

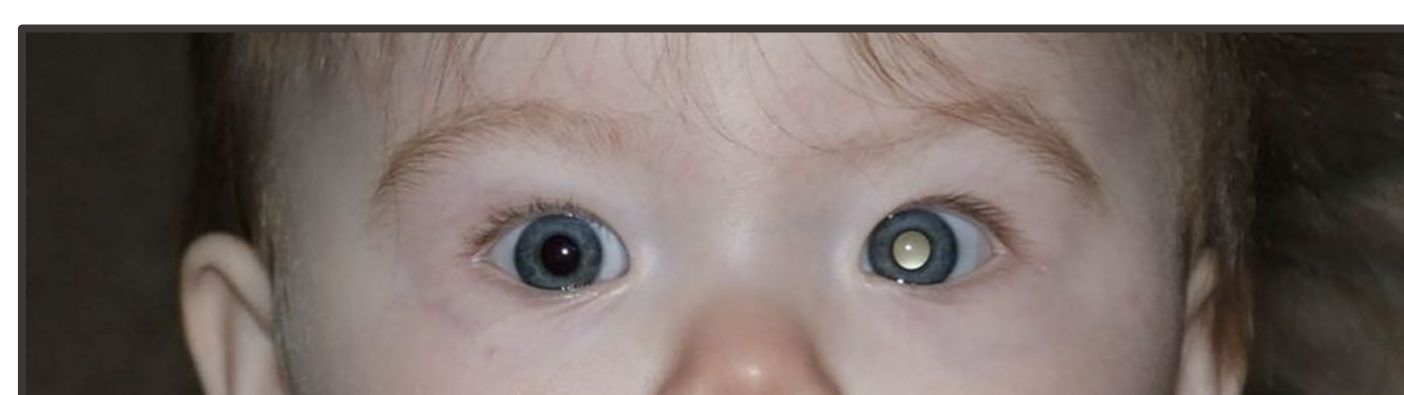
Clinical and Pathological Predictors of Visual Outcomes in Retinoblastoma: A Comprehensive Analysis of Individual Eyes and Patient Cohorts

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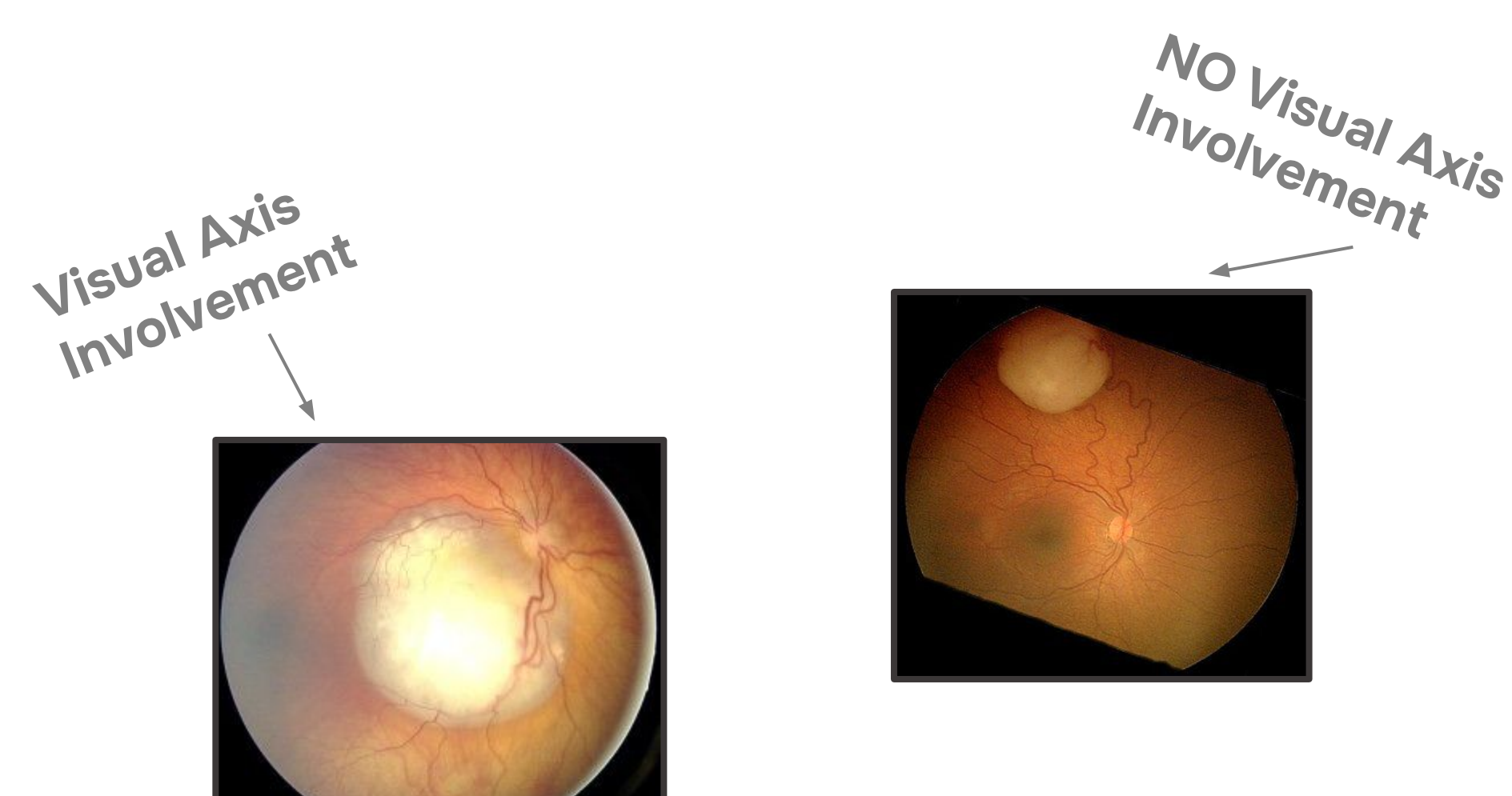
Statement of Problem and Aims

