

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

Abstract

Retinoblastoma (RB) is the most common primary malignant ocular tumor in children, with an incidence of 1 in 15,000-18,000 live births. Traditionally treated by enucleation, recent advances in radiotherapy and chemotherapy have enabled globe preservation and potential vision rescue. However, the vision rescue itself has remained highly variable and unpredictable. Physicians have yet to find a reliable therapeutic algorithm that better predicts vision outcomes.

As such, this study aims to identify clinical factors predicting whole-child visual outcomes post-RB treatment by observing a cohort of 102 eyes from 85 patients treated at the University of Colorado Anschutz from 2008 to 2024. Patients were classified using the American Joint Committee on Cancer Staging Manual (TNM8 Classification System) and vision status grouped into four categories: excellent (20/20-20/40), functional (20/50-20/150), ambulatory (20/200-CF), and blind (HM, LP, NLP).

Visual outcomes varied, with the majority of Better Treated Eyes (BTEs) achieving excellent vision, while many Worse Treated Eyes (WTEs) resulted in enucleation or poorer vision. Pathology findings were analyzed and compared across visual outcome categories, highlighting significant predictors of vision loss and enucleation. In WTEs, visual axis involvement, retinal detachment, glaucoma, and optic nerve invasion were significant predictors of poor visual outcomes or enucleation. In BTEs, factors like optic nerve invasion, seeding, and retinal detachment also influenced visual prognosis. Findings in bilateral BTEs patients are linked to overall visual outcomes rather than outcomes in individual eyes. The findings in these patients found that visual axis involvement, retinal detachment, glaucoma, neovascularization of the iris (NVI), buphthalmos, and calcification predict poorer visual outcomes, while invasion of the optic nerve correlates with enucleation specifically.

This retrospective observational study emphasizes the need for a reliable therapeutic algorithm to predict visual outcomes and improve treatment strategies for RB. Further research is required to understand the whole-child visual impact post-RB treatment, potentially guiding future therapeutic decisions.