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Scientific Article

Treatment Outcomes and Prognostic Factors of Chemotherapy Combined With Radiation Therapy for Patients With Early-Stage Extranodal Natural Killer/T-Cell Lymphoma

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Purpose: This study aimed to assess the treatment outcomes, toxicity, and potential prognostic factors in patients with early-stage extranodal natural killer/T-cell lymphoma treated with radiation therapy combined with chemotherapy.

Methods and Materials: One hundred eighteen patients with stage I/II extranodal natural killer/T-cell lymphoma who were treated with radiation therapy combined with chemotherapy were retrospectively analyzed between July 2003 and January 2019. The median dose was 50 Gy (Range, 45-61.2 Gy). The Kaplan-Meier method was used to calculate progression-free survival and overall survival. The patients were scored according to their prognostic indices.

Results: The overall and complete response rates were 93.2% and 82.2%, respectively. At a median follow-up of 43 months, the 5-year overall survival and progression-free survival rates were 73.9% and 68.4%, respectively. Adverse events of grade 3 or higher were observed in 20 patients (16.9%). Patients with primary disease in the Waldeyer's ring had poorer survival (P = .015). Compared with anthracycline-based regimens, non−anthracycline-based regimens significantly improved the 5-year overall survival (76.6% vs 54.8%, P = .027) and progression-free survival (72.4% vs 53.1%, P = .013). After treatment, the 5-year overall survival rate was 78.6% in complete response patients versus 44.9% in noncomplete response patients (P = .003). For patients with low- and intermediate-low-risk according to the nomogram-revised risk index model, the complete response rate was 100%. When primary lesion data were added to the nomogram-revised risk index as the basis for another prognostic index (modified nomogram-revised risk index), the low-risk (0 to 2 risk factors) and high-risk (3 or more risk factors) categories were noted (84.2% vs 62.2%, P = .036).

Conclusions: Patients with early-stage extranodal natural killer/T-cell lymphoma had high response rates and favorable survival rates with radiation therapy and non−anthracycline-based chemotherapy regimens. Patients who achieved complete response had better survival than those who did not. The extranodal natural killer/T-cell lymphoma-specific prognostic models may require further optimization.

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Introduction

Extranodal natural killer/T-cell lymphoma (ENKTCL) is prevalent in Asian populations and has highly aggressive and heterogeneous clinical behavior.[1,2] As the majority of patients with ENKTCL are diagnosed with stage I-II disease,[3,4] radiation therapy (RT) plays a key role in its treatment.[5,6] Improved local control with RT is associated with increased survival probability and decreased hazard of failure.[7,8] For intermediate- and high-risk patients, RT alone is considered insufficient.[9] RT combined with chemotherapy (CT) is the most effective treatment strategy for early-stage ENKTCL treatment.[10] However, the optimal treatment modalities and prognostic factors for nasal ENKTCL remain unclear.

Recently, numerous studies have demonstrated that upfront RT followed by CT confers a prognostic benefit over CT followed by RT alone for early-stage ENKTCL.[11,12] However, retrospective studies have shown that the sequence of CT and RT does not significantly affect the survival of ENKTCL.[10,13] Others have indicated that the "Sandwich" (CT followed by RT, again followed by CT) treatment exhibited an impressive complete response (CR) rate and high survival.[14,15]

International Prognostic Index scores have been widely used to predict the prognosis of non-Hodgkin's lymphoma; however, they have an inferior prognostic value for ENKTCL.[16] Several models, including the nomogram-revised risk index (NRI) and prognostic index of natural killer lymphoma (PINK), have been established for risk stratification of patients with ENKTCL.[17,18] However, these models are based on retrospective data; therefore, further verification and validation are necessary.

In this study, we assessed the treatment outcomes, toxicity, and potential prognostic factors in patients with early-stage ENKTCL who received definitive RT combined with CT.

Methods and Materials

Eligibility and study population

Herein, 118 patients initially diagnosed with ENKTCL between July 2003 and January 2019 were retrospectively included in this study. The eligibility criteria included patients with Ann Arbor stage I/II disease who underwent RT and CT. All patients were histologically confirmed ENKTCL. This study was approved by the institutional medicine review board, and a waiver for patient consent was obtained.

