Clinicoprognostic implications of head and neck involvement by mycosis fungoides: A retrospective cohort study

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Background: The clinicoprognostic implications of head and neck involvement of mycosis fungoides (MF) are poorly understood.

Objectives: To evaluate the association of head and neck involvement on the clinicoprognostic features of MF.

Methods: The clinical features and survival outcomes of patients with MF in a Korean academic medical center database were retrospectively evaluated according to the presence of head and neck involvement at diagnosis.

Findings: Cases of MF with (group A, n = 39) and without (group B, n = 85) head and neck involvement at diagnosis were identified. Advanced-stage disease (stages IIB-IVB) was more common in group A (43.6%) than in group B (5.9%) ($P < .001$). MF progression, extracutaneous dissemination, and large-cell transformation more commonly occurred in group A than in group B. The 10-year overall survival rate was worse in group A (53.4%) compared with group B (81.6%) ($P < .001$). Head and neck involvement at diagnosis was associated with poor prognosis in early-stage MF (stages IA-IIA) and was independently associated with worse progression-free survival (hazard ratio, 24.4; 95% confidence interval, 2.2-267.6; $P = .009$).

Limitations: A single center, retrospective design.

Conclusion: Head and neck involvement of MF was associated with a poor prognosis. (J Am Acad Dermatol 2022;86:1258-65.)

Key words: cutaneous T-cell lymphoma; disease progression; head and neck; mycosis fungoides; prognosis; skin.

INTRODUCTION

Mycosis fungoides (MF) is the most common cutaneous lymphoma, and represents 3.9% of all non-Hodgkin lymphomas.[1,2] Classic MF lesions are located in non-sun exposed areas, showing a bathing suit distribution, although any site can be affected.[2] Atypical variants of MF with distinct clinical behavior have also been described.[3-7] Among them, folliculotropic MF, pagetoid reticulosis, and granulomatous slack skin are recognized as distinct variants of MF according to the World Health Organization classification.[2,8,9]

Limited data exist on the incidence of head and neck involvement by MF, although a study has

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reported that approximately 70% of patients with MF had cutaneous or extracutaneous head and neck involvement.[10] MF tumors can occur at any site but are more likely to develop in the head and neck area.[11] Folliculotropic MF, which has been proposed to have a poor prognosis, preferentially involves the head and neck area.[4,8] However, the clinicoprognostic implications of head and neck involvement are poorly understood. Therefore, in this study, we compared the clinicoprognostic characteristics of patients with MF with and without head and neck skin involvement at diagnosis.

CAPSULE SUMMARY

- Approximately 30% of patients with mycosis fungoides had cutaneous head and neck manifestations at diagnosis.
- Mycosis fungoides involving the head and neck was associated with negative prognostic factors and was an independent factor correlated with shorter progression-free survival in this single-center study of Asians. Future large population-based studies are required to validate these results.

METHODS

Patients

After approval from the institutional review board, we searched the Asan Medical Center database for cases of MF that had been confirmed by skin biopsy between January 1997 and September 2020. Patients with MF with and without head and neck skin lesions at diagnosis were designated as groups A and B, respectively. The head and neck involvement of MF was assessed clinically.

Clinical variables of interest

The following information was collected: age at diagnosis, sex, prediagnosis duration, the morphology and location of the lesion, variant of MF, T-cell receptor (TCR) gene analysis of the MF lesion, clinical or pathologic lymph node (LN) involvement, pathologic visceral involvement, TNMB stage at diagnosis,[12] serum lactate dehydrogenase (LDH) level, and treatment. Overall survival (OS) was calculated from the date of the initial diagnosis to the date of death from any cause or the last follow-up examination. Progression-free survival (PFS) was calculated from the date of the initial diagnosis to the date of disease progression or the last follow-up.

Survival outcome analysis

We compared the OS and PFS of groups A and B. We also performed a survival analysis for each T stage alone as well as for early stage (stages IA-IIA) and advanced stage (stages IIB-IVB) to control for the disease stage.

Subgroup analysis

We compared group A to group B after excluding folliculotropic MF. Because folliculotropic MF is a previously reported negative prognostic factor and predominantly affects the head and neck area,[4,8] we aimed to exclude any confounding effects of the different distribution of this variant on the groups.

