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Malignant Lymphomas of the Nasal Cavity and Waldeyer's Ring

— Clinicopathologic and Immunohistochemical Study —

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The clinicopathologic and immunohistochemical finding of 10 cases of nasal non-Hodgkin's lymphoma (NHL) and 23 cases of Waldeyer's ring NHL were studied. Immunohistochemically, nasal NHL expressed T-cell markers exclusively, whereas the NHL of Waldeyer's ring were of both T-cell (56.5%) and B-cell lineages (43.5%). Angioinvasiveness by tumor cells was exclusively noted in the T-lineage lymphomas. Epithelial hyperplasia, epitheliotropism by tumor cells, and extensive invasion of adjacent normal tissue were more prominant in T-cell lymphomas than in B-cell lymphomas. T-lineage lymphomas showed distant extranodal spread pattern involving the skin, soft tissue, stomach, spleen, and the liver, whereas B-lineage lymphomas tended to localize in the lymph nodes. The survival rate of Nasal NHL was similar to that of Waldeyer's ring NHL. Although not statistically significant because of small sample numbers, immunophenotype, histologic groups of monomorphic lymphoma, and stage had prognostic importance. In general, T-lineage lymphomas presented with a higher stage than B-lineage lymphomas ($p<0.05$) and overall survival was poor. Stage I disease showed a much more favorable prognosis than stage II disease. Monomorphic lymphomas had a shorter survival than polymorphic reticulosis (PR) or lymphomas with features of PR. This result in conjunction with the morphologic transition between them suggested that monomorphic lymphoma may represent the most advanced stage in the spectrum of PR, lymphoma with features of PR, and monomorphic lymphoma.

Key Words: *Nasal cavity, Waldeyer's ring, Malignant lymphoma, Peripheral T-cell lymphoma*

INTRODUCTION

Extranodal non-Hodgkin's lymphomas (NHL) of the head and neck region can be divided into two large groups: one arising in the nasal cavity and the other in the Waldeyer's ring lymphoid tissue. In Korea, malignant lymphomas arising from these sites are relatively common. Twenty-two percent and 6.5 percent of NHL occured in Waldeyer's ring and in the nasal cavity respectively (Lymphoreticular study group, 1991). In contrast to the much lower incidence reported in western countries, this incidence is similar to those reported in Japan and Hongkong (Fellbaum et al., 1989; Freeman et al., 1972; Frierson et al., 1984; Frierson et al., 1989; Ho et al., 1984; NG et al., 1986; Yamanaka et al., 1985).

Although these lymphomas arise from very closely located sites, earlier studies (Clark et al., 1983; Horiuchi et al., 1982; Jacobs and Hoppe, 1985; Shibuya et al., 1987; Shidnia et al., 1985) suggested a distinct difference between the two. Immunohistochemically, most Waldeyer's ring NHL expressed B-cell phenotypes whereas nasal NHL cases studied in oriental countries were predominantly of T-cell lineage (Chen et al.,

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1987; Ho et al., 1984; Park et al., 1990; Yamanaka et al., 1985). While localized Waldeyer's ring NHL is highly curable with radiotherapy (Wang, 1969), nasal NHL tends to recur in distant extranodal regions with radiation therapy alone (Yamanaka et al., 1985). In this study, we analysed 34 cases of NHL arising in the nasal cavity and Waldeyer's ring in order to further define the nature of these lymphomas and evaluate important prognostic factors.

MATERIALS AND METHODS

Ten cases of nasal cavity lymphoma and twenty-three cases of Waldeyer's ring NHL were retrieved from surgical pathology files from september 1984 through February 1991 (78 months).

Nasal cavity NHLs were diagnosed if (a) the patient presented with symptoms referable to an intranasal lesion, (b) on clinical evaluation, lymphoma was either limited to, or predominantly involved the nasal cavity, or (c) the diagnosis of lymphoma was confirmed on biopsy obtained from the nasal cavity. Biopsies of Waldeyer's ring NHL were obtained from the tonsil in 14 cases, nasopharynx in 6, oropharynx in 2 and pharynx in one.

In all cases, hematoxylin and eosin-stained slides made from 10% formalin and/or B5 fixed and paraffin embedded tissue, were reviewed. Four-micron thick sections were processed for marker studies using the avidin-biotin-peroxidase complex (ABC) technique. Monoclonal antibodies used in the marker studies were presented in Table 1. The cases were classified histologically using the Working Formulation for clinical usage. Clinical information including age, sex, symptoms, clinical stage and treatment were obtained from clinical records. Most patients were treated with radiotherapy or chemotherapy alone or a combination of both. Only patients having received more than 2000 rads, or more than two cycles of chemotherapy were considered treated. Chemotherapy regimens included M-BACOD, or CHOP. Follow up ranged from one to ninety-six months with a median of 16 months. Patient survial was evaluated by the Kaplan-Meier methods and assessed by the log-rank test.

