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Treatment Patterns and Clinical Outcomes of Elderly Patients With Hodgkin Lymphoma

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Abstract

Background

Older patients with Hodgkin lymphoma (HL) have poorer outcomes than younger patients, reflecting a combination of advanced disease, comorbidity, impaired functional reserve, and reduced tolerance of conventional chemotherapy. Data describing treatment delivery and outcomes in this population from India remain limited.

Methods

We conducted a retrospective cohort study of patients aged ⩾50 years with newly diagnosed classical HL treated at Malabar Cancer Centre-Post Graduate Institute of Oncology Sciences and Research (MCC-PGIOSR), Thalassery, between January 2018 and December 2023. Demographic, clinical, treatment, toxicity, and outcome data were obtained from electronic medical records. Baseline characteristics were summarized descriptively. Overall survival (OS) and progression-free survival (PFS) were estimated by the Kaplan-Meier method in patients who received active treatment (n=34). Potential prognostic factors were explored using Cox proportional hazards regression.

Results

A total of 45 patients were included; the median age was 57 years (range, 50-80 years), and 27 (60.0%) were male. Eastern Cooperative Oncology Group (ECOG) performance status was ⩾2 in 22 patients (48.9%), and 29 (64.4%) had at least one comorbidity. Stage III-IV disease was present in 25 patients (55.6%), B symptoms in 15 (33.3%), and extranodal involvement in 21 (46.7%). Active treatment was administered to 34 patients (75.6%), most commonly with ABVD (adriamycin, bleomycin, vinblastine, dacarbazine) or AVD (adriamycin, vinblastine, dacarbazine) based regimens. Grade 3-4 toxicity occurred in 10 treated patients (29.4%), and six (17.6%) required hospitalization. Among treated patients, OS at 1, 3, and 5 years was 88.0%, 81.0%, and 71.7%, respectively, while corresponding PFS estimates were 76.2%, 64.7%, and 64.7%. In multivariable Cox analysis, increasing age at diagnosis was associated with higher hazards of death (HR, 1.180; 95% CI, 1.013-1.376; P=0.034) and progression or death (HR, 1.216; 95% CI, 1.006-1.469; P=0.043).

Conclusions

Older adults with HL commonly present with advanced disease, impaired performance status, and comorbidity, creating substantial challenges in delivering curative therapy. In this cohort, clinically important treatment-related toxicity was frequent, and long-term survival remained suboptimal. These findings support individualized treatment selection, careful assessment of functional reserve, and approaches that minimize avoidable toxicity.

Categories: Hematology, Oncology
Keywords: classical hodgkins lymphoma, elderly patients, overall survival (os), progression - free survival, treatment pattern

Introduction

Hodgkin lymphoma (HL) is a highly curable B-cell malignancy with a characteristic bimodal age distribution. In older adults, however, disease outcomes are consistently less favourable than in younger patients, owing to a combination of greater disease burden, comorbidity, reduced physiological reserve, and limited tolerance of intensive treatment [1,2].

The later incidence peak of HL occurs in older adulthood, with a substantial proportion of cases arising after 55 years of age. GLOBOCAN (Global Cancer Observatory) 2022 estimated 82,469 new cases worldwide and 9,611 cases in India [3]. In India, the second age peak of Hodgkin's lymphoma occurs at a slightly younger age. A multicentre registry shows that nearly one-third of cases occur in patients aged 50 and older [4].

ABVD has historically been the standard chemotherapy backbone, but its toxicity profile is particularly relevant in older patients, who are more susceptible to pulmonary, cardiac, infectious, and other complications. Bleomycin exposure may therefore need to be curtailed or omitted, with treatment intensity adjusted to individual fitness [5]. Current management also incorporates interim PET-adapted strategies, brentuximab vedotin, immune checkpoint inhibitors, and geriatric assessment. In advanced-stage disease, ECHELON-1 established the benefit of brentuximab vedotin plus AVD over ABVD, and SWOG S1826 subsequently demonstrated superior PFS with nivolumab plus AVD compared with brentuximab vedotin plus AVD [6,7]. Nevertheless, evidence on the application of these approaches in older patients, particularly in resource-constrained settings, remains limited [8,9].

