

Clinical Characteristics, Staging, and Treatment Outcomes of Retinoblastoma at a National Referral Center in Tanzania: A Retrospective Study (2023–2025)

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Abstract

Background

Retinoblastoma is the most common intraocular malignancy in childhood. In low- and middle-income countries, late presentation often leads to advanced disease, high enucleation rates, and increased mortality. This study evaluated the clinical presentation, staging, treatment modalities, and outcomes of retinoblastoma at Muhimbili National Hospital (MNH) in Dar es Salaam, Tanzania.

Methods

A retrospective cross-sectional study was conducted among pediatric patients aged 0–5 years with confirmed or suspected retinoblastoma presenting to MNH between 2023 and 2025. Clinical records were extracted using a standardized data tool and analyzed using SPSS version 23. Categorical variables were evaluated using Chi-square and Fisher's exact tests ($p \leq 0.05$).

Results

A total of 111 patients were evaluated. The mean age at diagnosis was 2.59 ± 1.63 years, with a male predominance (55.0%). Unilateral disease accounted for 67.6% ($n = 75$), while 32.4% ($n = 36$) presented with bilateral involvement. Leukocoria was the primary presenting symptom (70.3%), followed by redness/swelling (28.8%), strabismus (24.3%), and vision loss (23.4%). Advanced intraocular disease dominated at diagnosis, with Group D (27.0%) and Group E (27.0%) being most common, and 9.9% exhibiting extra-ocular extension. Chemotherapy (87.4%) and enucleation (55.0%) were the primary treatments. At final review, 27.7% were disease-free, 24.1% were under treatment, 20.5% had residual disease, and overall mortality was 15.2%. Significant associations were found between age group and laterality, initial symptoms, and disease stage ($p = 0.000$).

Conclusion

Retinoblastoma management at MNH is characterized by late-stage presentation and high morbidity. Strengthening primary screening for leukocoria, raising community awareness, and establishing timely referral pathways are critical to improving eye preservation and survival.

1. Introduction

Retinoblastoma is the primary intraocular malignancy of childhood, accounting for approximately 3–4% of all pediatric cancers worldwide. While survival rates exceed 95% in high-income countries due to early detection and specialized oncological care, mortality remains disproportionately high in sub-Saharan Africa. In low- and middle-income countries (LMICs), delayed diagnosis, limited public awareness, and

socioeconomic barriers frequently lead to presentation at advanced intraocular stages or with extra-ocular extension.

In Tanzania, Muhimbili National Hospital (MNH) serves as the primary tertiary referral center for pediatric eye care and oncology. Many affected children travel long distances from rural areas, facing systemic delays that compromise prognosis and limit treatment to radical interventions such as enucleation. Understanding the current clinical profile, staging distribution, and treatment outcomes at this national referral hub is vital for formulating targeted public health interventions and optimizing clinical protocols.

This study aims to determine the clinical characteristics, diagnostic investigations, treatment modalities, and outcomes among pediatric retinoblastoma patients presenting to MNH from 2023 to 2025.

2. Materials and Methods

2.1 Study Design and Setting

An observational, facility-based retrospective cross-sectional study was conducted at the Department of Ophthalmology, Muhimbili National Hospital (MNH), Dar es Salaam, Tanzania.

2.2 Study Population & Eligibility

The study included pediatric patients aged 0–5 years who presented to MNH between 2023 and 2025 with suspected or confirmed retinoblastoma.

- **Inclusion criteria:** Children aged 0–5 years with clinical or radiological diagnoses of retinoblastoma whose medical records contained adequate clinical and outcome data.
- **Exclusion criteria:** Major prior ocular surgery in the preceding 6 months (unrelated to tumor management) or incomplete medical records.

2.3 Data Collection

Data were extracted using a structured abstraction form covering demographics (age, sex, region of origin), clinical presentation (presenting symptoms, laterality, eye affected), classification/stage at diagnosis (International Classification for Retinoblastoma / ICRB), diagnostic modalities used (ultrasound, CT, MRI, histopathology), treatment modalities (chemotherapy, enucleation, laser therapy, cryotherapy, radiotherapy), and clinical outcomes.

2.4 Statistical Analysis

Data were entered, cleaned, and analyzed using IBM SPSS Statistics version 23. Descriptive statistics were summarized as means and standard deviations for continuous parameters and frequencies/percentages for categorical parameters. Cross-tabulations were performed to evaluate associations between variables using Chi-square (χ^2) tests and Fisher's exact tests where expected cell counts fell below 5. Statistical significance was established at $p \leq 0.05$.