Evaluation, stage, and risk stratification

The initial clinical evaluations included history collection, physical examination, blood analysis (including serum lactate dehydrogenase [LDH]), bone marrow aspiration and core biopsy, direct and endoscopic examination of the upper aerodigestive tract, magnetic resonance imaging, and computed tomography. Since 2007, positron emission tomography-computed tomography has been used to stage lymphomas at our hospital. Of 118 patients,112 (94.9%) were staged using positron emission tomography-computed tomography.

The patients were staged using the Ann Arbor staging system and stratified using the PINK and NRI models. Primary tumor invasion (PTI) is defined as a primary disease extending into neighboring structures or organs, as previously reported.[19] The PINK model includes 4 risk factors: age > 60 years, stage III/IV disease, distant lymph node involvement, and nonnasal type disease. Patients were stratified into 3 groups (low-risk [no risk factors], intermediate-risk [1 risk factor], and high-risk [≥2 risk factors]) according to PINK.[17] In stage I/II patients, the NRI model assigned 1 point each to age > 60 years, elevated LDH, Eastern Cooperative Oncology Group (ECOG) score ≥ 2, PTI, or stage II. Stage I/II patients were stratified into the low-risk (0), intermediate-low-risk (1), intermediate-high-risk (2), and high-risk (≥3) groups.[18]

Treatment

In the current study, all patients received RT and at least 1 course of CT as first-line treatment for newly diagnosed early-stage ENKTCL. Five patients received RT followed by CT (RT + CT), 20 received CT followed by RT (CT + RT), 90 received "Sandwich" treatment (CT + RT + CT), whereas 3 received concurrent chemoRT (CRT) (1 patient received CRT + CT, and 2 other patients received CT + CRT + CT) (Fig. 1). Patients were treated with a median dose of 50 Gy (Range, 45-61.2 Gy) in 23 to 34 fractions, and 1.8 to 2.0 Gy daily in 5 fractions per week.

CT was administered using nonanthracycline (ANT)-based (n = 91, 77.1%) or ANT-based (n = 27, 22.9%) regimens. The ANT-based regimens included cyclophosphamide, doxorubicin, vincristine, and prednisolone (CHOP, n = 24) or CHOP-like (n = 3). Non−ANT-based CT included CHOP/CHOP-like plus L/P (cyclophosphamide, doxorubicin, vincristine, prednisolone, L-asparaginase, or pegaspargase, n = 4), SMILE (dexamethasone, methotrexate, ifosfamide, L-asparaginase, and etoposide, n = 3), MESA (methotrexate, etoposide, dexamethasone, and pegaspargase, n = 45), AspaMetDex (methotrexate, dexamethasone, and pegaspargase, n = 3), ESA (etoposide, dexamethasone, and pegaspargase, n = 28), GEMOX (gemcitabine and oxaliplatin, n = 1), or P-GEMOX (pegaspargase, gemcitabine, and oxaliplatin, n = 3), and

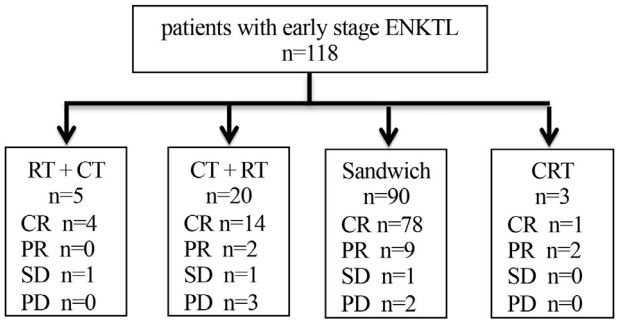

Figure 1 Patient flow diagram. RT + CT, radiation therapy followed by chemotherapy; CT + RT, chemotherapy followed by radiation therapy; Sandwich, chemotherapy sandwiched with radiation therapy.

Abbreviations: CR = complete response; CRT = concurrent chemoradiation therapy; CT = chemotherapy; ENKTL = extranodal natural killer/T-cell lymphoma; PD = progressive disease; PR = partial response; RT = radiation therapy; SD = stable disease.

other regimens (n = 4). The median number of CT cycles was 4 (Range, 1-10).

