Comparison Of Treatment Outcomes Between Epoch And Chop Regimens In Patients With Hiv Associated Nhl In A Low Resource Setting

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Abstract

Background: The optimal chemotherapy regimen for treating HIV associated NHL in low resource settings is unknown. We conducted a retrospective study to describe survival rates, treatment response rates and adverse events in patients with HIV associated NHL treated with EPOCH and CHOP regimens at the Uganda Cancer Institute.

Methods: A retrospective study of patients diagnosed with HIV and lymphoma and treated at the Uganda Cancer Institute from 2016 – 2018 was done.

Results: One hundred eight patients treated with CHOP and 12 patients treated with EPOCH were analysed. Patients completing 6 or more cycles of chemotherapy were 51 (47%) in the CHOP group and 8 (67%) in the EPOCH group. One year overall survival (OS) rate in patients treated with CHOP was 54.5% (95% CI, 42.8 – 64.8) and 80.2% (95% CI, 40.3 – 94.8) in those treated with EPOCH. The observed survival rates differences were not statistically different between the two groups; hazard ratio, 0.43 (95% CI, 0.10 - 1.78; $p=0.24$). Factors associated with favourable survival were BMI 18.5-24.9 kg/m², ($p=0.03$) and completion of 6 or more cycles of chemotherapy, ($p<0.001$). The overall response rate was 40% in the CHOP group and 59% in the EPOCH group. Severe adverse events occurred in 19 (18%) patients in the CHOP group and 3 (25%) in the EPOCH group; these were neutropenia (CHOP=13, 12%; EPOCH=2, 17%), anaemia (CHOP=12, 12%; EPOCH=1, 8%), thrombocytopenia (CHOP=7, 6%; EPOCH=0), sepsis (CHOP=1), treatment related death (EPOCH=1) and hepatic encephalopathy (CHOP=1).

Conclusion: Treatment of HIV associated NHL with curative intent using CHOP and infusional EPOCH is feasible in low resource settings and associated with >50% one year survival.

Background

Globally, the estimated incidence of non-Hodgkin's lymphoma (NHL) was 5/100,000 in 2012(1). In Uganda, the incidence of NHL was 1,426/100,000 from the year 1991–2010(2). In 2016, an estimated 1.4 million people in Uganda were living with HIV(3). The incidence of NHL remains significantly higher in HIV-positive patients compared with the HIV negative patients, even in the era of combination antiretroviral therapy (ART) (4-7). The outcomes for patients with HIV-associated NHL and non-HIV associated NHL treated with chemotherapy in resource limited settings is still disappointingly low(8). Notwithstanding, the introduction of combination ART resulted in reduced morbidity and mortality from HIV infection(9-11), and improved NHL specific outcomes(12).

The optimal chemotherapy regimen for the treatment of HIV associated NHL in low resource settings is still unclear. First line chemotherapy regimens used to treat HIV associated NHL in the post ART era include, but not limited to the infusional cyclophosphamide–doxorubicin–etoposide (CDE) with complete remission rate (CR) of 42%, median survival time of 17.8-month, and 1-year survival rate of 55%(13); and Cyclophosphamide, Doxorubicin, Vincristine and Prednisolone (CHOP) regimen with complete remission

in 57.6% and 47% in patients treated with R-CHOP and CHOP respectively, with an overall survival of about 35 months for R-CHOP and 28 months for CHOP(14).

Etoposide, Prednisone, Vincristine, Cyclophosphamide, and Doxorubicin (EPOCH) infusional chemotherapy is a relatively recent combination in this category. Hitherto, it has been reported to achieve 79% CR rate and 72% overall 2-year survival rate in patients with HIV associated NHL(15).

Use of the EPOCH regimen has been suggested as unreasonable in low resource settings(16) possibly due to lack of infrastructure and supportive medications in addition to the demands of the 24 hour continuous infusion of this regimen. Uganda Cancer Institute (UCI) has in the recent past embarked on the use of EPOCH regimen in a selected group of patients with HIV associated NHL. Due to the uncertainty regarding the optimum treatment of HIV associated NHL and the paucity of published data regarding the use of EPOCH in resource limited settings, we undertook a retrospective study to describe the treatment outcomes in patients with HIV associated NHL treated with EPOCH and CHOP regimens at the Uganda Cancer Institute.