Table 1. Antibodies Used for Immunohistochemical Studies

Antibody	Immunoreactivity	Source
MB 2	B lymphocytes, some epithelial cell	Biotest
MT 1	T lymphocytes, myeloid cells, histiocytes, monocytes	Biotest
L 26	B lymphocytes	Dako
UCHL 1	Thymocytes, mature activated T-lymphocytes	Dako
CD 68	Monocytes, histiocyte, myeloid cell	Dako

RESULTS (Tables 2 & 3)

Clinical Data

Six men and four women presented with nasal NHL. Ages ranged from 17 to 66 years (mean, 41.5 years; median, 43.5 years). The peak incidence was during the 4th decade. Initial symptoms at presentation included nasal obstruction in 7 patients (53.8%), pain in one patient (7.7%), facial swelling in 3 patients (23.1%), and nasal discharge in 2 patients (15.4%). Patients presenting with Waldeyer's ring NHL consisted of 16 men and 7 women with a male to female ratio of 2.3 to 1. Ages ranged from 16 to 71 years (mean, 47.5 years; median 51 years). The peak incidence was during the 6th decade. Initial symptoms at presentation included sore throat in 9 patients (33.0%), neck lump in 8 patients (30.3%), dysphagia in 6 patients (24.1%) and foreign body sensation in one patient (3.9%).

Pathologic Findings

1. Histologic classification:

Using the the Working Formulation for clinical usage, the ten nasal NHLs were subdivided into four cases of diffuse, mixed small cleaved and large cell lymphoma (40%) and six cases of diffuse, large cell lymphoma (60%). The twenty three cases of Waldeyer's ring NHL were classified as follicular, large cell lymphoma in one case (4.2%), diffuse, mixed small cleaved and large cell lymphoma in five cases (22%), diffuse, large cell lymphoma in twelve cases (52.2%) and large cell, immunoblastic lymphoma in four cases (17.4%). The immunoblastic types included two cases of polymorphous variant, one clear cell variant and one plasma cell variant.

2. Immunophenotype:

Nine cases (90%) of nasal NHL demonstrated a T-cell immunophenotype. One case of undetermined phenotype did not react with any of the B-cell, T-cell, or histiocytic markers employed in this study. Among the 23 cases of Waldeyer's ring NHL, 13 cases (56.5%) reacted with T-cell markers. The remainder, 43.5%, demonstrated B-cell immunophenotype. None of the case reacted with histiocytic markers. Among the 14 cases of tonsillar lymphoma, 7 cases were immunophenotypically of T-cell lineage and another 7 cases were B-cell immunophenotype. The six cases of nasopharyngeal lymphoma showed T-cell lineage

Table 2. Clinical and Histologic Findings of Nasal NHL

Case	Age	Sex	Stage	Extranasal disease at presentation	Histologic subtype by WF	PR	Lymphoma with features of PR	Monomorphic lymphoma	Immuno-phenotype	Angio-invasion	Treatment & outcome
1	22	F	IV	Skin	DL			+	T	+	RT. DOD 18 mo
2	50	F	I	PNS, oropharynx	DM			+	T	+	RT+chemo. DOD 30 mon
3	17	M	I		DM	+			T	+	NED 30 mo
4	31	M	II	PNS, soft tissue	DL			+	T	+	Chemo DOD 3 mo
5	66	F	I		DL			+	T	+	Chemo NED 7 mo
6	58	M	II	Lymph node	DM			+	T	+	Chemo DOD 3 mo
7	50	M	I		DM		+		T	–	NED 62 Mo
8	37	M	I		DL		+		U	–	NED 33 Mo
9	30	F	I	PNS, Nasopharynx	DL			+	T	–	Lost to follow up
10	54	M	IV	SKin	DL			+	T	–	Chemo AWD 16 mo

PR: Polymorphic reticulosis
PNS: Paranasal sinus
DL: Diffuse large cell
DOD: Died of disease
RT: Radiation therapy
Chemo: Chemotherapy
DM: Diffuse mixed small cleaved and large cell
AWD: Alive with disease
T: T-cell lineage
U: Undetermined
NED: No evidence of disease

in three cases and B-cell lineage in three cases. Two cases of oropharyngeal lymphoma and one case of pharyngeal lymphoma demonstrated T-cell immunophenotypes.

3. Correlation of histophthologic findings with immunophenotype.

Nasal lymphomas:

Six cases (67%) of nasal NHL with T-immunophenotypes showed vascular invasion of tumor cells accompanied by coagulative necrosis of varying degrees. Blood vessel invasion involved mostly small arteries and small veins and rarely included medium sized arteries. The vascular walls invaded by the tumor displayed varying degrees of mural thickening caused by extensive fibrosis. There was no necrosis of the vessel wall or luminal fibrin thrombi. The remaining four cases of nasal NHL lacked vascular invasion, but did exhibit extensive coagulative tumor necrosis. One of these cases was of undetermined immunophenotype while the other three cases demonstrated T-cell lineage.