All patients were treated with a 6 MV photon beam. Five patients were irradiated using a 2-dimensional technique, 8 were treated with 3-dimensional conformal RT, and 105 received intensity modulated RT. From 2003 to 2015, extended involved site RT was used in our center for patients who received 3-dimensional conformal RT or intensity modulated RT according to the clinical norms at that time. For patients treated with RT after 2015, the clinical target volume (CTV) was defined according to the guidelines of the International Lymphoma Radiation Oncology Group (ILROG).[20] The CTV included the pretreatment gross tumor volume if patients underwent CT before RT.

Endpoints and statistics

The treatment response was evaluated using the revised response criteria for malignant lymphoma.[21] Acute toxicity was assessed in accordance with the Common Toxicity Criteria for Adverse Events 5.0. Late toxicities were scored according to the Radiation Therapy Oncology Group Late Radiation Morbidity Scoring Criteria. The $\chi 2$ test was used to compare categorical variables. Overall survival (OS) was defined as the date from the initial therapy to death from any cause or the last follow-up. Progression-free survival (PFS) was defined as the date from initial therapy to the first disease progression or relapse or to the final follow-up. OS and PFS were calculated using the Kaplan-Meier method and compared using the log-rank test. Prognostic factors were identified using univariate Cox proportional hazard models. Statistical analyses and figure generation were performed using SPSS 26.0 (IBM, Armonk, New York, United States) and GraphPad Prism 8. Here, a P value $< .05$ was considered statistically significant.

Results

Clinicopathologic features and prognostic factors

The baseline clinical features are summarized in Table 1. Among the 118 patients, 71.2% were male. The median patient age was 45 years (Range, 14-77 years). The majority of patients were aged ≤60 years (78.8%). PTI was present in 54.2% of the patients, and 55.9% of the patients had stage I disease. Elevated LDH levels were observed in 39% of the patients, and 51.7% of the patients had B symptoms. The ECOG performance score was 0 to 1 in most patients (74.6%). Primary lesions were located in the nasal cavity in 78% of cases and the Waldeyer's ring in 22% of cases. Among the 26 patients with primary tumors located in the Waldeyer's ring, the most commonly involved lesion site at the initial diagnosis was the oropharyngeal wall (n = 19, 73.1%). The nasopharynx and tonsils were affected in 16 (61.5%) and 14 (53.8%) patients, respectively. The tongue base (n = 4, 15.4%) was less commonly involved.

Univariate analysis was performed using age, sex, stage, ECOG performance-status score, serum LDH level, B symptoms, PTI, tumor diameter, Ki-67, and primary site (Table 2). As presented in Table 2, the only statistically significant clinical variable associated with poor survival was the primary lesion in the Waldeyer's ring (5-year OS: 77.6% vs 49.6%, $P = .015$). Univariate analysis revealed only 1 significant association between survival and the clinical parameters. Therefore, multivariate analysis was not performed.

Subsequently, we explored whether there were any associations between clinical characteristics and different primary tumor sites. The $\chi 2$ test revealed a significant association between Waldeyer's ring location tumors and stage II ($\chi 2 = 4.130$, $P = .042$). This may explain the poorer prognosis of patients with Waldeyer's ring tumors. No difference was observed with age, sex, ECOG performance-status score, serum LDH, B symptoms, PTI, tumor diameter, and Ki-67.

Patients with Waldeyer's ring tumors tended to exhibit regional lymph node invasion. The cervical lymph node irradiation rates in patients with primary nasal tumors and Waldeyer's ring tumors were 47.8% (44/92) and 88.5% (23/26), respectively ($P < .001$). Thus, the mean CTV of patients with primary tumors located in the Waldeyer's ring was 745.15 mL, which was larger than that of patients with primary tumors located in the nasal cavity (486.79 mL; $P = .003$).

Toxicity effects

Acute toxic effects mainly include mucositis, radiodermatitis, dysphagia, xerostomia, and neutropenia (Table 3).

Table 1 Clinical characteristics of patients with early-stage extranodal natural killer/T-cell lymphoma

Clinicopathological data	No. of cases	%
Sex		
Male	84	71.2
Female	34	28.8
Age, median (range), (y)	45 (14-77)	
≤60, median	93	78.8
>60, median	25	21.2
Ann Arbor stage		
I	66	55.9
II	52	44.1
ECOG performance-status score		
0-1	88	74.6
2-3	30	25.4
Serum lactic dehydrogenase		
Normal	71	60.2
Elevated	46	39.0
Unclear	1	0.8
B symptoms		
No	57	48.3
Yes	61	51.7
Primary tumor invasion		
No	54	45.8
Yes	64	54.2
Tumor diameter (cm)		
≤5	113	95.8
>5	5	4.2
Ki-67 (%)		
<65	45	38.1
≥65	52	44.1
Unclear	21	17.8
Primary site		
Nasal cavity	92	78.0
Waldeyer's ring	26	22.0

Abbreviations: ECOG = Eastern Cooperative Oncology Group.