We therefore evaluated real-world treatment patterns, treatment-related toxicity, response, survival, and potential prognostic factors among patients aged ⩾50 years with HL treated at a tertiary cancer centre in South India.

Materials And Methods

Study design and setting

This retrospective cohort study was conducted in the Department of Clinical Haematology and Medical Oncology at Malabar Cancer Centre-Post Graduate Institute of Oncology Sciences and Research (MCC-PGIOSR), Thalassery, Keralam, India, from December 1, 2025 to March 30, 2026.

Study population

Patients aged 50 years or older with histologically confirmed Hodgkin's lymphoma diagnosed between January 2018 and December 2023 were eligible. Patients were excluded when medical records were incomplete or follow-up was inadequate for assessment of outcomes.

Data collection

Demographic, clinical, treatment, toxicity, and outcome information were extracted from electronic medical records and case files. The data cutoff date was November 30, 2025.

Outcome measures

The primary endpoints were overall survival (OS) and progression-free survival (PFS). Secondary endpoints were treatment patterns, treatment-related toxicity, response to therapy, and exploratory assessment of variables potentially associated with survival.

OS was defined as the interval from diagnosis to death from any cause or last follow-up. PFS was defined as the interval from diagnosis to progression, relapse, death, or last follow-up. Survival analyses were performed among the 34 patients who received active treatment.

Statistical analysis

Continuous variables were summarised as mean ± standard deviation or median with range, as appropriate, and categorical variables as counts and percentages. Kaplan-Meier methods were used to estimate OS and PFS. Exploratory univariable and multivariable Cox proportional hazards regression analyses were used to examine candidate baseline and treatment variables; hazard ratios (HRs) and 95% confidence intervals (CIs) were reported. A two-sided P-value <0.05 was considered statistically significant.

Results

The cohort included 45 patients aged 50 years or older. The median age at diagnosis was 57 years (range, 50-80 years), while the mean age was 60.2 ± 8.9 years. A total of 27 patients (60.0%) were male.

Baseline patient characteristics

A total of 23 patients (51.1%) had an ECOG performance status of 0-1, whereas 22 (48.9%) had ECOG ⩾2. Comorbidity was documented in 29 patients (64.4%); 16 (35.6%) had no recorded comorbidity. Stage III-IV disease was documented in 25 patients (55.6%), while 15 (33.3%) had stage I-II disease. Five patients (11.1%) were not staged because of poor performance status and received supportive care. B symptoms were present in 15 patients (33.3%). Extranodal involvement was recorded in 21 patients (46.7%); 19 (42.2%) had no extranodal disease, and five (11.1%) were not staged. No patient had documented bulky disease (Table *1*).

Characteristic	Category	n (%)
Total patients		45
Sex	Male	27 (60.0)
	Female	18 (40.0)
ECOG Performance Status	0–1	23 (51.1)
	≥2	22 (48.9)
Comorbidities	None	16 (35.6)
	≥1 present	29 (64.4)
Disease stage	Stage I–II	15 (33.3)
	Stage III–IV	25 (55.6)
	Not staged	5 (11.1)
Extranodal involvement	Present	21 (46.7)
	Absent	19 (42.2)
	Not staged	5 (11.1)
Number of sites of extra-nodal involvement (n=21)	≤2 sites	17 (37.8)
	>2 sites	4 (8.9)
B symptoms	Present	15 (33.3)
	Absent	30 (66.7)

TABLE 1: Baseline demographic and clinical characteristics

Data represented as n (%).

Clinical presentation

Isolated peripheral lymph-node enlargement was the most frequent presenting feature, occurring in 25 patients (55.6%). Fifteen patients (33.3%) presented with B symptoms with or without nodal enlargement, while five (11.1%) had other complaints, including abdominal discomfort, marked fatigue, or lower back pain (Table *2*). Among patients with extranodal disease, splenic involvement was the most frequently recorded site, followed by combined splenic and bone-marrow involvement. Four patients had more than two extranodal sites.