Statistical analysis

Continuous data are presented as mean ± standard deviation. Categorical variables were compared using chi-square tests or linear association tests, whereas continuous variables were compared using *t* test or Mann-Whitney U test. Survival analysis was performed using the Kaplan-Meier method, and the significance was tested using the log-rank test. Parameters affecting survival outcomes were assessed using Cox proportional hazards regression modeling. A multivariable analysis was performed using all the significant variables from the univariable analysis. All statistical analyses were performed using the R version 3.5.3 (R Foundation for Statistical Computing) software. A P value of $< .05$ was considered statistically significant.

RESULTS

We included 124 cases of MF, of which 39 were cases of MF with head and neck involvement at diagnosis (group A, Supplemental Fig 1 available via Mendeley at https://data.mendeley.com/datasets/vpyxs9trbh/1) and 85 were cases of MF without head and neck involvement at diagnosis (group B). A skin biopsy was performed in the head and neck area in 41% (16/39) of the patients in group A.

Clinical features at diagnosis

The mean age at diagnosis of the entire cohort was 42 years. There were 43 female (34.7%) and 81 male (65.3%) patients. The demographic data and clinical features of the patients with MF with and without head and neck involvement are summarized in Table I. The mean age of the patients with MF at diagnosis in group A (48.9 years) was significantly more than that in group B (38.8 years) ($P = .004$). The folliculotropic variant of MF affected 28.2% (11/39) of patients in group A, whereas it affected only 10.6% (9/85) of the patients in group B ($P = .027$). Regarding the T stage, the T1 stage was less frequent

Abbreviations used:

CI: confidence interval
LDH: lactate dehydrogenase
LN: lymph node
MF: mycosis fungoides
OS: overall survival
PFS: progression-free survival
TCR: T-cell receptor

in group A (6/39, 15.4%) than in group B (62/85, 72.9%). A more advanced T stage (T2 to T4) was more common in group A (33/39, 84.6%) than in group B (23/85, 27.1%). The frequency of LN involvement at diagnosis was significantly higher in group A (12/39, 30.8%) than in group B (2/85, 2.4%) ($P < .001$). Consistently, advanced stages (stages IIB-IVB) were more common in group A (17/39, 43.6%) than in group B (5/85, 5.9%) ($P < .001$). In group A, serum LDH elevation and clonal TCR rearrangement were present in 60.9% (14/23) and 85.2% (23/27) of patients, respectively. The frequency of serum LDH elevation and clonal TCR rearrangement were significantly higher in group A than in group B (serum LDH elevation, 3/32 (9.4%), $P < .001$; clonal TCR rearrangement, 29/58 (50%), $P = .004$).

Treatment and clinical course

Systemic methotrexate or retinoid therapy was administered significantly more frequently in group A (24/39, 61.5%) than in group B (18/85, 21.2%) ($P < .001$). Chemotherapy was used for 38.5% (15/39) of the patients in group A, whereas only 6 of 85 patients (7.1%) were treated with chemotherapy in group B ($P < .001$). Radiotherapy was also used more frequently in group A (17/39, 43.6%) than in group B (6/85, 7.1%) ($P < .001$) (Table II).

MF progression was significantly more common in group A (20/38, 52.6%) than in group B (7/78, 9%) ($P < .001$). The progression occurred after 1-76 months (median 9.5 months) and 10-177 months (median 104 months) for groups A and B, respectively.

During the disease course, LN invasion was observed in 48.7% (19/39) of the patients in group A, whereas only 3 of 85 (3.5%) patients showed LN dissemination in group B ($P < .001$). The bone marrow was involved pathologically by MF in 4 of 39 (10.3%) patients in group A, whereas no patient had pathologic MF involvement of the bone marrow in group B ($P = .014$). Large-cell transformation of MF was significantly more common in group A (6/39, 15.4%) than in group B (1/85, 1.2%) ($P = .006$). The frequency of secondary lymphoma development was not significantly different between both groups (Table II).

Survival outcomes

The median follow-up period and the 10-year OS rate of the entire cohort were 60 months (1-252 months) and 81.6% (95% confidence interval [CI], 73.4%-90.6%), respectively. The 10-year OS rates of groups A and B were 53.4% (95% CI, 36.8%-77.6%) and 94.6% (95% CI, 88.4%-100%), respectively. Both OS ($P < .001$) and PFS ($P < .001$) were significantly worse in group A than in group B (Fig 1).

