BACKGROUND

- Development of normal vision depends on correct timing and interaction of molecular and cellular factors in the eye and brain, which are influenced by environmental and genetic variables.
- Identification of causes of vision loss in preterm children may be confounded by developmental problems of the eye and brain.
- Portable, handheld spectral domain optical coherence tomography (SDOCT) imaging of infants in the intensive care nursery (ICN) allows noninvasive, bedside evaluation of developing retina and optic nerve (ON).
- Cystoid macular edema (CME) of prematurity, noted in ~50% of preterm infants on SDOCT but not traditional exam, is associated with worse developmental skills at 18-24 months.
- Etiology of neonatal CME unknown, but photoreceptor development is delayed in very preterm infants with CME versus without CME.
- Macularatomic features from SDOCT of retina and ON of infants may indicate abnormalities in visual pathway development.

PURPOSE

- To evaluate visual outcomes in preterm infants imaged by SDOCT in the ICN, and to correlate these outcomes with the presence or absence of neonatal CME in the ICN.

METHODS

- Case series of infants imaged with portable, non-contact hand-held SDOCT (Bioptigen, Inc., Research Triangle Park, NC) who had visual acuity (VA) assessed between 9 months and 5 years of age.
- Two trained graders masked to infant data graded each scan for:
  - Presence of CME
  - Central foveal thickness (CFT)
  - Foveal to parafoveal thickness (FP) ratio at 1000μm from foveal center
  - Presence of the ellipsoid zone (EZ) at the fovea
  - Vascular Anomaly Score on OCT (VASO)
  - Measured ON parameters with custom MATLAB script.
- Orthoptist masked to imaging data evaluated sensorimotor function and VA.
- With grating acuity by preferential looking for toddlers at 9-15 months
  - With Amblyopia Treatment Study (ATS) protocol on the Electronic Visual Acuity Tester for children at 4-5 years.
- Medical records reviewed for:
  - Basic demographic and health information.
  - Retinopathy of prematurity (ROP) status.
  - Magnetic resonance imaging (MRI) reports.
- Montage of B-scan images was used and assessed for regions of interest (ROI).

RESULTS

<table>
<thead>
<tr>
<th>No CME</th>
<th>CME</th>
</tr>
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<tbody>
<tr>
<td>No clinically indicated MRIs</td>
<td>Four infants had MRI (in ICN)</td>
</tr>
<tr>
<td>3 infants with Bayley Scores scales normal (~1 std dev of the mean for age) on all subscales</td>
<td>2 intraventricular Hemorrhage</td>
</tr>
<tr>
<td>No strabismus</td>
<td>1 Arteriovenous Malformation</td>
</tr>
<tr>
<td>CME No 5 Infants</td>
<td>1 Hydrocephalus</td>
</tr>
<tr>
<td>2 infants with Bayley Scales had 4/6 subscales &gt;2 std dev below mean for age</td>
<td>4/5 had strabismus</td>
</tr>
</tbody>
</table>

CONCLUSION

- Macular edema may be a biomarker for subnormal VA in some preterm infants.
- Infants with no CME on perinatal SDOCT subsequently had:
  - Normal VA
  - Appropriate neurodevelopmental outcomes
  - No clinical indication for brain MRI imaging while in the ICN
- Infants with CME subsequently developed:
  - Suboptimal VA
  - Sensorimotor deficits
  - Brain abnormalities
  - Poorer neurodevelopmental outcomes.
- A larger, prospective longitudinal study that includes neonatal SDOCT with visual and neurodevelopmental follow-up is needed to validate these pilot findings.

REFERENCES


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