Presenting symptoms	n (%)
Nodal swelling only	25 (55.6)
B symptoms ± nodal swelling	15 (33.3)
Other symptoms	5 (11.1)

TABLE 2: Clinical presentation

Data represented as n (%).

Treatment characteristics

Active treatment was administered to 34 of 45 patients (75.6%); the remaining 11 (24.4%) received best supportive care, primarily because of poor performance status or significant comorbidity. Of the treated patients, 33 (97.1%) received therapy with curative intent and one (2.9%) received palliative treatment with radiation therapy alone. ABVD was used most frequently (14 patients; 41.2%), followed by AVD (12 patients;

35.3%). Eight patients (23.5%) received other approaches, including EBVD, EVD, R-CHOP for nodular lymphocyte-predominant HL, or radiotherapy alone, according to comorbidity and disease-specific considerations. Six cycles of chemotherapy were planned for 22 patients (66.7%), and 17 among them (77.3%) completed all six cycles; the other five patients could not complete all the cycles due to tolerance issues. Dose reduction was required in three patients (9.1%), while nine (26.5%) experienced treatment delay. Radiotherapy was administered to 11 patients (32.4%), predominantly as consolidation after chemotherapy (Table 3).

Variable	Category	n (%)
Treatment intent (n=34)	Curative	33 (97.1)
	Palliative	1 (2.9)
Primary treatment (n=34)	ABVD	14 (41.2)
	AVD	12 (35.3)
	Other regimens	7 (20.6)
	Radiation alone	1 (2.9)
Planned chemotherapy cycles (n=33)	≤4 cycles	11 (33.3)
	6 cycles	22 (66.7)
Chemotherapy delivered among planned	≤4 cycles	11 (100)
	6 cycles	17 (77.3)
Chemotherapy dose reduction (n=33)	Yes	3 (9.1)
	No	30 (90.9)
Treatment delay	Yes	9 (26.5)
	No	25 (73.5)
Radiotherapy	Yes	11 (32.4)
	No	23 (67.6)

TABLE 3: Treatment characteristics among treated patients

Data represented as n (%).

Among 34 patients, 1 patient received radiation therapy alone.

Treatment-related toxicity

Clinically important treatment-related toxicity occurred in a substantial proportion of treated patients. Grade 3-4 toxicity was recorded in 10 patients (29.4%). Grade 3-4 hematologic toxicity occurred in 4 patients (11.7%), while cardiac toxicity occurred in 2 patients (5.9%) and pulmonary toxicity in 3 patients (8.8%). One patient (2.9%) developed a grade 3-4 infection. Six patients (17.6%) required hospitalisation for treatment-related toxicity.

Type of Grade 3/4 toxicity	n (%)
Hematologic toxicity	4 (11.7)
Cardiac toxicity	2 (5.9)
Pulmonary toxicity	3 (8.8)
Grade 3–4 infection	1 (2.9)

TABLE 4: Treatment-related grade 3/4 toxicity among treated patients

Data represented as n (%).

Interim PET was performed in 26 of the 33 patients who received chemotherapy (78.8%), with one patient receiving radiation therapy alone. Complete metabolic response was observed in 17 patients (65.4%), while nine (34.6%) had a partial response.

End-of-treatment PET-CT was available for 19 patients; 17 (89.5%) achieved complete remission, and two (10.5%) had progressive disease. Nine additional patients with a complete metabolic response on interim PET did not undergo end-of-treatment PET because of physician discretion. Overall, 26 patients (78.8%) were classified as having achieved complete remission after first-line treatment, while two (6.1%) experienced progression during the period of follow-up in the study.

Assessment	Category	n (%)
Interim PET (n = 26)	Complete response	17 (65.4)
	Partial response	9 (34.6)
End-of-treatment assessment*(n=33)	Complete response	26 (78.8)
	Progressive disease	2 (6.1)
	Not evaluable†	5 (15.2)

TABLE 5: Response assessment after first-line treatment (n = 33)

Data represented as n (%).