- **Retinoblastoma (RB)** is the most common primary malignant ocular tumor in children, with an incidence of 1 in 15,000-18,000 live births.
- While advancements in treatment have improved globe salvage rates, **visual outcomes remain variable** and unpredictable.
- This study aims to identify clinical and pathological factors associated with visual outcomes post-treatment to help guide future therapeutic decisions and enhance vision preservation strategies.

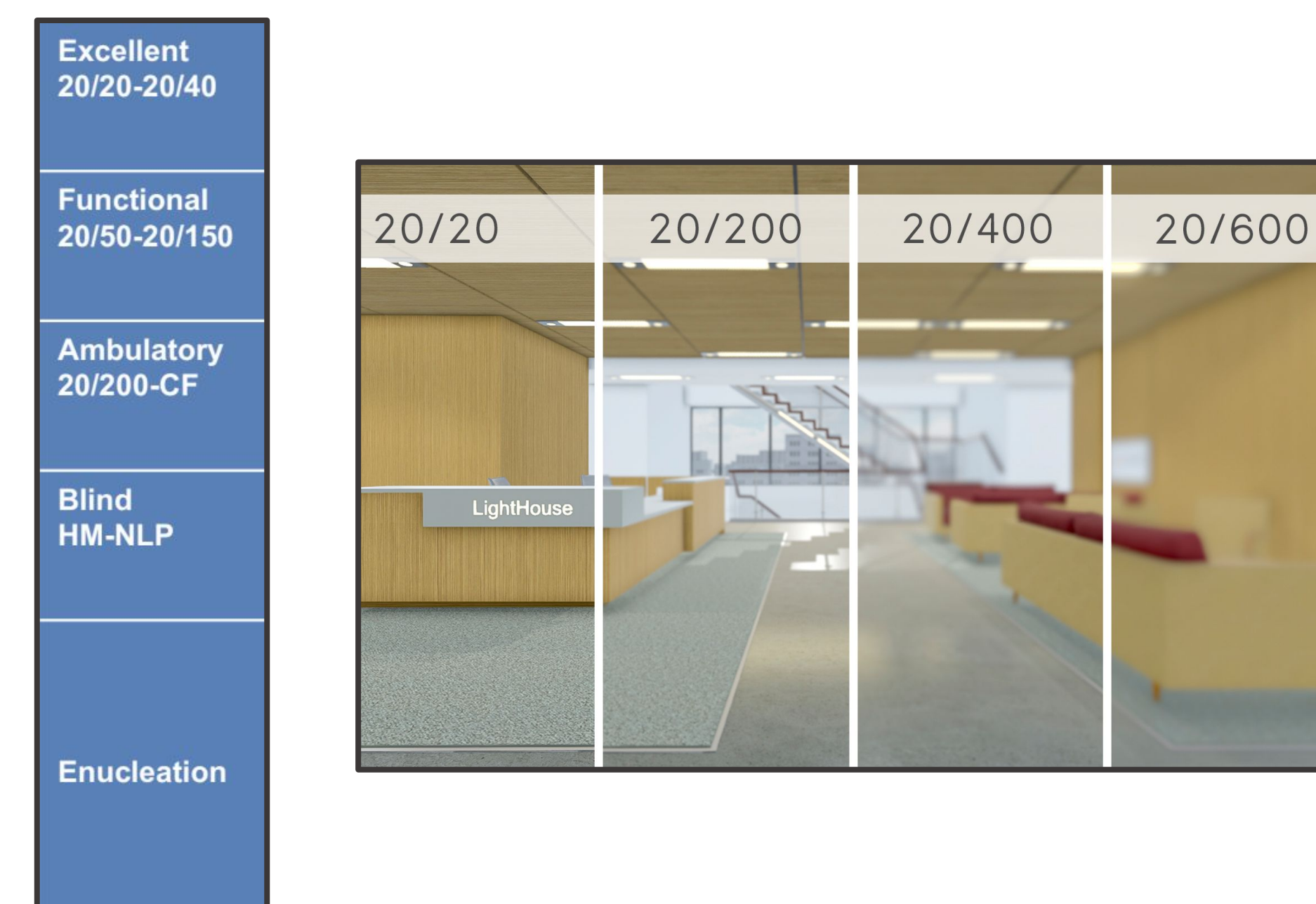


Hypothesis

- This study hypothesizes that specific clinical and pathological factors, including **visual axis involvement** and **optic nerve invasion**, are significant predictors of visual outcomes and globe salvage in retinoblastoma patients.
- Furthermore, we hypothesize that **early intervention** and less advanced disease correlate with improved visual outcomes, particularly in the Better Treated Eye (BTE).