Pseudoepitheliomatous hyperplasia of the overlying squamous epithelium was noted in three cases. In one case, tumor cells invaded the glandular epithelium of the submucosal glands.

All of the cases were also histologically reclassified into polymorphic reticulosis (PR), malignant lymphoma with features of PR, and malignant lymphoma of monomorphic types according to the classification of Ho et al (1990). Polymorphic reticulosis was diagnosed when atypical tumor cells were dispersed among variable numbers of plasma cells, histiocytes and eosinophils. These atypical cells were medium sized cells with irregular or twisted nuclei, dense chromatin, and without prominent nucleoli (Fig. 1). Malignant lymphoma with features of PR was characterized by relatively monotonous infiltration of atypical cells with occasional plasma cells, eosinophils or histiocytes. Tumor cells were more uniform and compactly arranged when compared to those of PR, but their nuclear characteristics were similar (Fig. 2). Malignant lymphomas of monomorphic type consisted of compactly arranged uniform large cells lacking an inflammatory component. Their marked nuclear irregularity was very similar to those cells found in PR (Fig. 3). Among 10 cases of nasal NHL, one, two, and seven cases belonged to PR, lymphoma with features of PR, and monomorphic lymphoma respectively. Angioinvasion was noted in the one case classified as PR, in five of the seven cases of monomorphic lympho-

Table 3. Clinical and Histologic Findings of Waldeyer's Ring NHL

Case	Age	Sex	Stage	Site	Spread	Histologic type by WF	Lymphoma with features of PR	Monomorphic lymphoma	Immuno-phenotype	Angio-invasion	Treatment & out come
1	67	F	I	Tonsil		DM	+		T	–	lost to follow up
2	44	M	I	Pharynx	liver	DM	+		T	–	Radiation 31 Mo, DOS
3	23	M	II	Oropharynx	inguinal LN spleen	DM	+		T	–	Chemo 9 Mo, DOD
4	16	M	I	Oropharynx		DM	+		T	+	Chemo+RT 7 Mo, AWD
5	66	F	III	Nasopharynx	skin	DL		+	T	–	RT 6 Mo, AWD
6	52	M	II	Nasopharynx	stomach	DL		+	T	–	RT 42 Mo, DOD
7	54	M	II	Tonsil		DL		+	T	+	23 Mo, DOD
8	22	M	IV	Nasopharynx	celiac LN	Immunoblastic, clear cell		+	T	–	RT+Chemo 3 Mo, AWD
9	53	M	III	Tonsil		DSC		+	T	+	Chemo 27 Mo, NED
10	28	M	I	Tonsil		Immunoblastic, polymorphous		+	T	+	Chemo+RT 30 Mo, NED
11	30	M	I	Tonsil		DL		+	T	–	RT+Chemo 14 Mo, NED
12	66	M	IV	Tonsil		DL		+	T	+	Chemo+RT 3 Mo, DOD
13	36	M	I	Tonsil		DM		+	T	+	RT+Chemo 5 Mo, NED
14	48	M	II	Tonsil	neck LN	DL		+	B	–	DOD, 5 Mo
15	56	M	II	Tonsil	LN	DL		+	B	–	Chemo DOD, 12 Mo
16	71	F	II	Nasopharynx	LN	DL		+	B	–	RT DOD, 12 Mo
17	67	M	II	Tonsil	LN, uvula	DL		+	B	–	DOD, 3 Mo
18	66	M	II	Tonsil	LN	Immunoblastic		+	B	–	Chemo NED, 42 Mo
19	51	F	I	Tonsil		DL		+	B	–	Chemo NED, 42 Mo
20	40	F	II	Tonsil		DL	+	B	–		
21	47	F	II	Nasopharynx		Immunoblastic polymorphous		+	B	–	RT NED, 33 Mo
22	56	F	II	Tonsil	inguinal LN	DL		+	B	–	RT NED, 14 Mo
23	32	M	II	Nasopharynx		FL		+	B	–	Chemo NED, 4 Mo

LN: Lymph node
DL: Diffuse large cell
FL: Follicular large
NED: No evidence of disease
DM: Diffuse mixed
AWD: Alive with disease
DSC: Diffuse small cleaved
DOD: Died of disease

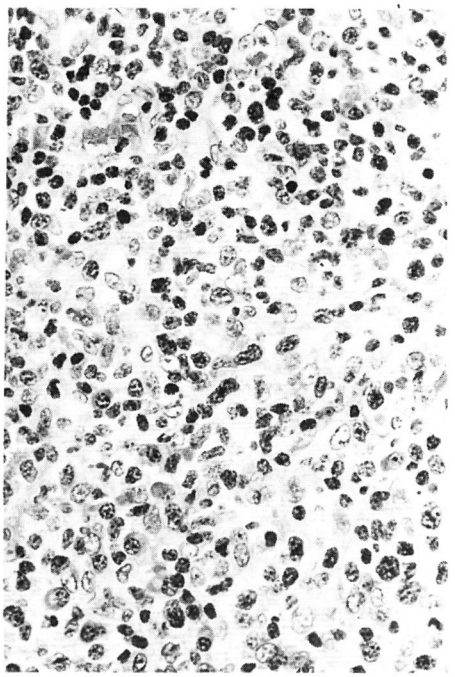

Fig. 1. Polymorphic reticulosis. Medium sized atypical cells dispersed among plasma cells, histiocytes, and eosinophils.