Most patients experienced acute mucositis (94.9%) and radiodermatitis (66.1%). Acute grade 3+ toxicity occurred in 20 patients (16.9%), most commonly mucositis (16 patients) and dysphagia (12 patients). Only 1 (0.8%) patient experienced grade 4 neutropenia, and 1 (0.8%) had grade 4 dysphagia.

Grade 1 or 2 late adverse events occurred in 44 patients (37.3 %) and included xerostomia (6.8%), dysphagia (5.1%), mucositis (28.0%), dermatitis (6.8%), and hoarseness (4.2%) related to RT (Table 3). No serious late adverse events (grade 3 or higher) or treatment-related death was observed.

Treatment response

Among the 118 patients, the overall response rate after initial treatment was 93.2%. The CR, partial response, stable disease, and progressive disease rates were 82.2% (n = 97), 11.0% (n = 13), 2.5% (n = 3), and 4.2% (n = 5), respectively (Fig. 1). During the follow-up period, 29 (24.6%) patients progressed or relapsed, and 25 (21.2%) died. Of these patients, 5 had locoregional recurrence only, 16 had systemic failure without locoregional disease, and 8 had both locoregional and systemic failure (Fig. 2). In the 13 patients with locoregional recurrence, dosimetric analysis exhibited in-field recurrence in 3 cases, out-field failure in 3 cases, and both in- and out-field failure in 7 cases. Among the 29 patients with tumor relapse, 3 (10.3%) achieved CR after salvage CT. The other 3 patients received peripheral blood stem cell transplantation for recurrent disease. Unfortunately, all 3 patients who received stem cell transplantation experienced disease progression after transplantation and died.

Survival

At a median follow-up of 43 months (Range, 4-201), the 5-year OS and PFS rates were 73.9% and 68.4%, respectively, in all patients (Fig. 3A, B). Patients who achieved a CR had significantly better survival rates than those who did not. The 5-year OS rates in the CR and non-CR groups were 78.6% and 44.9%, respectively (P = .003; Fig. 3C). The 5-year PFS rates were 72.3% and 49.6%, respectively (P = .004; Fig. 3D). Non−ANT-based (vs ANT-based) regimens significantly improved 5-year OS (76.6% vs 54.8%, P = .027; Fig. 3E) and PFS (72.4% vs 53.1%, P = .013; Fig. 3F) in the RT setting.

The 5-year OS rate was 37.5% for RT + CT, 46.7% for CT + RT, 75.1% for the "Sandwich" treatment, and 50% for CRT, respectively (P = .392). The 5-year OS and PFS rates were 75.1% and 68.7% for "Sandwich" treatment patients compared with 58.0% (P = .157) and 55.2% (P = .202) for other patients. The 5-year OS and PFS rates were 74.2% and 56.8% in patients receiving high-dose RT (>50 Gy, n = 29), 71.7% and 68.9% in patients receiving medium-dose RT (50 Gy, n = 82), and 71.4% and 71.4% in patients receiving low-dose RT (<50 Gy, n = 7), respectively (P > .05).

Comparison of different risk patients who received non−ANT-based therapy

After excluding 27 patients who received ANT-based therapy, 91 were included in the analysis. According to

Table 2 Univariate analysis of the prognostic factors in patients with early-stage extranodal natural killer/T-cell lymphoma

