Surgical Outcomes in Intermittent Exotropia

Jeffrey D. Colburn, M.D., PGY-3
Preceptor: David Morrison, M.D.
Vanderbilt Eye Institute
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Intermittent Exotropia

- Intermittent exotropia x(t) is a latent tendency (phoria) for the eyes to turn out, which is intermittently controlled by fusional convergence.
- Characteristics
  - Typically good bifoveal fusion and stereoacuity when aligned.
  - Amblyopia is rare in x(t).
  - X(t) Tends to remain stable or progress.
  - Progression might result in dense suppression.
Intermittent Exotropia

• **X(t) Sub-types**
  1. **Basic**
     • Angle is equal at near & distance
  2. **Pseudo-divergence excess (PDE)**
     • Angle is equal at near & distance but appears larger in distance because of masking
  3. **True divergence excess (TDE)**
     • Angle is larger in distance
  4. **Convergence insufficiency (CI)**
     • Angle is larger at near
Surgical Treatment

• Goals
  – Improve alignment & control
  – Improve binocular vision

• Basic concepts
  – Recession (weakening procedure)
  – Resection (strengthening procedure)

• Two primary approaches
  – Bilateral lateral rectus recession (BLRc)
  – Unilateral recess & resect (R&R)
## Predictors of Outcomes

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Significant predictive factors</th>
<th>Insignificant factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pratt-Johnson &amp; Tillson</td>
<td>1977</td>
<td>surgery before age 4</td>
<td>post-op overcorrection</td>
</tr>
<tr>
<td>Scott, et al</td>
<td>1981</td>
<td>moderate overcorrection at POW#1 visit</td>
<td></td>
</tr>
<tr>
<td>Richard &amp; Parks</td>
<td>1983</td>
<td></td>
<td>age sub-type</td>
</tr>
<tr>
<td>Kushner, et al.</td>
<td>1993</td>
<td>pre-op deviation</td>
<td></td>
</tr>
<tr>
<td>Kushner</td>
<td>1998</td>
<td>procedure type</td>
<td>central fusion or stereopsis age pre-op deviation</td>
</tr>
<tr>
<td>Yildirim</td>
<td>1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee &amp; Lee</td>
<td>2000</td>
<td>overcorrection on POD#1</td>
<td>procedure type age pre-op deviation</td>
</tr>
<tr>
<td>Somer, et al.</td>
<td>2004</td>
<td>asymmetric accommodation</td>
<td>procedure type pre-op deviation</td>
</tr>
<tr>
<td>Franzco, et al.</td>
<td>2005</td>
<td>R&amp;R sub-type</td>
<td>R&amp;R pre-op control age</td>
</tr>
</tbody>
</table>
Observations

- Effect of pre-operative angle size on surgical outcomes in x(t) patients.

- Disparate opinions on the more successful procedure for x(t).
Hypotheses

1. Larger angle $x(t)$ patients have more successful surgical outcomes than smaller angle $x(t)$ patients.

2. R&R procedures have more successful surgical outcomes than BLRc in the management of $x(t)$.
Methods

• Retrospective chart review
  – Inclusion criteria
    • X(t) surgical cases
    • January, 2003 through January, 2008
    • Age $\leq$ 18 years
Methods

• **Exclusion criteria**
  – Developmental delay  
  – Vertical deviation  
  – Pattern deviation  
  – Prior surgery  
  – Partially or untreated amblyopia  
  – Monocular exotropia  
  – Constant exotropia  
  – Secondary exotropia  
  – Nystagmus
Data collection

- Variables considered
  - Gender
  - Age at time of surgery
  - X(t) sub-type
  - Pre-op deviation
  - Stereo-acuity
  - Presence of fusion
  - Presence of suppression
  - Procedure type
  - Deviation post-op visit #1
  - Deviation post-op visit #2
Outcome Measures

• Surgical success:
  – Intermittent exotropia ≤ 8 PD
  – No esotropia

• Surgical failure:
  – Not meeting above success criteria
  – Repeat surgery for poor control

• Time to surgical failure

• Over-correction or under-correction
# Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Percent or Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number</strong></td>
<td>82</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>38, 46.3%</td>
</tr>
<tr>
<td>Female</td>
<td>44, 53.7%</td>
</tr>
<tr>
<td><strong>Mean age at surgery (mos)</strong></td>
<td>69.1, 17-172</td>
</tr>
<tr>
<td><strong>Subtypes</strong></td>
<td></td>
</tr>
<tr>
<td>Basic</td>
<td>46, 56.1%</td>
</tr>
<tr>
<td>PDE</td>
<td>33, 40.2%</td>
</tr>
<tr>
<td>CI</td>
<td>2, 2.4%</td>
</tr>
<tr>
<td>TDE</td>
<td>1, 1.2%</td>
</tr>
<tr>
<td><strong>Average pre-op deviation (PD)</strong></td>
<td>26.4, 16-45</td>
</tr>
<tr>
<td>History of amblyopia</td>
<td>8, 9.8%</td>
</tr>
<tr>
<td>Mean follow-up (mos)</td>
<td>17.3, 1-43</td>
</tr>
</tbody>
</table>
Results