The factors affecting the prognosis in the entire cohort were analyzed in the univariable and multivariable analyses (Table III). The multivariable analyses revealed that stage IV was independently associated with a worse OS and PFS. Head and neck involvement at diagnosis was not independently associated with OS (hazard ratio, 6.38; 95% CI, 0.71-57.25; $P = .098$) but was an independent factor associated with a worse PFS (hazard ratio, 24.44; 95% CI, 2.23-267.59; $P = .009$).

Stage-matched survival outcomes

When we performed a T-stage–matched comparison, both OS and PFS were not significantly different between groups A and B in T1, T3, and T4 stages. However, in the T2-stage–matched comparison, both OS ($P = .007$) and PFS ($P = .008$) were significantly worse in group A than in group B. Supplemental Table 1 (available via Mendeley at https://data.mendeley.com/datasets/vpyxs9trbh/1) shows the results of the T2-stage–matched subgroup analysis. In the early-stage (stages IA-IIA) patients, group A had a significantly worse OS ($P = .004$) and PFS ($P < .001$) compared with group B. In contrast, no significant difference of OS or PFS was found between the groups in advanced stages (stages IIB-IVB).

Subgroup analysis after excluding folliculotropic MF

In this analysis, T2-T4 stages were significantly more common in group A (T2, 14/28, 50%; T3, 9/28, 32.1%; T4, 4/28, 14.3%) than in group B (T2, 14/76, 18.4%; T3, 4/76, 5.3%; T4, 1/76, 1.3%) (T2, $P = .003$; T3, $P = .001$; T4, $P = .026$). The frequency of LN involvement at diagnosis was significantly higher in group A (10/28, 35.7%) than in group B (2/76, 2.6%) ($P < .001$). Advanced stages (stages IIB-IVB) were also more common in group A (14/28, 50%) than in group B (5/76, 6.6%) ($P < .001$).

During the disease course, MF progression was significantly more common in group A (17/28, 60.7%) than in group B (7/69, 10.1%) ($P < .001$).

Table I. Clinical features of mycosis fungoides with and without head and neck involvement at diagnosis

Feature	Group A* (n = 39), n (%)	Group B* (n = 85), n (%)	*P* value
Sex			.219
Male	29/39 (74.4)	52/85 (61.2)	
Female	10/39 (25.6)	33/85 (38.8)	
Age (years)	48.9 ± 18.8	38.8 ± 17.6	**.004**‡
Prediagnosis duration (months)	45.9 ± 48.3	51.4 ± 51.7	.584
Subtype of mycosis fungoides			
Folliculotropic	11/39 (28.2)	9/85 (10.6)	**.027**‡
Pagetoid reticulosis	0/39	2/85 (2.4)	.843
Granulomatous slack skin	1/39 (2.6)	0/85	.688
Site of lesion			
Head and neck	39/39 (100.0)	0/85	**<.001**‡
Trunk	36/39 (92.3)	69/85 (81.2)	.184
Upper extremities	34/39 (87.2)	51/85 (60.0)	**.005**‡
Lower extremities	34/39 (87.2)	68/85 (80.0)	.472
T stage			
T1	6/39 (15.4)	62/85 (72.9)	**<.001**‡
T2	18/39 (46.2)	18/85 (21.2)	**.008**‡
T3	10/39 (25.6)	4/85 (4.7)	**.002**‡
T4	5/39 (12.8)	1/85 (1.2)	**.019**‡
Extracutaneous involvement			
Lymph node involvement†	12/39 (30.8)	2/85 (2.4)	**<.001**‡
Visceral involvement	3/39 (7.7)	0/85 (0)	.050
Blood involvement	1/39 (2.6)	0/85 (0)	.69
Overall stage			
Early stage (IA-IIA)	22/39 (56.4)	80/85 (94.1)	**<.001**‡
Advanced stage (IIB-IVB)	17/39 (43.6)	5/85 (5.9)	**<.001**‡
Serum lactate dehydrogenase elevation	14/23 (60.9)	3/32 (9.4)	**<.001**‡
Clonal T-cell receptor rearrangement (skin lesion)	23/27 (85.2)	29/58 (50.0)	**.004**‡

*Group A, mycosis fungoides with head and neck involvement at diagnosis; Group B, mycosis fungoides without head and neck involvement at diagnosis.
†Clinical or pathologic lymph node involvement.
‡Bold figures are statistically significant.