* End-of-treatment response was done for patients treated with curative intent,1 patient who received radiation therapy alone with palliative intent is excluded. It includes patients with complete metabolic response on interim PET who did not undergo end-of-treatment PET.

† Patients who did not complete response assessment because of treatment discontinuation, loss to follow-up, or best supportive care

Survival analysis

Survival analyses were restricted to the 34 patients who received active treatment. Median follow-up duration was 54 months (95% CI 44-63 months). It was calculated using the reverse Kaplan-Meier method. There were 10 deaths and 24 censored observations for OS; 12 progression/death events and 22 censored observations were recorded for PFS. Kaplan-Meier estimates of OS were 88% at 1 year, 84.9% at 2 years, 81.0% at 3 years, 76.5% at 4 years, and 71.7% at 5 years. Median OS was not reached. Corresponding PFS estimates were 76.2%, 76.2%, 64.7%, 64.7%, and 64.7%.

Time point	Overall survival	Progression-free survival
1 year	88%	76.2%
2 years	84.9%	76.2%
3 years	81.0%	64.7%
4 years	76.5%	64.7%
5 years	71.7%	64.7%

TABLE 6: Survival analysis

Kaplan-Meier estimates of overall survival (OS) and progression-free survival at 1,2,3,4,5 years.

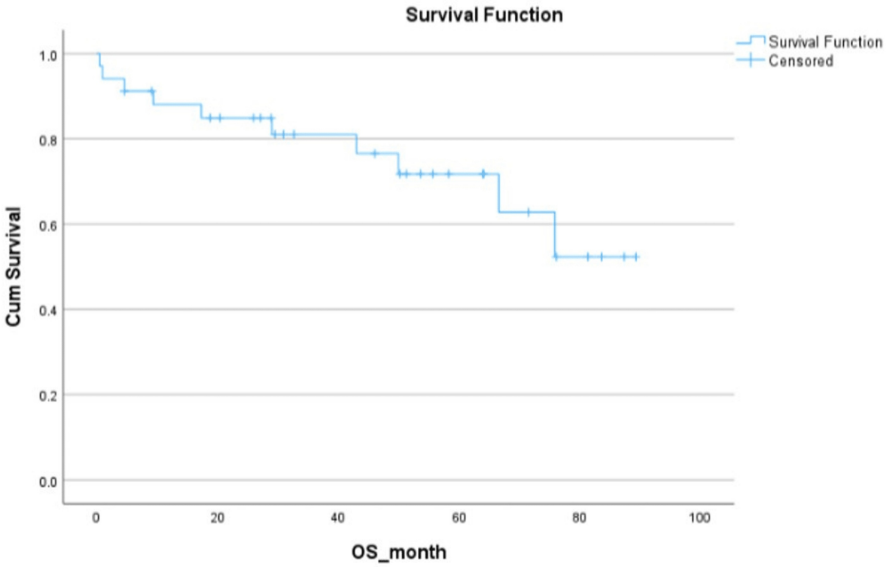


FIGURE 1: Overall survival

Kaplan-Meier plot for overall survival.

