Vision in Retinoblastoma: Practical Outcomes and Predictors of Visual Prognosis

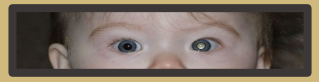
Emma R. Shelby, BA, MS[2,1]; Jennifer L. Patnaik, PhD[2]; Emily A. McCourt, MD[2]; Scott C. N. Oliver, MD[2]

[1] CU Anschutz School of Medicine, University of Colorado Medicine, Aurora, CO

[2] Department of Ophthalmology, University of Colorado Medicine, Aurora, CO

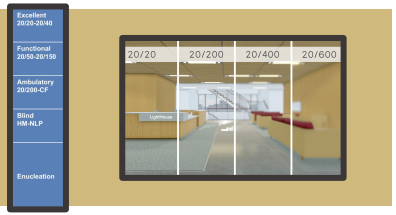
Statement of Problem and Aims

- **Retinoblastoma (RB)** is the most common primary malignant ocular tumor of childhood, and although modern therapies often preserve the eye, visual outcomes remain unpredictable.
- **The problem** is that parents and clinicians lack clear, real-world data on functional visual outcomes and the factors that shape them.
- **This study aims** to characterize whole-child visual outcomes after RB treatment and identify clinical predictors of functional vision and blindness risk.

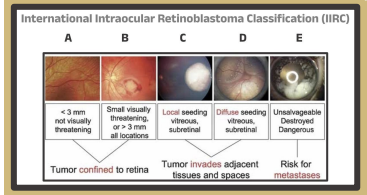


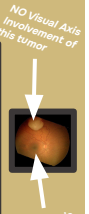
Disclosures

- **Financial Support:** Research to Prevent Blindness, Dolores Schlessman
- **Clinical Trial Support:** Castle Bioscience, Roche/Genentech, Regeneron, Aura Bioscience



Visual References



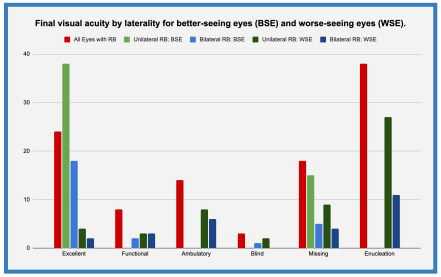


Methods

- **Retrospective chart review** of children treated for retinoblastoma from 2008–2024, collecting demographics, laterality, tumor features, treatment details, and visual rehabilitation data.
- Each eye was staged using the International Classification of Retinoblastoma **(ICRB A–E)** and assessed for macular involvement.
- Best-corrected visual acuity **(BCVA)** was categorized using study-specific groups: **Excellent** (≥20/40), **Functional** (20/50–20/150), **Ambulatory** (20/200–counting fingers), and **Blind** (hand motion to no light perception).
- Timing of amblyopia therapy and use of visual rehabilitation services were recorded after tumor control.
- **Visual outcomes** were analyzed by laterality, ICRB stage, macular involvement, and treatment type (including enucleation).

Results and Trends

- Among 79 children (67% unilateral, 33% bilateral), 78/79 **(99%)** did not meet WHO criteria for bilateral blindness.
- **Unilateral RB: a**ll retained normal or functional vision in the fellow eye; 72% of affected eyes maintained ≥20/200 vision.
- **Bilateral RB:** better-seeing eye had excellent or functional vision in 77%; only 1 child (4%) met WHO blindness criteria.
- Across 105 eyes, **23% achieved excellent vision** (≥20/40), 8% functional (20/50–20/150), and 13% ambulatory (20/200–CF).
- **Enucleation** occurred in 42% of children with bilateral disease and 51% of ICRB Group D/E eyes, mostly in worse-seeing or advanced eyes.
- **Visual prognosis** declined with ICRB stage: excellent vision in 100% Group A, 67% B, 25% C, 8% D, and 5% E eyes.
- **Macular involvement** strongly predicted poor vision: eyes without macular disease achieved 83% excellent vision versus 24% with macular involvement; none of the macula-sparing eyes were blind.
- **Amblyopia** therapy began within one month of tumor control in most patients.



Conclusions

- Most children with RB achieve functional or better vision, even in bilateral disease, with **true bilateral blindness being rare.**
- Macular involvement and advanced ICRB stage are the strongest **predictors** of poor outcomes.
- **Early amblyopia therapy** and timely rehabilitation support help maximize functional vision after tumor control.

Future Work

- **Develop predictive models** or algorithms to better forecast visual outcomes and guide individualized RB treatment.
- **Conduct multi-center studies** to increase cohort size and validate prognostic factors, including genetics and tumor characteristics.
- **Explore treatment refinements** and early interventions that minimize vision-threatening complications, such as macular involvement or retinal detachment.

References

Children's Hospital Colorado
Here, it's different.™

Sue Anschutz-Rodgers Eye Center
SCHOOL OF MEDICINE
UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**