Clinicopathological data	No. of cases	5-year OS		5-year PFS	
		%	*P*	%	*P*
Sex					
Male	84	70.9	*.344*	65.4	*.517*
Female	34	80.7	-	75.1	-
Median age (y)					
≤60	93	75.1	*.372*	69.6	*.427*
>60	25	68.8	-	64.3	-
Ann Arbor stage					
I	66	75.1	*.953*	69.9	*.856*
II	52	67.3	-	67.0	-
ECOG performance-status score					
0-1	88	75.7	*.340*	71.5	*.249*
2-3	30	58.8	-	59.5	-
Serum lactic dehydrogenase					
Normal	71	72.9	*.996*	67.0	*.890*
Elevated	46	68.3	-	70.4	-
Unclear	1	-	-	-	-
B symptoms					
No	57	74.7	*.469*	64.1	*.836*
Yes	61	69.0	-	64.8	-
Primary tumor invasion					
No	54	70.9	*.574*	65.0	*.557*
Yes	64	71.3	-	71.5	-
Tumor diameter (cm)					
≤5	113	72.8	*.306*	65.0	*.224*
>5	5	100.0	-	100.0	-
Ki-67 (%)					
<65	45	78.4	*.265*	71.4	*.509*
≥65	52	70.0	-	69.9	-
Unclear	21	-	-	-	-
Primary site					
Nasal cavity	92	77.6	*.015*	71.7	*.330*
Waldeyer's ring	26	49.6	-	56.0	-

Abbreviations: ECOG = Eastern Cooperative Oncology Group; OS = overall survival; PFS = progression-free survival.

the PINK model, the patients were classified as having low- (n = 69), intermediate-, or high-risk disease (n = 22). The CR rates of low- and intermediate- or high-risk patients were 87.0% and 86.4%, respectively (P = .943). The 5-year OS rates were as follows: low-risk, 78.1%; and intermediate- or high-risk, 71.0% (P = .514; Fig. 4A).

Patients who received non−ANT-based therapy were stratified into 4 groups according to the NRI model: low-risk (n = 12), intermediate-low-risk (n = 20), intermediate-high-risk (n = 33), and high-risk (n = 26). The CR rates in the low-, intermediate-low-, intermediate-high-, and high-risk groups were 100%, 100%, 84.8%, and 73.1%, respectively (P = .026). According to the NRI, the 5-year OS rates of the different risk groups were as follows: low-risk, 83.3%; intermediate-low-risk, 86.7%; intermediate-high-risk, 78.2%; and high-risk, 66.9% (P = .602; Fig. 4B).

Table 3 Acute and late toxicity effects

Toxicities	All grades, n (%)	Grade 3, n (%)	Grade 4, n (%)
Acute toxicities			
Any adverse event	118 (100)	18 (15.3)	2 (1.7)
Neutropenia	38 (32.2)	4 (3.4)	1 (0.8)
Anemia	10 (8.5)	0 (0)	0 (0)
Thrombocytopenia	4 (3.4)	1 (0.8)	0 (0)
Radiodermatitis	78 (66.1)	1 (0.8)	0 (0)
Mucositis	112 (94.9)	16 (13.6)	0 (0)
Xerostomia	67 (56.8)	7 (5.9)	0 (0)
Dysphagia	71 (60.2)	11 (9.3)	1 (0.8)
Late toxicities			
Any adverse event	44 (37.3)	0 (0)	0 (0)
Xerostomia	8 (6.8)	0 (0)	0 (0)
Dysphagia	6 (5.1)	0 (0)	0 (0)
Mucositis	33 (28.0)	0 (0)	0 (0)
Dermatitis	8 (6.8)	0 (0)	0 (0)
Hoarseness	5 (4.2)	0 (0)	0 (0)

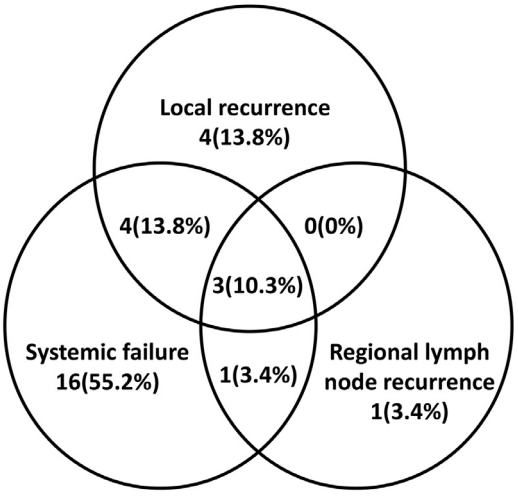

Figure 2 Initial failure patterns of extranodal natural killer/T-cell lymphoma patients undergoing radiation therapy and chemotherapy.

In our study, the primary lesion was a prognostic factor for OS. We added primary lesion data as 1 point to the NRI model to develop the modified-NRI model, wherein we classified patients into low-risk (0 to 2, n = 60) and high-risk (≥3, n = 31) groups, with 5-year OS of 84.2% and 62.2%, respectively (P = .036; Fig. 4C).