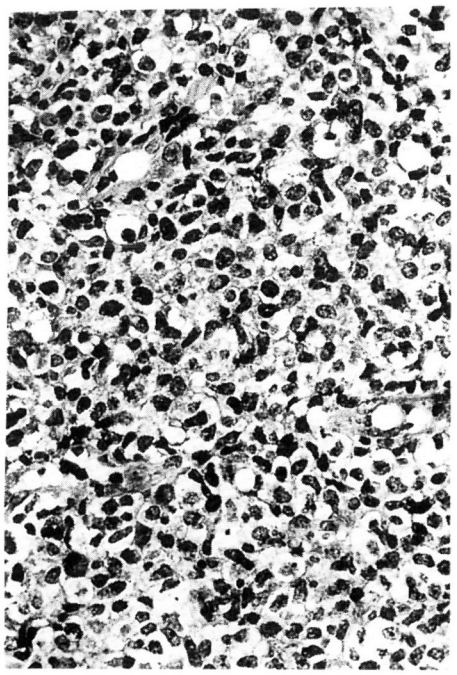

Fig. 2. Malignant lymphoma with features of PR. Relati vely monotonous infiltration of atypical tumor cells with occasional plasma cells, eosinophils, or histiocytes.

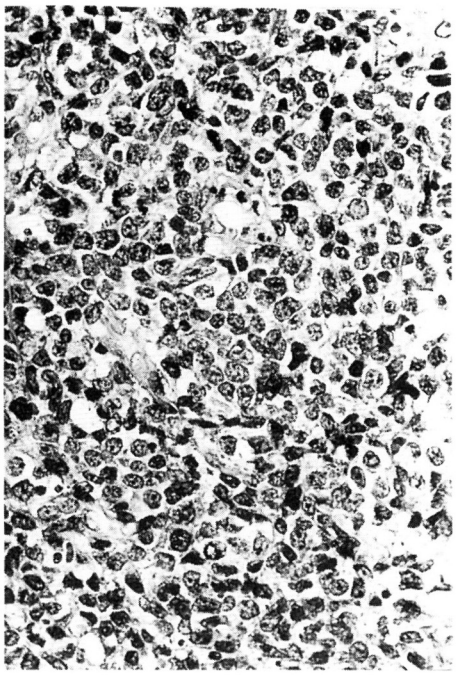

Fig. 3. Malignant lymphoma of monomorphic type consisting of compactly arranged uniform large cells lacking an inflammatory component.

ma, but in neither of the two cases classified as lymphoma with features of PR.

Waldeyer's ring lymphoma:

Angioinvasion was present in five (38.5%) of thirteen T-lineage Waldeyer's ring NHL. None of the B-cell lymphomas showed angioinvasion. Ten of the 13 cases of T-lineage lymphomas and 7 of the 11 cases B-lineage lymphomas showed mucosal ulceration and coagulative necrosis. Epitheliotropism of tumor cells was present in 8 of the 13 cases of T-lineage lymphoma and 2 of the 10 cases of B-lineage lymphoma. Three T-lineage lymphomas showed epithelial hyperplasia. One T-cell lymphoma showed prominent epithelioid cells resembling Lennert's lymphoma. There was diffuse infiltration of tumor cells between the skeletal muscle of subcutaneous soft tissue and between the mucous glands in two T-lineage lymphomas.

Among the 13 cases of T-lineage lymphomas, polymorphic reticulosis was not evident. Four cases of lymphoma with features of polymorphic reticulosis were present. They occured in the tonsil in one case, oropharnyx in two, and pharynx in one. The remaining nine cases were classified as monomorphic lymphomas. Angioinvasion of tumor cells was noted in

one of four lymphomas with features of PR and four of nine monomorphic lymphomas. Polymorphic reticulosis-like histology was not seen in any of the B-lineage lymphomas.

