimension (µm)</td>
<td>0.018</td>
<td>0.994</td>
<td>(0.990, 0.999)</td>
<td>0.717</td>
<td>(0.540, 0.894)</td>
</tr>
<tr>
<td>Hole height (µm)</td>
<td>0.281</td>
<td>0.996</td>
<td>(0.998, 1.004)</td>
<td>0.579</td>
<td>(0.379, 0.779)</td>
</tr>
<tr>
<td>Macular Hole Index</td>
<td>0.091</td>
<td>1.510</td>
<td>(0.937, 2.433)</td>
<td>0.782</td>
<td>(0.608, 0.955)</td>
</tr>
<tr>
<td>Tractional Hole Index</td>
<td>0.178</td>
<td>1.130</td>
<td>(0.946, 1.350)</td>
<td>0.615</td>
<td>(0.437, 0.793)</td>
</tr>
</tbody>
</table>
a = Base diameter
f = Macular hole inner opening
Receiver Operating Characteristic (ROC) curve for anatomical success using the Base Diameter parameter

- A base diameter value of 747μm corresponds to 76.2% sensitivity and 100% specificity.
- 10% reduction in the odds of anatomical success for every 13μm increase in base diameter.
Thank you