LN invasion occurred in 53.6% (15/28) of patients in group A, whereas 3 of 76 (3.9%) patients had LN involvement in group B ($P < .001$). Large-cell transformation of MF was significantly more common in group A (5/28, 17.9%) than in group B (1/76, 1.3%) ($P = .006$) (Supplemental Table 1).

Regarding the prognosis, both OS ($P < .001$) and PFS ($P < .001$) were significantly worse in group A than in group B.

DISCUSSION

MF is generally indolent in behavior.[13] However, advanced-stage MF, which is often refractory to treatment, has a poor prognosis.[4,14,15] Accurate staging is fundamental to guide treatment and for prognostication.[12] Factors such as advanced age at diagnosis, elevated LDH and β_2-microglobulin levels, folliculotropic variant, and large-cell transformation have been associated with a poor prognosis.[4,14,15]

The exact frequency of head and neck presentation of MF is unclear. Brennan[10] reported that cutaneous or extracutaneous head and neck involvement by MF was found in 69.8% (30/43) of patients with MF. In our study, approximately 30% of patients with MF had cutaneous head and neck manifestations at diagnosis, suggesting that initial head and neck involvement by MF is not uncommon.

In this study, the patients in group A were significantly older than those in group B when MF was diagnosed, which could have harmfully affected the prognosis in group A.[4] Although the prediagnosis duration was not significantly different between the groups, group A showed a greater extent of cutaneous involvement than group B. T2, T3, and T4 stages were 2.2, 5.4, and 10.7 times more common, respectively, in group A than in group B.

Initial LN involvement was approximately 13 times more frequent in the former than in the latter (30.8% vs 2.4%). This lymphotropic propensity of head and neck MF is supported by a previous study

Table II. Treatment modalities, extracutaneous lymphoma involvement, large-cell transformation, and secondary lymphoma development in mycosis fungoides with and without head and neck involvement at diagnosis during the disease course

Variable	Group A* (n = 39), n (%)	Group B* (n = 85), n (%)	*P* value
Treatment			
Phototherapy	29/39 (74.4)	62/85 (72.9)	>.99
Topical steroid	28/39 (71.8)	56/85 (65.9)	.655
Systemic methotrexate or retinoid	24/39 (61.5)	18/85 (21.2)	**<.001**‡
Chemotherapy	15/39 (38.5)	6/85 (7.1)	**<.001**‡
Radiotherapy	17/39 (43.6)	6/85 (7.1)	**<.001**‡
Stem cell transplantation	2/39 (5.1)	0/85	.181
Extracutaneous involvement			
Any extracutaneous involvement	19/39 (48.7)	3/85 (3.5)	**<.001**‡
Lymph node†	19/39 (48.7)	3/85 (3.5)	**<.001**‡
Bone marrow	4/39 (10.3)	0/85	**.014**‡
Blood	2/39 (5.1)	0/85	.181
Spleen	1/39 (2.6)	0/85	.688
Lung	1/39 (2.6)	0/85	.688
Stomach	0/39	1/85 (1.2)	>.99
Large-cell transformation	6/39 (15.4)	1/85 (1.2)	**.006**‡
Secondary lymphoma development (anaplastic large-cell lymphoma)	2/39 (5.1)	0/85	.181

*Group A, mycosis fungoides with head and neck involvement at diagnosis; Group B, mycosis fungoides without head and neck involvement at diagnosis.
†Clinical or pathologic lymph node involvement.
‡Bold figures are statistically significant.