Discussion

The optimal therapeutic schedule for ENKTCL has not yet been defined owing to its relative resistance to ANT-based CT. Several studies have explored different treatment sequences (CT + RT, RT alone, CRT, and sandwich therapy) and CT regimens for ENKTCL.[22-25] However, most studies have limitations owing to their small sample sizes and treatment heterogeneity. The results of this study show that RT combined with a non−ANT-based CT regimen resulted in favorable survival for patients with early-stage ENKTCL. Non-CR patients, after treatment, exhibited a poor prognosis. Compared with patients with nasal origin diseases, patients with primary tumors located in the Waldeyer's ring had worse survival rates.

Our study clarified that RT with CT resulted in an overall response rate of 93.2% (CR rate, 82.2%) for patients with early-stage ENKTCL and that the 5-year OS and PFS were 73.9% and 68.4%, respectively. These results were relatively consistent with published results of RT with CT for ENKTCL, with a reported overall response rate of 83.3% to 96.7%.[25-28]

Previously, early-stage ENKTCL treatments were developed using non−ANT-based regimens of CT and RT.[29-31] Considering that non−ANT-based regimens were effective for early-stage ENKTCL,[17] in our institution, from 2013 onwards, non−ANT-based regimen CT with RT became the preferred treatment for ENKTCL. In this study, 91 of the 118 patients (77.1%) received a non−ANT-based regimen. We found that non−ANT-based regimen CT with RT resulted in improved 5-year PFS (72.4% vs 53.1%) and OS (76.6% vs 54.8%) compared with patients who received an ANT-based regimen. Our results further supported those of a real-world retrospective study investigating the efficacy of non