Methods

Study setting and design

Charts of patients with a diagnosis of HIV and NHL treated with either CHOP or EPOCH chemotherapy regimens at the Uganda Cancer Institute (UCI) from 2016 - 2018 were retrospectively studied. UCI is the only tertiary cancer treatment facility in Uganda. It receives patients from the entire country, with some patients traveling over 600km to seek treatment. Diagnosis of NHL at the UCI is based on morphological examination of the haematoxylin and eosin (H&E) stained tissues. Patients who can afford additional immunohistochemistry undertake them from private laboratories. Staging of NHL is based on the Ann Arbor staging system(17). There is no national medical insurance cover in Uganda. Aggressive HIV associated NHLs are treated with CHOP; however, since the year 2016, a selected group of patients have been treated with DA-EPOCH based on the physicians' judgement. Additional therapy of HIV associated B cell NHL with rituximab at the UCI is limited due to the cost involved.

Study procedure

Charts of eligible patients were consecutively identified by the Records Officer. Patients treated with CHOP received cyclophosphamide 750mg/m² IV on day 1, doxorubicin 50mg/m² IV bolus on day 1, vincristine 1.4mg/ m² IV bolus (max dose 2mg) on day 1, and prednisolone 60mg/m² orally on days 1-5, repeated every 21 days for 6 – 8 cycles on either outpatient or inpatient basis. Patients treated with EPOCH received etoposide 50mg/m² + doxorubicin 10mg/m² IV + vincristine 0.4mg/m² infusion for 24 hours on days 1-4, cyclophosphamide 750mg/m² IV on day 5, and prednisolone 60mg/m² PO on days 1-5 on an inpatient basis; the EPOCH dosages were adjusted based on nadir neutrophil counts in the preceding treatment cycle (DA-EPOCH). All infusions were administered through peripheral intravenous lines. Normal saline was infused concurrently with EPOCH through Y-junction pot until the chemotherapy

infusion was completed. No patient received rituximab or G-CSF. Data concerning additional medications, especially ART and Pneumocystis jiroveci pneumonia (PCP) were included. Adverse events were recorded at the time of each chemotherapy cycle and graded according to the NCI Common Terminology Criteria for Adverse Events (CTCAE) v5. In participants who had CT scans at baseline and end of therapy, treatment response was assessed using the Lugano Criteria but without the use of positron Emission Tomography. The last date of hospital review or death was recorded for survival analysis. Data was manually abstracted from charts using a standard data collection tool, coded, and then double entered into a computer using Epidata version 3.1 (Epidata association, Denmark) before exporting into STATA Version 14 (StataCorp, USA) for analysis.

Study variables

The study variables included participant's age and sex; type and stage of lymphoma, comorbidities, baseline ECOG performance score, body mass index (BMI), and number of chemotherapy cycles received, ART regimen and other additional concomitant medications received, and B-symptoms; nadir complete blood count (CBC) post chemotherapy and other adverse events, and disease response.

DATA ANALYSIS

Continuous variables were expressed as means and standard deviation (SD) if normally distributed or medians and inter quartile ranges (IQR) if skewed; categorical variables were described using frequencies and percentages; the overall treatment response rates (complete response, partial response) were estimated for both CHOP and EPOCH chemotherapy arms using the binomial proportion and its 95% confidence interval as separate categories using the total number of participants enrolled at baseline as the denominator in each study arm. The two treatment regimens were compared with respect to overall response rate using Fisher's exact test; the proportion of patients who completed each treatment regimen were described as separate categories using the total number of participants enrolled at baseline as the denominator in each study arm and compared using Fisher's exact test. Reasons for non-completion of chemotherapy were also described and compared using Fisher's exact test. The one year overall survival was described for patients in the two treatment regimens using the Kaplan-Meier curves and compared using log-rank test. A two sided alpha of 0.05 was used for comparison. Cox proportional hazards model was constructed to evaluate the association between patient characteristics and OS. Hazard ratios and 95% confidence intervals were generated, with hazard ratio <1.0 indicating survival benefit. With a sample size of 120 at a proportion of 9:1 for CHOP to EPOCH, a two sided alpha of 0.05, and a hazard ratio of 0.43, the study had 80% power to detect a difference in one year overall survival rate.