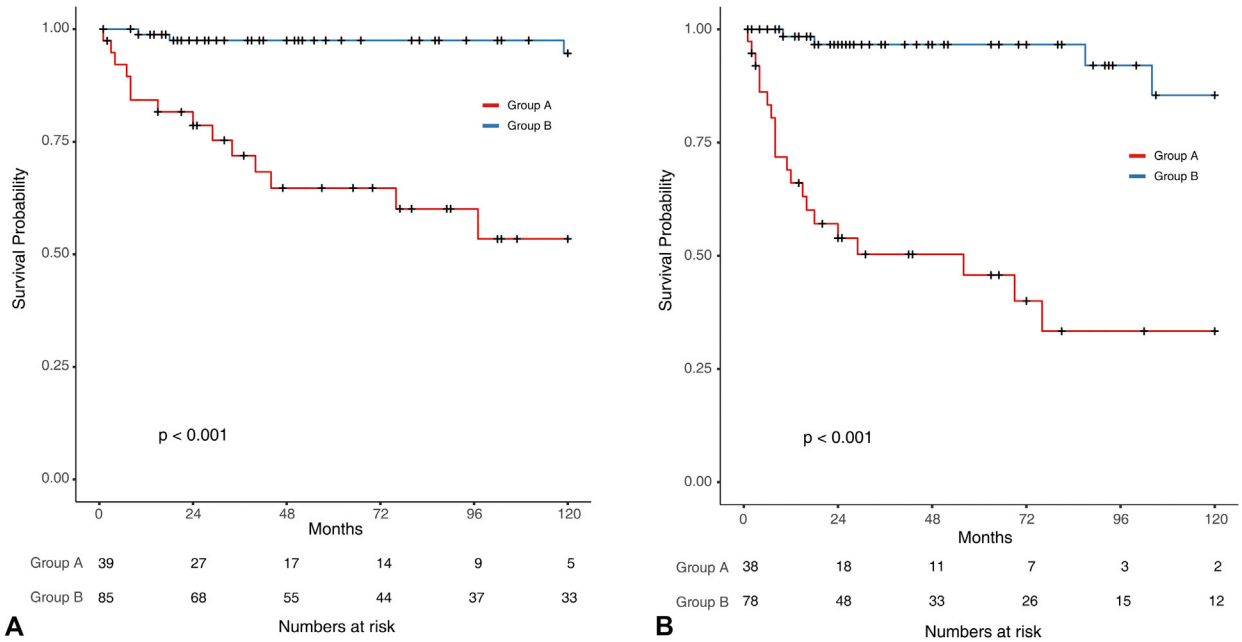

Fig 1. Survival analysis of mycosis fungoides. **A**, Differences in overall survival between mycosis fungoides with head and neck involvement at diagnosis (group A) and mycosis fungoides without head and neck involvement at diagnosis (group B). **B**, Comparison of progression-free survival between mycosis fungoides with head and neck involvement at diagnosis (group A) and mycosis fungoides without head and neck involvement at diagnosis (group B).

Table III. Factors affecting prognosis

	Univariable analysis		Multivariable analysis*	
Variable	**HR (95% CI)**	***P* value**	**HR (95% CI)**	***P* value**
Overall survival				
Age at diagnosis, years	1.06 (1.03-1.09)	**<.001**†	1.01 (0.97-1.06)	.55
Sex (male vs female)	0.90 (0.36-2.27)	.83		
Stage at diagnosis				
Stage II vs I	13.9 (3.75-51.36)	**<.001**†	0.61 (0.10-3.60)	.58
Stage III vs I	33.9 (7.71-149.16)	**<.001**†	0.84 (0.11-6.47)	.87
Stage IV vs I	98.2 (23.46-411.32)	**<.001**†	23.36 (3.61-150.93)	**<.001**†
Elevated serum LDH at diagnosis	5.86 (1.85-18.54)	**.003**†	3.50 (0.69-17.78)	.13
Head and neck involvement at diagnosis	7.50 (2.84-19.81)	**<.001**†	6.38 (0.71-57.25)	.098
Large-cell transformation	7.55 (2.65-21.55)	**<.001**†	1.56 (0.35-6.92)	.56
Progression-free survival				
Age at diagnosis, years	1.04 (1.02-1.07)	**<.001**†	1.01 (0.98-1.05)	.48
Sex (male vs female)	0.82 (0.37-1.79)	.61		
Stage at diagnosis				
Stage II vs I	8.38 (2.85-24.65)	**<.001**†	1.13 (0.22-5.71)	.88
Stage III vs I	27.47 (8.03-94.02)	**<.001**†	4.35 (0.33-58.23)	.27
Stage IV vs I	29.12 (8.66-97.89)	**<.001**†	14.37 (2.29-90.34)	**.005**†
Elevated serum LDH at diagnosis	3.57 (1.38-9.29)	**.009**†	0.88 (0.24-3.27)	.85
Head and neck involvement at diagnosis	9.50 (3.78-23.90)	**<.001**†	24.44 (2.23-267.59)	**.009**†
Large-cell transformation	6.75 (2.78-16.35)	**<.001**†	0.99 (0.19-5.12)	.99