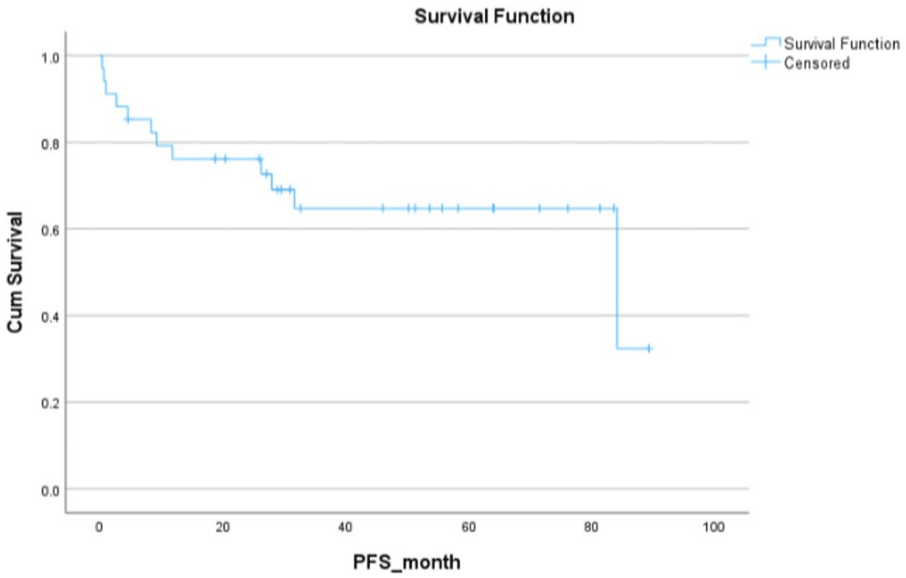


FIGURE 2: Progression-free survival

Kaplan-Meier plot for progression-free survival.

Prognostic Factor Analysis

Prognostic factor analysis is exploratory due to the small sample size. Univariable Cox proportional hazards regression analyses evaluated age at diagnosis, sex, and comorbidity in relation to OS and PFS (Tables 7 and 8). For OS, increasing age was associated with a higher hazard of death (HR, 1.110; 95% CI, 1.004-1.227; P=0.041). Sex (HR, 0.157; 95% CI, 0.020-1.241; P=0.079) and comorbidity (HR, 3.934; 95% CI, 0.821-18.852; P=0.087) were not significantly associated with OS. For PFS, increasing age was associated with a higher hazard of progression or death (HR, 1.113; 95% CI, 1.013-1.222; P=0.026), while female sex was associated with a lower hazard (HR, 0.118; 95% CI, 0.015-0.913; P=0.041). Comorbidity was not significantly associated with PFS (HR, 2.820; 95% CI, 0.762-10.433; P=0.120).

Factor	HR	95% CI for HR	P-value
Age at diagnosis	1.11	1.004–1.227	0.041
Female Sex	0.157	0.020–1.241	0.079
Comorbidity present	3.934	0.821–18.852	0.087

TABLE 7: Prognostic factors for overall survival

Univariable Cox regression for overall survival.

P-value less than 0.05 is considered statistically significant.

Factor	HR	95% CI for HR	P-value
Age at diagnosis	1.113	1.013–1.222	0.026
Female sex	0.118	0.015–0.913	0.041
Comorbidity present	2.82	0.762–10.433	0.12

TABLE 8: Prognostic factors for progression-free survival

Univariable Cox regression for for progression-free survival.

P-value less than 0.05 is considered statistically significant.

In multivariable Cox regression, age at diagnosis was associated with OS (HR, 1.180; 95% CI, 1.013-1.376; P=0.034) and PFS (HR, 1.216; 95% CI, 1.006-1.469; P=0.043) (Tables *9*-*10*). Sex and comorbidity were not statistically significantly associated with either outcome. These findings suggest that increasing age may be an important prognostic factor in this cohort, although the small number of events and wide confidence intervals limit the precision of the estimates.

Factor	HR	95% CI for HR	P-value
Age at diagnosis	1.18	1.013–1.376	0.034
Female Sex	0.191	0.018–1.980	0.165
Comorbidity present	5.01	0.769–32.649	0.092

TABLE 9: Prognostic factors for overall survival

Multivariable Cox regression for overall survival.

P-value less than 0.05 is considered statistically significant.

Factor	HR	95% CI for HR	P-value
Age at diagnosis	1.216	1.006–1.469	0.043
Female sex	0.124	0.009–1.692	0.118
Comorbidity present	3.983	0.603–26.297	0.151

TABLE 10: Prognostic factors for progression-free survival

Multivariable Cox regression for for progression-free survival.

P-value less than 0.05 is considered statistically significant.

Discussion

This retrospective cohort describes treatment selection, toxicity, response, and survival among older adults with HL treated in a tertiary cancer centre in India. A substantial proportion presented with advanced disease, poor performance status, or comorbidity, factors that can limit the feasibility of standard-intensity treatment.