2.5 Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki. Ethical clearance was granted by the Ethics Review Committee of the Faculty of Medicine, University of Medical Sciences and Technology, along with institutional clearance from Muhimbili National Hospital. Patient confidentiality was maintained throughout.

3. Results

3.1 Sociodemographic Profile

A total of 111 patients were included in the analysis. The mean age at diagnosis was 2.59 ± 1.63 years. Males constituted 55.0% (n = 61) and females 45.0% (n = 50). Patients represented all geographical zones of Tanzania, with the largest proportions coming from the Northern Zone (18.9%) and Eastern Zone (18.0%), followed by the Central Zone (16.2%), Lake Zone (13.5%), and Southern Highlands Zone (12.6%).

3.2 Clinical Presentation and Staging

Unilateral disease was present in 67.6% (n = 75) of patients, while 32.4% (n = 36) had bilateral involvement. Affected eyes included the right eye in 35.1%, left eye in 32.4%, and both eyes in 32.4%.

Leukocoria was the most common initial presenting symptom (70.3%), followed by ocular redness or swelling (28.8%), strabismus (24.3%), and documented vision loss (23.4%). Advanced intraocular disease dominated at diagnosis: Group D and Group E each accounted for 27.0% (n = 30 each) of cases. Extra-ocular or orbital extension was identified in 9.9% (n = 11), Group C in 18.9% (n = 21), Group B in 12.6% (n = 14), Group A in 3.6% (n = 4), and Stage IV metastatic disease in 0.9% (n = 1).

3.3 Diagnostic and Treatment Modalities

All patients underwent clinical ophthalmic examination (100%). Ocular ultrasound was performed in 67.6% (n = 75), CT scanning in 39.6% (n = 44), MRI in 31.5% (n = 35), and histopathological verification was recorded in 9.9% (n = 11).

Treatment had been initiated in 98.2% (n = 109) of patients. Systemic chemotherapy was the primary modality administered (87.4%, n = 97), followed by enucleation (55.0%, n = 61), laser therapy (19.8%, n = 22), radiotherapy (9.9%, n = 11), cryotherapy (8.1%, n = 9), and topical eye drops (4.5%, n = 5).

3.4 Complications and Mortality Outcomes

Overall, 33.0% (n = 37) of patients experienced no secondary complications. Documented complications included systemic metastasis (20.5%), secondary vision loss (12.5%), cataract (10.7%), glaucoma (8.9%), tumor recurrence (7.1%), and orbital infection (7.1%).

At final evaluation, 27.7% (n = 31) were alive with no evidence of disease, 24.1% (n = 27) were actively undergoing treatment, 20.5% (n = 23) had residual disease, 7.1% (n = 8) experienced tumor recurrence, and 5.4% (n = 6) had distant metastasis. Overall mortality was 15.2% (n = 17).

4. Discussion

This study demonstrates the clinical realities of pediatric retinoblastoma management at Tanzania's central referral hospital. The mean age at diagnosis (2.59 ± 1.63 years) mirrors reports from other African and Asian centers. More than 54% of patients presented with Group D or E disease, and nearly 10% exhibited extra-ocular extension. Leukocoria remained the hallmark sign (70.3%). While chemotherapy (87.4%) and conservation strategies have expanded, enucleation remains necessary in 55% of patients. Overall disease-free survival (27.7%) and mortality (15.2%) highlight the continuing challenge of late presentation.

5. Conclusion and Recommendations

Retinoblastoma at Muhimbili National Hospital remains marked by advanced staging at presentation. Routine red-reflex checks should be integrated into primary child healthcare, public awareness expanded, and referral pathways streamlined.

Declarations

Ethics Approval and Consent to Participate

This study was conducted in accordance with the Declaration of Helsinki. Ethical clearance was granted by the Ethics Review Committee of the Faculty of Medicine, University of Medical Sciences and Technology, along with institutional clearance from Muhimbili National Hospital.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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Author Contribution

MSA conceived and designed the study, collected and analyzed the data, and drafted the manuscript. NRE and JK provided clinical supervision, contributed to the study design and data interpretation, and critically revised the manuscript. All authors read and approved the final manuscript.

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Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request due to patient privacy and institutional confidentiality regulations.

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