Images

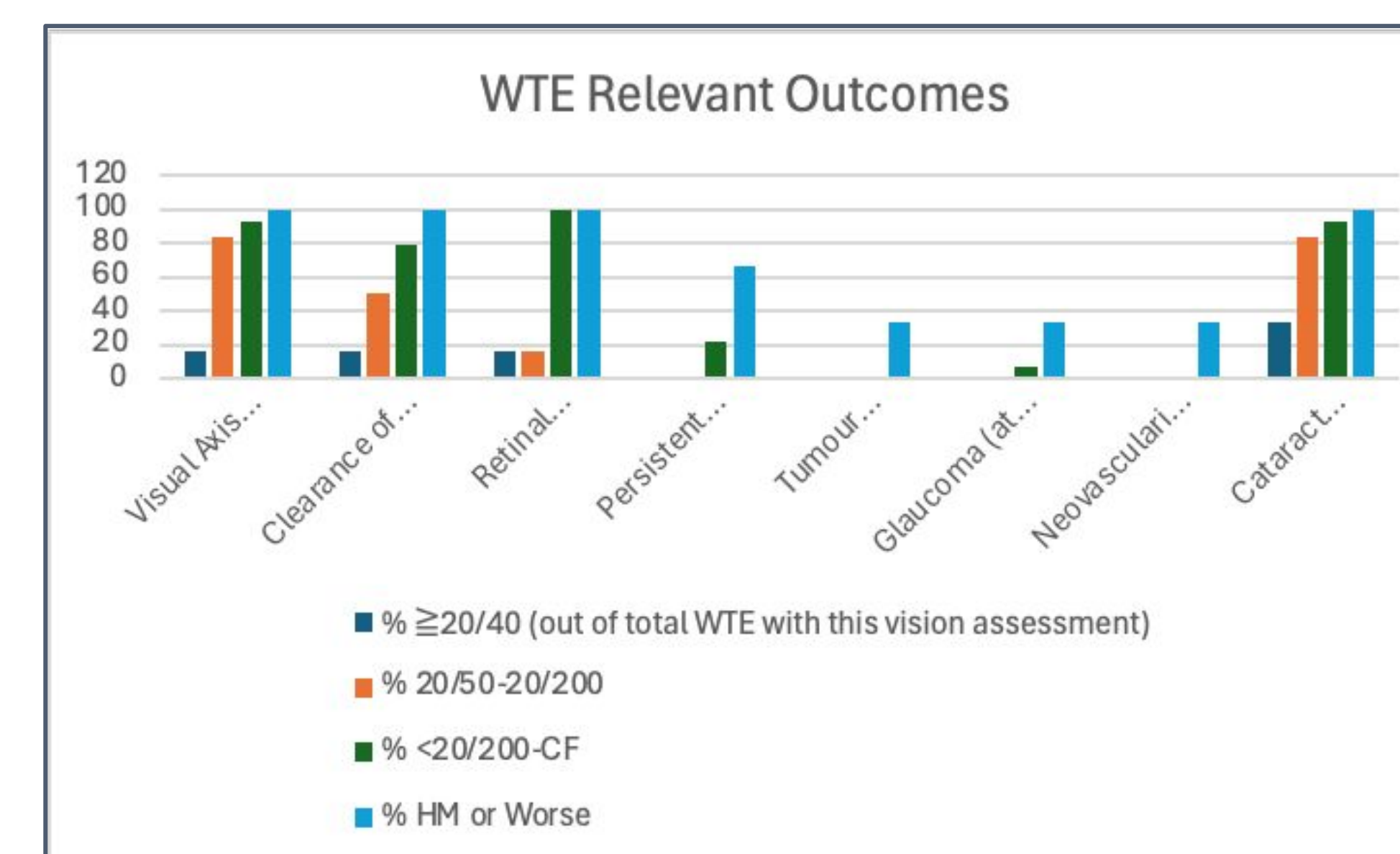


Methods

- This retrospective observational study examined **106 eyes** from 80 retinoblastoma patients treated at the University of Colorado Anschutz from 2008 to 2024.
- Data were collected from EPIC medical records and included patient demographics, RB staging (using the **TNM Classification System** and International Classification of Retinoblastoma), treatment details, and visual and pathology outcomes.
- Patients were categorized into unilateral or bilateral disease, and each eye's **Best Corrected Visual Acuity (BCVA)** was measured post-treatment. Vision outcomes were classified as Excellent (E), Functional (F), Ambulatory (A), or Blind (B), and eyes were further categorized into **BTE or Worse Treated Eye (WTE)**.
- Statistical analysis was conducted to identify significant predictors of visual outcomes, including the presence of glaucoma, retinal detachment, visual axis involvement, optic nerve invasion, and other pathological findings.

Results

- The cohort included 80 retinoblastoma patients, with 66% of 106 eyes achieving globe preservation.
- **Globe salvage success decreased with advanced disease staging**, from 100% in ICRB Group A to 25% in Group E.
- Mean age of diagnosis was 2.0 years.
- The majority of BTEs achieved Excellent BCVA, while WTEs often resulted in poorer vision or enucleation.
- In Worse Treated Eyes (WTEs), visual axis involvement at diagnosis ranged from 16.67% in BCVA E class eyes to 100.00% in B class eyes, with similar trends in clearance of the visual axis by the first exam under anesthesia (EUA).
 - Optic nerve invasion was absent in BCVA E, F, A, and B eyes and present in 100.00% of enucleated eyes.
 - **Retinal detachment** during treatment appeared in 16.67% of E and F eyes, **increasing to 100.00% in A and B eyes**.