The median age was 57 years and 60% of patients were male. This profile is broadly comparable with reports from India and other settings describing older patients with HL, in whom advanced-stage disease and systemic symptoms are frequent at presentation [8,10]. A separate North Indian cohort that included a broader age range also reported a high frequency of advanced-stage disease and B symptoms [11]. The

relatively high frequency of advanced disease reflects greater disease burden in older patients and delayed diagnosis in some resource-limited settings [8].

ABVD remained the most frequently used regimen, although treatment was often modified according to comorbidity and functional status. Nearly one-third of treated patients developed grade 3-4 toxicity, with haematologic toxicity predominating, a rate higher than that reported in younger patients [12]. Pulmonary toxicity was less frequent in this cohort, potentially reflecting reduced or omitted bleomycin exposure. This is consistent with evidence that prolonged bleomycin exposure increases pulmonary risk in older patients and that bleomycin can be omitted after an appropriate interim PET response [5,13].

Treatment options have changed considerably since the period covered by this cohort. ECHELON-1 demonstrated improved disease control and overall survival with brentuximab vedotin plus AVD compared with ABVD in advanced-stage HL [6]. SWOG S1826 subsequently showed superior PFS with nivolumab plus AVD compared with brentuximab vedotin plus AVD [7]. Because older adults, particularly frail patients, remain underrepresented in pivotal trials, treatment selection must still be individualised. Nevertheless, approaches that avoid routine bleomycin exposure offer an important opportunity to reduce pulmonary toxicity.

Among actively treated patients, the estimated 5-year OS was 71.7% and 5-year PFS was 64.7%. OS at 1, 3, and 5 years was 88.0%, 81.0%, and 71.7%, respectively, while corresponding PFS estimates were 76.2%, 64.7%, and 64.7%. The sharp decline and plateauing of the PFS curve may be due to either late relapses or a small study population. These data provide a real-world estimate of long-term outcomes from an Indian tertiary-care setting.

In univariable analyses, increasing age was associated with poorer OS and PFS, while female sex was associated with a lower hazard of progression or death. Comorbidity was not significantly associated with either outcome in univariable analyses. In multivariable analyses, age at diagnosis remained associated with both OS and PFS, whereas sex and comorbidity were not statistically significant. The consistency of the association between age and both endpoints suggests that age may be an important prognostic marker in this cohort; however, the limited number of events and the width of the confidence intervals warrant cautious interpretation.

The strengths of this study include detailed assessment of treatment delivery, toxicity, response and survival in a real-world cohort. Important limitations include the retrospective single-centre design, small sample size, potential selection bias and limited availability of newer agents during the study period. Only 10 deaths and 12 PFS events were observed, limiting the precision of multivariable estimates. Accordingly, the prognostic findings should be considered exploratory and require validation in larger prospective multicentre studies.

Conclusions

Older adults with HL remain clinically vulnerable because advanced disease, impaired functional status, and comorbidity can restrict treatment intensity and increase toxicity. In this cohort, approximately three-quarters of patients received active treatment, and most were treated with curative intent, predominantly using ABVD- or AVD-based chemotherapy. Although substantial responses were achieved, treatment-related toxicity remained frequent and long-term survival was lower than that generally reported in younger populations. In exploratory Cox analyses, age at diagnosis was associated with both OS and PFS, while sex and comorbidity were not statistically significant in the multivariable analyses. Given the limited number of outcome events, these findings should be interpreted cautiously and explored in larger prospective multicentre studies to validate prognostic markers and define treatment strategies that balance disease control, tolerability, and competing health risks in this population.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Shoaib Nawaz, Abhilash Menon, Chandran Nair

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Supervision: Shoaib Nawaz

Critical review of the manuscript for important intellectual content: Abhilash Menon

Acquisition, analysis, or interpretation of data: K Ratheesan

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board – Scientific Committee (IRB-SRC) issued approval 1616/IRB-SRC/13/MCC/18-12-2025/4. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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