CI, Confidence interval; *HR*, hazard ratio; *LDH*, lactate dehydrogenase.
*Multivariable analysis was performed using all of the significant variables in the univariable analysis.
†Bold figures are statistically significant.

in which 39.5% of patients with MF showed cervical lymphadenopathy.[10] In that cohort, 70% of patients with MF had head and neck cutaneous lesions.[10] In addition to a high LDH level, all these findings suggest that a high tumor burden and aggressive tumor biology are associated with head and neck involvement of MF at diagnosis. In head and neck MF, the hair follicles are also more likely to be involved.[16] These lesions may initially present as folliculotropic MF but may also evolve from classic MF to follicular involvement during the disease course.

During the disease course, extracutaneous involvement and large-cell transformation were significantly more common in group A than in group B. These results suggest an aggressive clinical course associated with an initial head and neck manifestation of MF. The advanced stage at diagnosis and frequent disease progression resulted in systemic chemotherapy and radiation therapy being more frequently used in group A than in group B. In contrast, skin-directed therapies such as phototherapy and topical steroids, which are the accepted therapies for early-stage MF,[17-20] were used at similar frequencies in groups A and B.

The 10-year OS rate of the entire MF cohort of our study was better than the previously reported OS of 53%-66%.[4,14] This result may be attributable to a younger mean age at diagnosis and the proportion of early-stage disease being higher in our study than in previous studies.[4,14] Despite the aggressive treatments, the prognosis was much worse in group A than in group B, with the absolute difference in the 10-year OS rates between the groups being 41.2%. This poor prognosis of group A is readily predictable given the characteristics of group A, with many prognostic factors indicating a poor outcome, including advanced age at diagnosis, advanced stage, folliculotropic variant, elevation of the LDH level, and large-cell transformation.

To better understand the prognostic implications of head and neck cutaneous involvement of MF, we performed matched subgroup analyses according to stages. In this analysis, the poor prognosis of head and neck involvement of MF was shown in early-stage and T2-stage MF but not in T1 stage and advanced-stage disease. Thus, these results indicate that T1 stage and advanced-stage disease, which have extremely good and poor outcomes, respectively, barely have their prognosis affected by head and neck involvement. The results of multivariable analyses for survival outcomes implied that the implications of head and neck involvement of MF on OS is weaker than the overall stage of MF, although it can affect disease progression regardless of the overall stage of MF.

The aggressive clinical course and poor survival outcomes of group A were still maintained after excluding folliculotropic MF, suggesting this aggressiveness is not merely attributable to this variant.

The reasons for the poor prognosis of initial head and neck involvement of MF as revealed in this study are unclear. There are several examples of skin cancer where the prognosis can be affected by the anatomical location of the cutaneous lesion. In primary cutaneous diffuse large B-cell lymphoma, a location on the leg is reported to be a major negative prognostic factor.[21] Angiosarcoma originally located on the scalp and melanoma developing in the acral area are associated with a worse prognosis.[22,23] Considering the relatively high frequency of histopathologic folliculotropism, TCR gene rearrangements and large-cell transformation in MF with clinical head and neck lesions revealed in the present study, its aggressive behavior is assumed to be due to inherent biological differences from MF without head and neck involvement.

This study has limitations. First, the number of patients included, especially those of pediatric and advanced-stage patients, was limited. Second, the treatment protocols were not standardized because of its retrospective nature. Third, head and neck involvement of MF was mainly assessed clinically.

In conclusion, head and neck involvement of MF was associated with advanced age at diagnosis, the presence of folliculotropism, large-cell transformation, LN involvement, advanced T and overall stages, and an elevated serum LDH level, which have all been previously suggested to be indicators of a poor prognosis of patients with MF. The prognostic implications of head and neck involvement can be especially important in early-stage disease but not in very early T1 stage disease. Considering the poor survival outcomes of patients with head and neck MF, active staging work-up with a multidisciplinary approach to assess LN and viscera involvement and closer follow-up should be considered for these patients.

Conflict of interest

None disclosed.