Clinical stage

There was no difference in clinical stage between nasal NHL and Waldeyer's ring NHL at presentation. Nasal NHL presented with stage I disease in 6 cases, stage II disease in 2 cases, and stage IV in 2 cases. Waldeyer's ring NHL presented with stage I diseage in 7 cases, stage II in 12 cases, stage III in 2 cases, and stage IV in 2 cases. T-lineage Waldeyer's ring NHL tended to present with a higher stage than B-lineage lymphoma ($p<0.05$). (Table 4)

Table 4. Stage at Time of Presentation in Waldeyer's Ring NHL ($P<0.05$)

Stage	T-lineage	B-lineage
I/II	9	10
III/IV	4	0

Spread

Nasal NHLs tended to spread along the mucosal surface to the oropharynx, nasopharynx, and paranasal sinuses. Extranasal involvement of nasal NHL was noted in the skin in 2 cases, cervical lymph node in 1 case, and neck soft tissue in 1 case. T-lineage Waldeyer's ring NHL also showed distant extranodal spread patterns, involving the skin in one case, the stomach in 1 case, the spleen in 1 case, and the liver in 1 case. Two cases of T-lineage Waldeyer's ring NHL involved the abdominal and the inguinal lymph nodes, respectively. In contrast to T-lineage lymphoma, B-lineage tended to localize in the lymph nodes. Five cases disseminated to the cervical lymph nodes and one case to the inguinal lymph nodes.

Survival

The three year survival for nasal NHL was 47.5% and Waldeyer's ring NHL was 45%. There was no statistically significant difference ($p = 0.9378$) (Fig. 4). Three-year-survival for T-lineage nasal NHL showed no great difference from that for T-cell Waldeyer's ring NHL (40% us, 32.5%) ($p = 0.8733$) (Fig. 5). Although not statistically significant because of small sample numbers ($p = 0.7977$), T-lineage Waldeyer's ring NHL showed a lower three year survival rate than B-lineage Waldeyer's ring W-NHL (32.5% vs. 50%) (Fig. 6). Also, when only the cases with stage I or II were analysed, T-lineage Waldeyer's ring NHL showed a worse three-year survival than B-lineage Waldeyer's ring NHL (30% vs. 50%) ($p = 0.8378$) (Fig. 10). The survival for T-lineage nasal NHL was compared according to histologic groups. The one patient with polymorphic reticulosis and the two patients with lymphoma with features of PR were alive at last follow up (30Mo-62Mo), whereas three patients among the six with monomorphic lymphoma had died of disease (3Mo-30Mo). In T-lineage Waldeyer's ring NHL; two of the three patients with PR-like lymphomas died of dis-

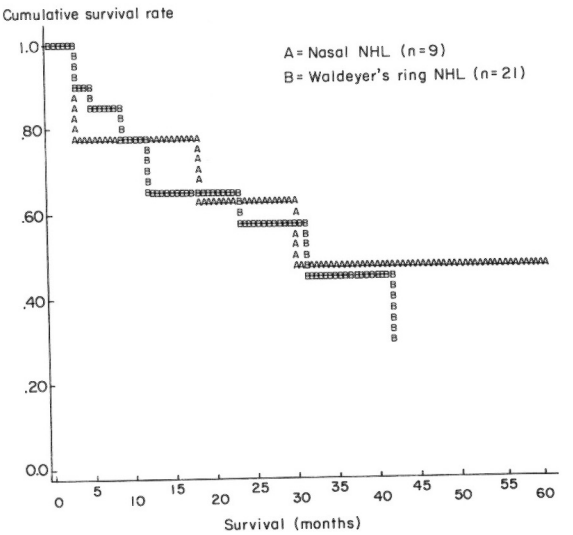

Fig. 4. Comparison of survival: Nasal vs. Waldeyer's ring lymphoma.

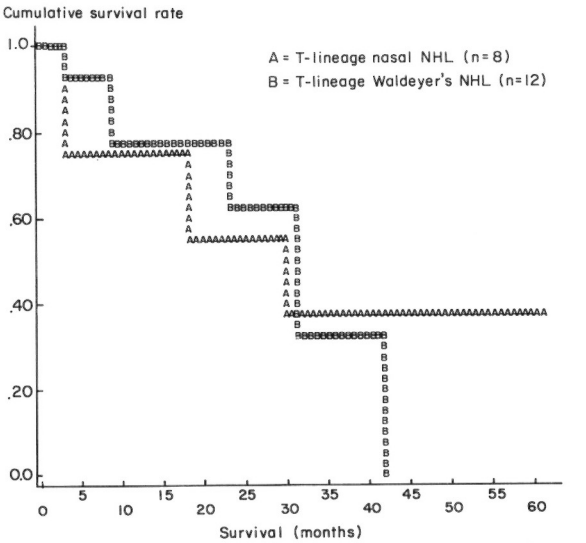

Fig. 5. Comparison of survival: T-lineage nasal NHL vs. T-lineage Waldeyer's ring NHL.

ease at 9Mo, and 31Mo. Three of nine patients with T-lineage monomorphic lymphomas died of disease at 3Mo, 23Mo, and 42Mo. The three year survival rates for all nasal and Waldeyer's ring NHLs were 52.5% in PR and lymphomas with features of PR, and 42.5% in monomorphic lymphomas (p = 0.3391) (Fig. 7).