Results

Baseline clinical characteristics

Charts of 120 patients were identified (CHOP, n=108; EPOCH, n=12). The commonest histological diagnosis in the EPOCH group was DLBCL, 7(58%) while for the CHOP group was Diffuse Large Cell

lymphoma (DLCL), 65(60%) (Table 1). Diagnosis of DLCL was obtained from the H&E stain with no additional IHC. All patients in the EPOCH group and a majority of patients in the CHOP group (n=105; 97.2%) were already receiving ART prior to initiation of chemotherapy. Only 3 patients (2.8%) in the CHOP group initiated ART after completion of their chemotherapy cycles. Ten patients (83%) in the EPOCH group were receiving tenofovir/lamivudine/efavirenz, one was receiving zidovudine/lamivudine/efavirenz, and the other was receiving tenofovir/lamivudine/nevirapine. Patients in the CHOP group received a variety of ART combination with 42(39%) patients receiving either tenofovir or zidovudine in combination with lamivudine and efavirenz. The rests of the patients received other combination of first line ART. No patient had ART interrupted while receiving chemotherapy. All patients in the EPOCH group and a majority of patients in the CHOP group (n=99, 92%) were receiving cotrimoxazole for PCP prophylaxis. The rest were either on dapsone, or none. Markers for HIV control were not documented as these were collected at a separate ART treatment centre, independent of the UCI.

TABLE 1: DEMOGRAPHIC FACTORS AND BASELINE CHARACTERISTICS

Variable	All patients n=120	CHOP, n=108	EPOCH, n=12
Sex, n(%)			
Male	64 (53)	53 (49)	11(92)
Female	56 (47)	55 (51)	1 (8)
Mean age, years (SD)			
	40 (10)	40(10.2)	42(8.1)
Mean BMI, kg/m² (SD)			
	22 (4.7)	21 (4.6)	24(4.4)
NHL type, n(%)			
DLBCL	34 (28)	27 (25)	7(58)
DLCL (IHC not done)	69 (58)	65 (60)	4(33)
PBL	5 (4)	4 (4)	1(8)
NHL Other	9 (8)	9 (8)	0
Burkitt's	3 (3)	3 (3)	0
ECOG score, n(%)			
0	9 (8)	8 (7)	1(8)
1	29 (24)	22 (20)	7(58)
2	12 (10)	12 (11)	0
3	7 (6)	6 (6)	1(8)
Not assessed	63 (53)	60 (56)	3(25)
B-Symptoms			
Yes	65 (54)	58 (54)	7(58)
No	55 (46)	50 (46)	5(42)
Comorbidity			
Yes	17 (14)	14 (13)	3(25)
No	103(86)	94 (87)	9(75)
Stage			
I	4 (3)	4 (4)	0
II	21(18)	17(16)	4(33)
III	54 (45)	48(44)	6(50)
IV	21 (18)	19(18)	2(17)
Not assessed	20 (17)	20(19)	0

NB: DLBCL - Diffuse large B-cell lymphoma; DLCL - Diffuse large cell lymphoma; ECOG - Eastern Cooperative Oncology Group; IHC - Immunohistochemistry; PBL - Plasmablastic lymphoma; Comorbidity referred to the presence of any other diagnosis besides NHL.