• Overall outcomes
  – 61 BLRc, 19 R&R, 2 unilateral LRc
  – 42 (51.2%) patients failed
  – Mean time to failure was 6.9 months (1-34)
  – 35 patients (43%) were under corrected
  – 6 patients (7.3%) were over corrected
Results

Pre-operative deviation

Two sample t-test

Mean deviation in success group = 26.2
Mean deviation in failure group = 26.6
p = 0.786
Results

**Procedure type**
Chi-squared test

\[ p = 0.608 \]
## Results

### Other variables

Multivariate logistic regression

<table>
<thead>
<tr>
<th>Factor</th>
<th>Chi-square</th>
<th>d.f.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.96</td>
<td>1</td>
<td>0.33</td>
</tr>
<tr>
<td>Sub type (basic vs. pde)</td>
<td>0.40</td>
<td>1</td>
<td>0.53</td>
</tr>
<tr>
<td>Pre-operative deviation</td>
<td>0.69</td>
<td>1</td>
<td>0.41</td>
</tr>
<tr>
<td>Stereo acuity</td>
<td>3.27</td>
<td>3</td>
<td>0.35</td>
</tr>
<tr>
<td>Presence of fusion</td>
<td>2.15</td>
<td>1</td>
<td>0.14</td>
</tr>
<tr>
<td>Presence of suppression</td>
<td>0.62</td>
<td>1</td>
<td>0.43</td>
</tr>
<tr>
<td>Surgical procedure (blrc vs. r&amp;r)</td>
<td>2.37</td>
<td>1</td>
<td>0.12</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6.97</td>
<td>9</td>
<td>0.64</td>
</tr>
</tbody>
</table>
Results

Kaplan-Meier Survival Estimate with 95% CI
Results

Survival curves by $x(t)$ sub-type

Survival curves by procedure type

P = 0.80

P = 0.96
## Results

### Multivariate survival analysis
Cox proportional hazards model

<table>
<thead>
<tr>
<th>Variables</th>
<th>coef</th>
<th>exp(coef)</th>
<th>p</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative Deviation</td>
<td>-0.0538</td>
<td>0.9480</td>
<td>0.1300</td>
<td>0.884, 1.016</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0149</td>
<td>0.9850</td>
<td><strong>0.0140</strong></td>
<td>0.9735, 0.997</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>-0.0489</td>
<td>0.9520</td>
<td>0.9000</td>
<td>0.4435, 2.045</td>
</tr>
<tr>
<td>Presence of Fusion</td>
<td>-1.5830</td>
<td>0.2050</td>
<td>0.0760</td>
<td>0.0358, 1.178</td>
</tr>
<tr>
<td>Presence of Suppression</td>
<td>-0.4880</td>
<td>0.6140</td>
<td>0.5600</td>
<td>0.1198, 3.144</td>
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<tr>
<td>Stereo Acuity (vs. 40-100 arc sec)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>140-800 arc sec</td>
<td>1.1500</td>
<td>3.1590</td>
<td><strong>0.0430</strong></td>
<td>1.0377, 9.617</td>
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<tr>
<td>3600 arc sec</td>
<td>0.4100</td>
<td>1.5080</td>
<td>0.5100</td>
<td>0.4392, 5.179</td>
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<tr>
<td>None</td>
<td>0.6780</td>
<td>1.9700</td>
<td>0.3700</td>
<td>0.4516, 8.597</td>
</tr>
<tr>
<td>Surgical procedure</td>
<td>-0.8170</td>
<td>0.4420</td>
<td>0.2200</td>
<td>0.1186, 1.644</td>
</tr>
</tbody>
</table>
Results

Fisher’s exact test, $p = 0.00006$
Results

Fisher’s exact test,  \( p = <0.00001 \)
Comment

• Weaknesses of study
  – Retrospective in nature
  – Small sample size
  – Early drop out of successful cases

• Future Directions
  – Prospective study
Summary

• Power limited by sample size

• No statistical significance found for:
  – Degree of post-operative deviation
  – Procedure type

• The following were found to have statistical significance:
  – Age at time of surgery
  – High level of stereo-acuity
  – Ocular alignment at first & second post-operative visits
Acknowledgements

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Comments or Questions?