EVALUATION OF VISUAL OUTCOMES, DISTANCE-TO-DISC AND MORTALITY RATES IN CHOROIDAL MELANOMA PATIENTS UNDERGOING PROTON BEAM THERAPY: A SERVICE REVIEW AND AUDIT

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BACKGROUND

Choroidal melanoma is the most common primary intraocular malignancy in adults. Proton beam therapy is a preferred treatment modality that allows targeted tumour control while minimising damage to adjacent ocular structures. Tumour size and location—particularly its proximity to the optic disc—have been shown to impact visual outcomes and mortality risk. Understanding how these variables interact with treatment outcomes is crucial for improving prognosis and guiding treatment strategy. This review aims to evaluate outcomes following proton beam therapy, focusing on critical distances to the optic disc, tumour size, and survival.

METHODS

- **Design**: Retrospective service evaluation and audit using cases from Clatterbridge Hospital.
- **Sample**: 1,563 patients with choroidal melanoma treated with proton beam therapy
- **Inclusion criteria**: Documented visual acuity (pre- and post-treatment), tumour dimensions, and optic disc distance
- **Tumour classification**: Categorised by Collaborative Ocular Melanoma Study criteria into small, medium, and large tumours.
- **Outcomes measured**:
  - Change in visual acuity (logMAR)
  - Tumour distance to optic disc
  - Mortality and recurrence rates
- **Analysis**:
  - ANOVA for visual acuity vs tumour size
  - Linear regression for distance-to-disc vs logMAR change
  - Logistic regression for mortality
  - Kaplan-Meier survival analysis for recurrence

RESULTS

- Small Tumours: 641 cases
- Medium Tumours: 771 cases
- Large Tumours: 151 cases

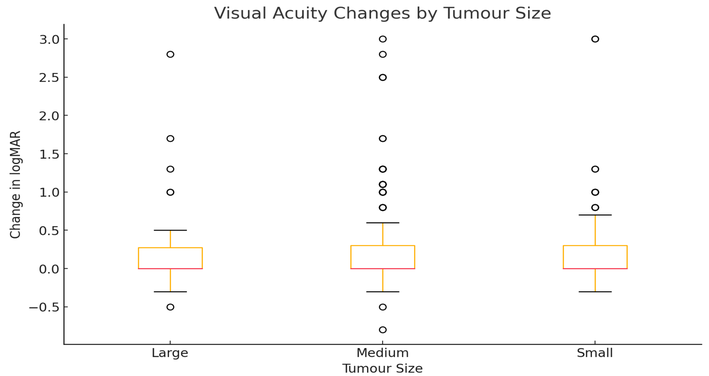
Analysis of outliers in visual acuity changes identified several patients with significant deviations. Among these outliers, common systemic diseases included hypertension, arthritis, and heart disease, which could potentially explain the substantial changes in visual acuity observed. Notably, some outliers were marked as "healthy," indicating that other factors, possibly unrecorded or patient-specific responses to treatment, may be influencing these visual outcomes.

- **Visual acuity deteriorated with increasing tumour size**, with large tumours showing the greatest mean logMAR change. Patients with small tumours generally retained better vision post-treatment, supporting the protective effect of early intervention (Figure 1).

- **Tumour proximity to the optic disc strongly influenced visual outcomes**. Tumours within 0–2 mm of the disc had the highest mean logMAR deterioration (0.32), with decreasing impact as distance increased; those >10 mm away had the least vision loss (0.11 logMAR) (Figure 2).

- **Mortality rates rose significantly with tumour size**, from 12.8% in small tumours (87 deaths) to 38.4% in large ones (54 deaths). The most common cause of death was **metastatic melanoma**, particularly to the **liver**, although some deaths were due to systemic comorbidities like cardiovascular disease. Figure 3 displays probabilities of recurrence overtime for each size.

FIGURE 1: Summary of mean changes in visual acuity following Proton Therapy:



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FIGURE 2: Visual Acuity Changes by Distance to Optic Disc:

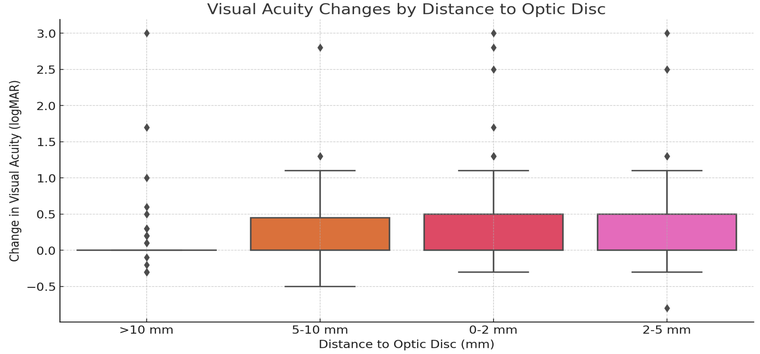
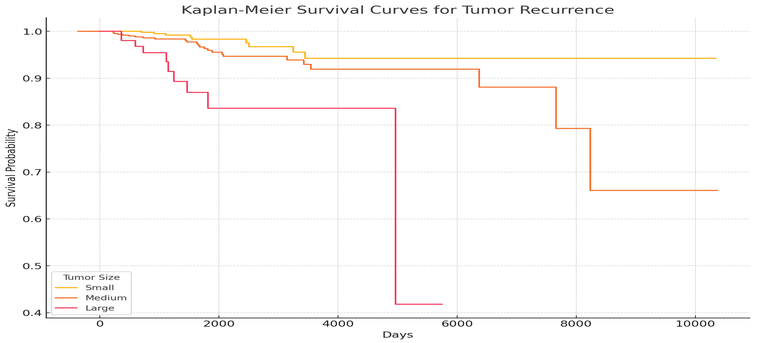


FIGURE 3: Kaplan-Meier survival curves for tumour recurrence



CONCLUSION

Larger choroidal melanomas and those closer to the optic disc are associated with worse visual outcomes and higher mortality following proton beam therapy. Early detection and precise tumour localisation are critical for optimising treatment outcomes. These findings support the importance of risk-based follow-up and timely referral in ophthalmic oncology practice.