The histologic types by WF was not correlated with survival. Diffuse mixed small cleaved and large cell lymphoma from Waldeyer's ring had no three year survival whereas large cell lymphoma showed 32% of three year survival. Nasal NHLs showed 45% three-year-survival in mixed lymphoma and 75% in large cell lymphoma. The three-year-survival rates for all nasal and Waldeyer's ring NHLs were 25% in diffuse, mixed, small cleaved and large cell lymphoma, 35% in diffuse, large cell lymphoma, and 100% in large cell, immunoblastic lymphoma (p=0.6170) (Fig. 8). Other subtypes were too small in the number of cases to analyse their survival.

Clinical stage greatly influences survival. Three-year survival in stage II disease was lower than stage I disease (37.5% vs. 50%) (p=0.1425) (Fig. 9). Waldeyer's ring NHL showed 52% 3-year survival for stage I with only 35% for stage II. Nasal NHL 3-year survival of 50% for stage I but 0% for stage II. Because there were few cases of stage III or IV, 3-year survival in these cases could not be compared with that of stage I or II disease. In stage I disease, there appeared to be no difference in survival between Waldeyer's ring NHL and nasal NHL. In stage II disease, comparison between Waldeyer's ring NHL and nasal NHL was impossible because of the small number of cases.

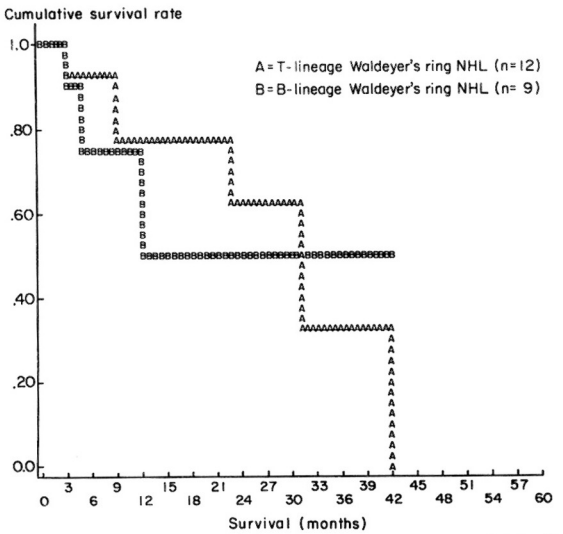

Fig. 6. Comparison of survival in Waldeyer's ring NHL: T-cell vs. B-cell.

DISCUSSION

This study clearly demonstrates the distribution differences of cell lineage between nasal NHL and Waldeyer's ring NHL. Nasal NHL is exclusively comprised of T-cell lineage. Previous immunohistochemical studies from the Orient indicate that the majority of lymphomas of the nasal cavity and paransal sinuses are of T-cell origin (Chan et al., 1987). In western countries, the results of immunophenotypic studies were heterogenous: some showing B-cell predominance

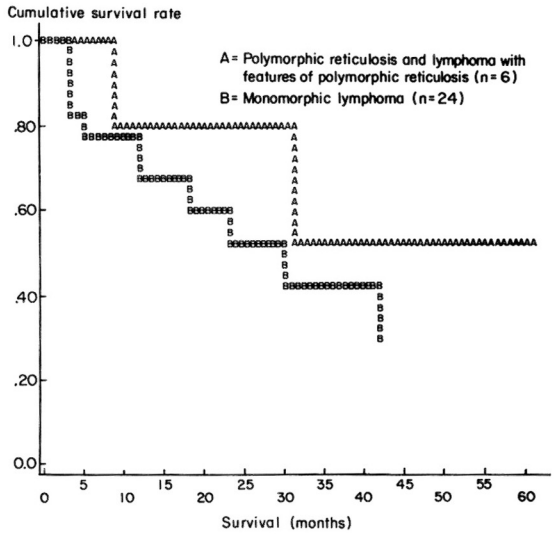

Fig. 7. Comparison of survival in polymorphic reticulosis, lymphoma with features of PR, and monomorphic lymphoma.

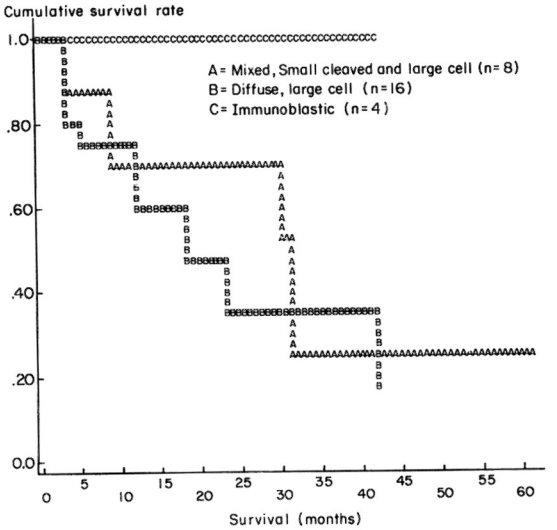

Fig. 8. Comparison of survival in histologic subtypes by WF.