- In Better Treated Eyes (BTEs), 25.45% of BCVA E eyes had only one tumor at diagnosis, with this rate reaching 100.00% in class B.
- Bilateral BTEs with visual axis involvement ranged from 16.67% in BCVA E eyes to 100.00% in B eyes, while **retinal detachment** was present in 11.11% of E eyes, **increasing to 100.00% in B eyes**.
 - Tumor recurrence occurred in 3.64% of E class eyes, 50.00% in F, and 100.00% in B class eyes.



Conclusions

- Early diagnosis and intervention were associated with better outcomes, as demonstrated by younger age at diagnosis (mean 2.0 years) and higher salvage rates in less advanced cases.
- Complications like **visual axis involvement**, **retinal detachment**, and **optic nerve invasion** were strongly linked to poorer visual outcomes, especially in blind or enucleated eyes.
- Less severe initial disease, minimal visual axis involvement, and absence of retinal detachment correlated with better vision. Findings in bilateral cases echoed these trends, underscoring specific features, including visual axis issues and glaucoma, as predictors of adverse outcomes.

Future Work

- The findings underscore the need for a predictive therapeutic algorithm to guide treatment decisions and improve long-term visual outcomes in RB patients.
- Further research is required to **validate these findings** and develop a predictive model or algorithm that clinicians can use to forecast visual outcomes.
- Future studies should focus on multi-center data to **increase the cohort size**, examine genetic factors influencing visual outcomes, and explore treatment modifications that could reduce risk factors like retinal detachment and optic nerve invasion.

Acknowledgements

<https://docs.google.com/document/d/1gkfBVfwZlIpKOmJwhMJ71xN7CJ2UuQQ8Cj2Z9gnbQc/edit?usp=sharing>