Treatment completion

Only 51(47%) patients in the CHOP group and 8(67%) patients in the EPOCH group completed 6 or more cycles of chemotherapy. Those who completed 3-5 cycles were 31(29%) in the CHOP group and 1(8.3%) in the EPOCH group. Three patients in each group received less than 3 cycles of chemotherapy. Reasons

for non-completion of chemotherapy cycles were serious adverse events (n=12, 10%), other reasons (n=4, 3%), and were not described in 104(87%) patients. Nineteen patients (18%) in the CHOP group and 3(25%) in the EPOCH group had serious adverse events detected, p=0.53. Most were laboratory adverse events like neutropenia (CHOP=13, 12%; EPOCH=2, 17%); p=0.65), anaemia (CHOP=12, 12%; EPOCH=1, 8%; P=0.71), and thrombocytopenia (CHOP=7, 6%; EPOCH=0; p=0.36). Others were sepsis (CHOP=1), treatment related death (EPOCH=1) and hepatic encephalopathy (CHOP=1), (Table 2). The lowest neutrophil count recorded was $0.12 \times 10^3/\mu\text{L}$ after the first cycle of chemotherapy in a patient treated with EPOCH.

Table 2: TREATMENT OUTCOMES

Variable		CHOP n=108	EPOCH n=12
RESPONSE TO TREATMENT, n(%)			
Complete response (CR)		29 (27)	5 (42)
Partial response (PR)		14 (13)	2 (17)
Progressive disease (PD)		15 (14)	1 (8)
No response assessment		50 (46)	4 (33)
ADVERSE EVENTS			
Neutropenia, n(%)		13 (12)	2 (17)
Grade	≤2	0	0
	3	6 (6)	2 (17)
	4	7 (6)	0 (0)
Anaemia, n(%)		13 (12)	1 (8)
Grade	≤2	4 (4)	1 (8)
	3	9 (8)	0 (0)
Thrombocytopenia, n(%)		7 (6)	0 (0)
Grade	≤2	6 (3)	0 (0)
	3	1 (1)	0 (0)
Other Adverse Events, n(%)		4 (3)	0 (0)
Sepsis		1 (1)	0 (0)
Death		0 (0)	1 (8)
Hepatic Encephalopathy		1 (1)	0 (0)

Note: Nadir levels of neutrophil, haemoglobin and platelet counts were recorded after each chemotherapy cycles; adverse events were classified using the NCI CTCAE v5.0

Treatment response and survival

Overall treatment response rate was 40% in the CHOP group and 59% in the EPOCH group. Complete response (CR) was achieved in 29(27%) patients in the CHOP group and 5(42%) patients in the EPOCH group. Partial response was observed in 16(13%) patients in the CHOP group and 2(17%) patients in the EPOCH group. (Table 3).

The entire study population had a one year (12 months) overall survival (OS) rate of 56.7% (95% CI, 45.4–66.5), (Figure 1, Panel A). Patients treated with CHOP had a one year OS of 54.5% (42.8–64.8) and those treated with EPOCH of 80.2% (95% CI, 40.3–94.8), but the difference was not statistically significant (hazard ratio, 0.43 (95% CI, 0.10-1.78), (Figure 1, Panel). Subset analysis for patients with DLBCL showed a one year OS rate of 56.1% (95% CI, 33.0–74.0) in the CHOP group and 100% in the EPOCH group. Predictors of survival were analysed using patients’ age, sex, type of chemotherapy received, completion of 6 or more cycles of chemotherapy, type of lymphoma, stage of lymphoma, presence of B-symptoms and comorbidities. At univariable analysis, factors that were associated with favourable survival were ECOG performance score of 3-4, BMI 18.5-24.9 kg/m² and completion of 6 or more cycles of chemotherapy. However, at multivariable analysis, only BMI 18.5-24.9 kg/m² (normal BMI), (p=0.03) and completion of 6 or more cycles of chemotherapy, (p<0.001) were favourably associated with survival, Table 3.