(Fellbaum et al., 1989; Frierson et al., 1984; Frierson et al., 1989) and others demonstrating T-cell predominance (Ferry et al., 1991; Ratech et al., 1989). Recently, a Hong Kong study demonstrated T-lineage sinonasal lymphomas the meaning of which is not clear at this time. Little has been reported on the immunophenotype of malignant lymphomas arising from Waldeyer's ring in the literature. Yamanaka et al (1985) reported 86% of 22 cases of Waldeyer's ring NHL as having B-cell lineage attributing this to the fact that tonsils are B-cell predominant organs. In our study, only

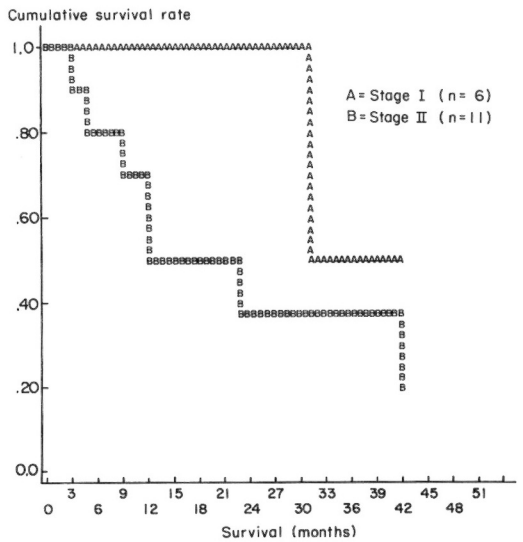

Fig. 9. Comparison of survival in Waldeyer's ring lymphoma according to stage

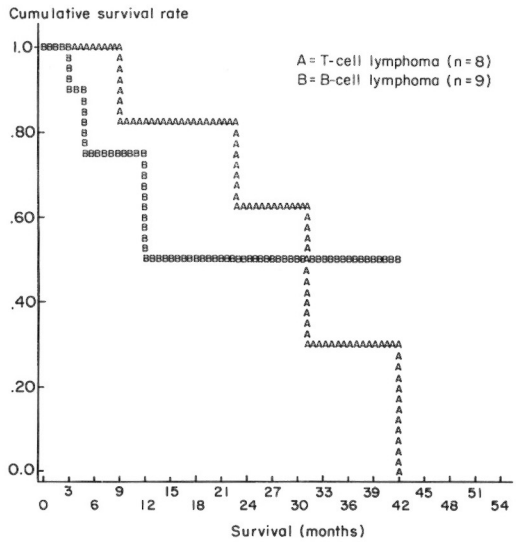

Fig. 10. Comparison of survival in stage I and II disease in Waldeyer's ring NHL

43.5% of Waldeyer's ring NHL cases expressed B-cell markers and the remainders were of T-lineage. The relatively high prevalence of T-lineage lymphomas in Waldeyer's ring may be explained by the close locational relationship with the nasal cavity having a high incidence of T-cell lymphoma.

Pathologic features of nasal NHL and Waldeyer's ring NHL were not greatly different, but there were noticeable histologic differences between T-cell and B-cell lymphomas. Angioinvasion was exclusively noted in T-cell lymphoma. Epithelial hyperplasia and extensive invasion of adjacent normal tissue were prominent finding in T-cell neoplasms. Epitheliotropism by neoplastic cells was more prominent in T-cell neoplasms than in B-cell neoplasms. Coagulative necrosis was frequently seen not only in T-cell neoplasms, but also in B-cell tumors. T-lineage lymphomas in Waldeyer's ring and the nasal cavity shared similar histologic findings including angioinvasiveness, polymorphic cellular infiltrates, and nuclear irregularity; features noted in the so-called polymorphic reticulosis (PR) group.

Since the term was coined by Eichel et al. (Eichel et al., 1966), the nature of PR has been controversial. Recent immunopathologic studies consistently showed PR as an unusual type of peripheral T-cell lymphoma (Aozasa and Inoue, 1982; Bender and Jaffe, 1980; Chott et al., 1988; Ishii et al., 1982; Yamamura et al., 1986). Lipford et al., (1988) considered PR as a specific type of peripheral T-cell lymphoma and placed PR and angiocentric lymphoma under the angiocentric immunoproliferative lesions. Recently Ho et al., (1990) insisted that PR, lymphoma with features of PR, and pleomorphic T-cell lymphoma of conventional type represented a spectrum of the same disease. They demonstrated overlapping of histologic features and cases of PR that have progressed into malignant lymphoma. In this study, 3 of 9 case of nasal NHL (33%) and 4 of 13 cases of T-lineage Waldeyer's ring NHL (30%) were classified as PR or lymphoma with features of PR. The remainder were monomorphic T-lineage lymphomas lacking polymorphic cellular infiltrates, but sharing similar histologic features with PR and lymphoma with features of PR such as nuclear irregularity and angioinvasion. Two of 7 case of lymphoma with features of PR (29%), and 9 of 16 cases of monomorphic lymphomas (56%) showed angioinvasiveness of tumor cells.