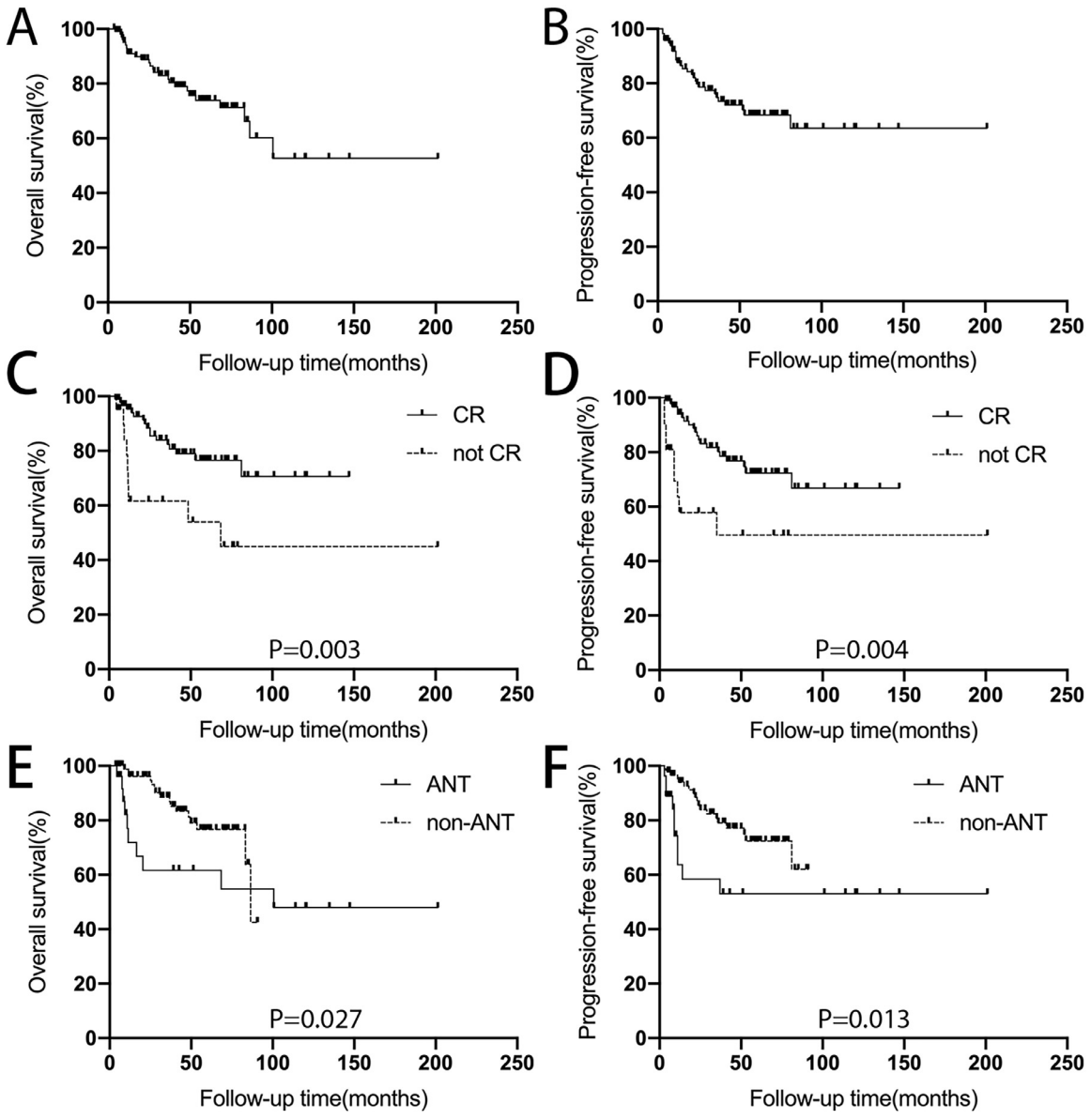

Figure 3 Kaplan-Meier of progression-free survival (PFS) and overall survival (OS). (A) OS in the 118 patients. (B) PFS in the 118 patients. (C) Kaplan-Meier OS according to treatment response. (D) Kaplan-Meier PFS according to treatment response. (E) Kaplan-Meier OS according to the chemotherapy regimen. (F) Kaplan-Meier PFS according to the chemotherapy regimen.
Abbreviations: ANT = anthracycline; CR = complete response.

−ANT-based versus ANT-based regimens for early-stage ENKTCL.[32]

For patients with early-stage ENKTCL, the quality of response after first-line treatment is crucial for survival. Previous studies have shown that deep remission was associated with better survival in patients with early-stage ENKTCL receiving CT and RT.[33,34] In our study, patients who achieved CR after CT and RT had a higher 5-year survival rate than those who did not (5-year OS: 78.6% for CR vs 44.9% for non-CR, P = .003; 5-year PFS: 72.3% for CR vs 49.6% for non-CR, P = .004). Choosing different treatment strategies based on different treatment responses is recommended in clinical practice.

In this study, we compared the outcomes of different CT and RT sequences. The combination mode of CT and RT varies among institutes and includes concurrent or sequential CT and RT.[10,35] Some studies have shown a positive association between early RT and better survival in early-stage ENKTCL.[11,12] Other studies have not shown a significant difference between different CT/RT sequences.[13,27,36] In our study, the 5-year OS rate was 75.1% for "Sandwich" treatment patients compared with 58.0% for other patients. However, this difference was not statistically significant (P = .157). The small number of patients included in this study may have limited our conclusions.