Table 3: PREDICTORS OF SURVIVAL

Variable	Univariable		Multivariable	
	CHR (95%CI)	P-Value	AHR (95%CI)	P-Value
Age in years	1.0 (0.98 - 1.05)	0.32	1.0 (0.96 - 1.04)	0.95
Sex: Male	1.2 (0.64 - 2.24)	0.57	1.6 (0.76 - 3.32)	0.22
Study arm: EPOCH	0.4 (0.10 - 1.78)	0.24	0.6 (0.13 - 2.84)	0.52
ECOG				
0 - 2				
3 - 4	3.4 (1.10 - 8.82)	0.01	1.7 (0.55 - 5.26)	0.36
Not assessed	2.3 (1.01 - 5.05)	0.05	1.5 (0.60 - 3.80)	0.39
BMI				
<18.5 Kg/m ²				
18.5 - 24.9 kg/m ²	0.4 (0.20 - 0.83)	0.01	0.4 (0.18 - 0.89)	0.03
≥25 kg/m ²	0.5 (0.23 - 1.33)	0.19	0.6 (0.21 - 2.02)	0.45
Lymphoma stage				
Early stage				
Late stage	1.8 (0.76 - 4.04)	0.19	1.6 (0.58 - 4.60)	0.35
Not assessed	1.5 (0.49 - 4.32)	0.50	1 (0.28 - 3.94)	0.95
Type of lymphoma				
Diffuse large B-cell lymphoma				
Diffuse Large cell lymphoma	1.2 (0.58 - 2.63)	0.58	1.0 (0.39 - 2.43)	0.95
Plasmablastic lymphoma	2.1 (0.58 - 7.75)	0.25	1.4 (0.30 - 6.02)	0.69
NHL Other	2.5 (0.84 - 7.28)	0.10	1.7 (0.52 - 5.74)	0.37
Burkitt's	1.0 (0.12 - 7.45)	0.96	0.3 (0.03 - 3.45)	0.33
Presence of B-symptoms	0.9 (0.47 - 1.63)	0.67	0.9 (0.44 - 1.96)	0.85
Presence of comorbidity	0.7 (0.24 - 1.91)	0.46	0.9 (0.28 - 2.69)	0.81
Chemotherapy cycles received				
< 6				
≥ 6	0.2 (0.11 - 0.43)	<0.001	0.2 (0.10 - 0.47)	<0.001

Note: AHR: Adjusted Hazard Ratio, BMI: Body Mass Index, CHR: Crude Hazard Ratio, ECOG: Eastern Cooperative Oncology Group

Discussion

This retrospective study highlighted that treatment of HIV-associated NHL with curative intent using CHOP and infusional EPOCH is feasible in low resource setting.

The one year OS of patients treated with CHOP and EPOCH in our study is comparable to other results in Africa. A study in Malawi reported a one year OS of 59.4% in patients with HIV-associated lymphomas treated with CHOP(18); in Botswana, the 1 year survival rate in patients with DLBCL was 52.8% following

treatment with CHOP($\pm$ R)(19); a retrospective study in south Africa on patients with HIV associated DLBCL treated with CHOP and concomitant ART reported a 2 year OS of 40.5%(20). It has been noted that the outcomes of treating aggressive B cell NHL with chemotherapy appear to be similar in HIV-positive and HIV-negative populations especially in the era of combination ART(7, 21, 22). Some studies report a CD4 count <100/uL as a negative prognostic finding (14, 23). However, our study did not have data on CD4 counts.

Normal BMI and completion of 6 or more cycles of chemotherapy were associated with favourable survival in our study. A retrospective study on HIV associated lymphomas in Nigeria reported stage of lymphoma as the only factor predictive of survival(24). Other factors that have been noted to predict survival include type of lymphoma(25), age, ECOG performance scores, stage of lymphoma and LDH level(26).

Our result show a trend towards better survival with the EPOCH regimen. The initial study on EPOCH in patients with DLBCL reported better OS rate at 62 months of 73% than with CHOP(27). Subsequent addition of Rituximab to EPOCH produced even better results of a 12-month PFS rate of 85% (28, 29).

Our study showed a trend in favour of EPOCH regimen in all the treatment response categories. Nonetheless, the CR rate in our study is less impressive than reported in other studies. A study by the AIDS-Malignancies Consortium Trial 010, a phase 3 trial of CHOP vs R-CHOP in patients with HIV-associated NHL showed a better CR of 47% for CHOP(14) than was observed in our study (27%).