There were prognostic differences between PR, lymphoma with features of PR, and monomorphic lymphoma, although these were not statistically significant because of the small number of cases. Polymorphic reticulosis had the most favorable survival and mono-

morphic lymphoma had the worst. The prognosis of PR has been continuously debated. Eichel et al (1966) stressed the more favorable prognosis of PR compared with the typical monomorphic NHL of the nasal cavity. Other series have also supported a favorable prognosis of PR (Crissman et al., 1982; Deremee et al., 1978; McDonald et al., 1976). In contrast, however, a less favorable prognosis for PR has been reported by other institutions (Fu and Perzin, 1979; Ishi et al., 1982; Itami et al., 1991; Maeda et al., 1988; Michaels and Gregory, 1977). In our study, T-lineage lymphomas of monomorphic type had the worst survival in comparison to PR and lymphoma with features of PR. In conjunction with the morphologic transition between them, this result suggests that monomorphic lymphoma represents the most advanced disease in the spectrum of PR, lymphoma with features of PR, and monomorphic lymphoma.

Reports comparing the survival of nasal NHL with Waldeyer's ring NHL are not commonly found in the literature. Shibuya et al., (1987) reported that ten year survival was better for the 32 patients with Waldeyer's ring NHL than for the 34 with oral-sinonasal NHL (83% vs. 47% in stage I, 75% vs. 50% in stage II). However, Horiuchi et al., (1982) reported that the actuarial 5 year survival rate for nasal NHL and Waldeyer's ring NHL in stage I and II was not different. In our study, there was no difference in the survival rate between nasal NHL and Waldeyer's ring NHL. The reason for the poor survial in oral-sinonasal lymphomas in Shibuya's study may be explained by the inclusion of oral-paranasal NHL in their series. Paranasal NHL has a graver prognosis in comparison with nasal NHL (Takenaka et al., 1988).

With regard to survival of Waldeyer's ring and nasal cavity lymphomas, stage and histologic subtypes had been regarded as significant factors (Barton et al., 1984; Frierson et al., 1984; Jacobs and Hoppe, 1985; Tokunaga and Sato, 1980; Yamanaka et al., 1985). Stage, especially, had been stressed as a most important factor (Barton et al., 1984; Kim et al., 1987; Maeda et al., 1988; Yamanaka et al., 1985). In this study, stage at presentation was important to survival; stage I disease showing a much more favorable survival than stage II disease. The data on the prognostic importance of histologic subtypes showed contradictory results. Frierson et al (1984) found that immunoblastic lymphomas in the sinonasal region have a shorter survival than other types of large cell lymphoma. In Waldeyer's ring, some authors (Jacobs and Hoppe, 1985; Robinson et al., 1971; Tokunaga and Sato, 1980) gave prognostic importance to the histologic subtype wherease Ratch et al (1989) denied correlation of histologic subtypes and survival. In this study, the histologic types by WF did not correlate with survival, while the histologic classification of T-lineage lymphomas as PR, malignant lymphoma with features of PR, and monomorphic lymphoma appeared to have an influence on survival.

The present study demonstrates the significant influence of immunophenotype on the prognosis of malignant lymphomas. Overall survival for T-cell lymphomas was lower than that for B-cell lymphoma. This result agrees with that of Yamanaka et al (1985) who demonstrated that survival of T-cell lymphoma was much lower than those of B-cell lymphoma in nasal cavity and Waldeyer's ring. Previous studies for node based peripheral T-cell lymphomas suggested that higher stage at presentation is a main factor leading to poor survival in T-cell lymphoma (Krajewski et al., 1988; Noordijn et al., 1990). But our study analysing only stage I and II disease also showed that survival for T-cell lymphoma was worse than that for B-cell lymphoma.

In our study, T-lineage nasal lymphomas frequently spread to the distant skin and T-lineage Waldeyer's lymphomas spread to the stomach or liver as reported by other authors (Horiuchi et al., 1982; Jacobs and Hoppe, 1985; Ree et al., 1980; Yamanaka et al., 1985). In contrast, B-lineage Waldeyer's ring lymphomas frequently involved regional lymph node and disseminated to the distant lymph nodes. This difference in biologic behavior suggested significant therapeutic Implications. Although localized Waldeyer's ring lymphomas have been known to be cured with radiation therapy alone (Jacobs and Hoppe., 1985; Shibuya et al., 1987; Yamanaka et al., 1985), distant spread of T-lineage Waldeyer's ring NHL to the stomach, spleen, liver and skin as demonstrated in our study suggests that T-lineage Waldeyer's ring NHL should be treated with systemic chemotherapy under the accurate staging. The high proportion of T-lineage lymphomas occurring in the nasal cavity with frequent distant extranodal spread also suggests the necessity of adding systemic chemotherapy to radiation therapy, a well established first line treatment modality for stage I and II sinunasal lymphoma (Itami et al., 1991; Kim et al., 1987; Shibuya et al., 1987).

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