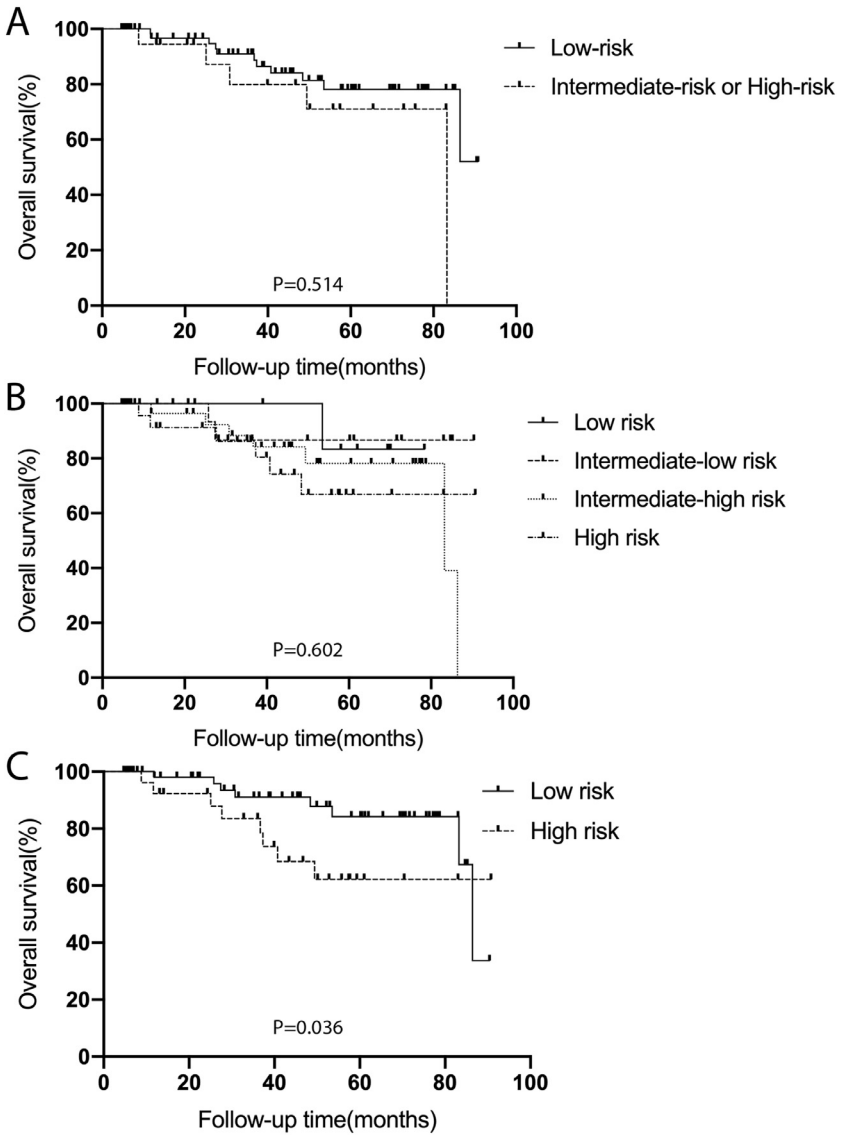

Figure 4 Survival comparison in different risk patients. (A) Kaplan-Meier overall survival according to prognostic index of natural killer lymphoma groups. (B) Kaplan-Meier overall survival according to nomogram-revised risk index groups. (C) Kaplan-Meier OS according to modified nomogram-revised risk index groups.

Previous studies have identified several prognostic factors for survival in ENKTCL, such as nonnasal type disease,[17] extensive disease,[37] serum LDH concentrations,[38] primary Waldeyer's ring lymphoma,[39] and Ki-67 expression.[40] However, in this study, the univariate analysis identified only 1 significant risk factor for poor survival: primary Waldeyer's ring lymphoma. Even the mean CTV of patients with primary tumors located in the Waldeyer's ring was larger than that of patients with primary tumors located in the nasal cavity. Similarly, the ILROG guideline[41] highlighted that patients with nonnasal upper aerodigestive tract ENKTCL tended to have multisite involvement, PTI, and regional lymph node involvement. Different primary sites of ENKTCL affect its prognosis; however, the reason for this is unclear. In the future, more studies are needed to explore the underlying mechanisms, such as the microenvironment of the tumor, blood supply to different lesions, and infiltration of tumor lymphocytes. These results support the recommendations of the ILROG[41] guideline. The CTV varies between different primary sites.

Recently, several models, such as PINK[17] and NRI,[18] have been validated for the clinical outcomes of patients with ENKTCL treated with non−ANT-based treatments. Our study showed that the NRI model was more conducive to predicting treatment responses. We attempted to establish a new prognostic model to subdivide patients with similar NRI and select suitable treatment strategies with additional individuality. We established a modified-NRI model by combining primary lesions with NRI. The

low-risk patients in our new prognostic model had a higher survival rate. As determined in our new model, a primary Waldeyer's ring lesion was considered a risk factor, and more intensive treatment could be selected. However, our prognostic model needs to be further verified using a larger sample size of patients.

A limitation of our study is that it was a retrospective study conducted at a single center. Prospective studies of early-stage ENKTCL should be conducted in the future.

Conclusions

This study concluded that RT combined with CT showed a high response rate and favorable survival in patients with early-stage ENKTCL. A non−ANT-based CT regimen was effective in treating patients with ENKTCL. Patients with primary Waldeyer's ring lesions and non-CR after treatment had poorer survival rates. ENKTCL-specific prognostic models require further optimization.

Disclosures

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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