Other studies on the treatment of HIV associated NHL with CHOP or EPOCH in the sub-Saharan Africa show similar results with our study. De Witt (2013) in their retrospective study on patients with HIV associated DLBCL treated with CHOP (n=34) and CHOP-like (n=2) regimens in south Africa reported CR of 38.9%(20). A smaller study in Malawi (n=12) on patients with plasmablastic lymphoma in HIV positive (n=6) and HIV negative patients (n=6) in which 8 patients were treated with CHOP and 4 patients were treated with modified EPOCH reported an overall CR in 42% of the patients (CHOP=25%; EPOCH=75%) (30). In another retrospective study in south Africa where only 4 cases (<1%) were HIV(+) and no specific chemotherapy regimens were defined, the overall CR range was 46–75% for all subtypes of NHL(31); and in a large retrospective study of paediatric Burkitt's Lymphoma in Uganda where 70 of the 228 patients were HIV positive with a mean age of 6.7 years and no specific chemotherapy was mentioned, CR was 36%(32).

The low completion rate of chemotherapy in our study may have partly contributed to the low treatment response rates. However, adverse events contributed to non-completion of chemotherapy in only 10% of the patients whereas a majority of patients did not have clearly documented reasons for non-completion of chemotherapy.

Our study show that haematological adverse events (AEs) were the most prevalent in the two treatment groups. However, this should be taken with caution due to the limitation associated with data abstraction from patient charts that may not easily capture non lab based AEs. Takondwa et al.(30) in their study in

Malawi reported treatment delays in patients receiving EPOCH (n=4/4) and patients treated with CHOP (n=4/8) due to grade 3/4 neutropenia and grade 3 anaemia (CHOP=1). It is possible that the small number of patients in our study and that by Takondwa et al.(30) may not have been sufficient to adequately evaluate the AEs. Despite the infusion of EPOCH through peripheral lines, there were no other major documented concerns in the patients who received it.

To the best of our knowledge, our study is one of the few studies describing CHOP and EPOCH regimens in the treatment of HIV associated NHL in the sub-Saharan Africa. It included a relatively larger sample size than other previously related studies(30). However, we acknowledge the numerous limitations attributed to our study, these include: the imbalance between the two groups in terms of the sample size and the other baseline characteristics, inadvertent patient selection bias to the treatment groups – moreover, recent treatment approaches might have favoured patients treated with EPOCH, lack of HIV characteristics, limited data on chemotherapy toxicities that might have resulted from inadequate documentation by the treating physicians, and lack of immunohistochemistry to refine the diagnosis. It is possible that some patients who were treated with the CHOP regimen might have had more aggressive histological subtypes of NHL such as Burkitt lymphomas or plasmablastic lymphomas that were treated inadequately. CHOP regimen is considered less intensive and therefore inadequate for the treatment of Burkitt lymphoma(33, 34) and Plasmablastic lymphoma (35). All these may limit the generalizability of our findings.

Abbreviations

ART: Antiretroviral Therapy; CHOP: Cyclophosphamide, Doxorubicin, Vincristine and Prednisolone; CTEP-AERS: Cancer Therapy Evaluation Program Adverse Event Reporting System; EPOCH: Etoposide, Doxorubicin, Vincristine, Cyclophosphamide, and Prednisone; HIV: Human Immunodeficiency Virus; UCI: Uganda Cancer Institute.

Declarations

Ethics approval and consent to participate

Waiver of consent and study approvals were obtained from the Uganda Cancer Institute Research Ethics Committee (Reference number: 15-2018) and the study was registered at the Uganda National Council for Science and Technology (Reference number: HS 2568).

Consent for publication

Not applicable

Availability of data and materials

All data generated or analysed during this study are included in this published article

Competing interests

All the authors have declared no conflicts of interest.

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Authors' contributions

CDO: Wrote the manuscript. AO: Reviewed the manuscript; HD; Reviewed the manuscript; YM: Analysed data and reviewed the manuscript; JO: Reviewed the manuscript. All authors read and approved the final manuscript.

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Figures

Panel A: Overall survival for the entire study population

Panel B: Overall survival by treatment regimen

Figure 1

Overall survival graphs

Figure 2

Overall survival among study population

Figure 3

Overall survival among patients treated with CHOP vs EPOCH chemotherapy regimens

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