REFERENCES

1. Bradford PT, Devesa SS, Anderson WF, et al. Cutaneous lymphoma incidence patterns in the United States: a population-based study of 3884 cases. *Blood*. 2009;113(21):5064-5073.
2. Willemze R, Jaffe ES, Burg G, et al. WHO-EORTC classification for cutaneous lymphomas. *Blood*. 2005;105(10):3768-3785.
3. Abbott RA, Sahni D, Robson A, et al. Poikilodermatous mycosis fungoides: a study of its clinicopathological, immunophenotypic, and prognostic features. *J Am Acad Dermatol*. 2011;65(2):313-319.
4. Agar NS, Wedgeworth E, Crichton S, et al. Survival outcomes and prognostic factors in mycosis fungoides/Sézary syndrome: validation of the revised International Society for Cutaneous Lymphomas/European Organisation for Research and Treatment of Cancer staging proposal. *J Clin Oncol*. 2010;28(31):4730-4739.
5. Alsaleh QA, Nanda A, Al-Ajmi H, et al. Clinicoepidemiological features of mycosis fungoides in Kuwait, 1991–2006. *Int J Dermatol*. 2010;49(12):1393-1398.
6. Boulos S, Vaid R, Aladily TN, et al. Clinical presentation, immunopathology, and treatment of juvenile-onset mycosis fungoides: a case series of 34 patients. *J Am Acad Dermatol*. 2014;71(6):1117-1126.
7. Hodak E, Amitay-Laish I, Feinmesser M, et al. Juvenile mycosis fungoides: cutaneous T-cell lymphoma with frequent follicular involvement. *J Am Acad Dermatol*. 2014;70(6):993-1001.
8. Hodak E, Amitay-Laish I, Atzmony L, et al. New insights into folliculotropic mycosis fungoides (FMF): a single-center experience. *J Am Acad Dermatol*. 2016;75(2):347-355.
9. Kempf W, Ostheeren-Michaelis S, Paulli M, et al. Granulomatous mycosis fungoides and granulomatous slack skin: a multicenter study of the Cutaneous Lymphoma Histopathology Task Force Group of the European Organization for Research and Treatment of Cancer (EORTC). *Arch Dermatol*. 2008;144(12):1609-1617.
10. Brennan JA. The head and neck manifestations of mycosis fungoides. *Laryngoscope*. 1995;105(5 Pt 1):478-480.
11. Heald PW, Girardi M, Subtil-DeOliviera A. Cutaneous T-cell lymphoma. Program and abstracts of the 64th Annual American Academy of Dermatology. San Francisco, California: Symposium 303; March 3-7, 2006.
12. Olsen E, Vonderheid E, Pimpinelli N, et al. Revisions to the staging and classification of mycosis fungoides and Sezary syndrome: a proposal of the International Society for Cutaneous Lymphomas (ISCL) and the Cutaneous Lymphoma Task Force of the European Organization of Research and Treatment of Cancer (EORTC). *Blood*. 2007;110(6):1713-1722.
13. Kim YH, Jensen RA, Watanabe GL, et al. Clinical stage IA (limited patch and plaque) mycosis fungoides. A long-term outcome analysis. *Arch Dermatol*. 1996;132(11):1309-1313.
14. Kim YH, Liu HL, Mraz-Gernhard S, et al. Long-term outcome of 525 patients with mycosis fungoides and Sezary syndrome: clinical prognostic factors and risk for disease progression. *Arch Dermatol*. 2003;139(7):857-866.
15. Talpur R, Singh L, Daulat S, et al. Long-term outcomes of 1,263 patients with mycosis fungoides and Sezary syndrome from 1982 to 2009. *Clin Cancer Res*. 2012;18(18):5051-5060.
16. Lehman JS, Cook-Norris RH, Weed BR, et al. Folliculotropic mycosis fungoides: single-center study and systematic review. *Arch Dermatol*. 2010;146(6):607-613.
17. Zackheim HS, Kashani-Sabet M, Amin S. Topical corticosteroids for mycosis fungoides. Experience in 79 patients. *Arch Dermatol*. 1998;134(8):949-954.
18. Boztepe G, Sahin S, Ayhan M, et al. Narrowband ultraviolet B phototherapy to clear and maintain clearance in patients with mycosis fungoides. *J Am Acad Dermatol*. 2005;53(2):242-246.
19. Pavlotsky F, Barzilai A, Kasem R, et al. UVB in the management of early stage mycosis fungoides. *J Eur Acad Dermatol Venereol*. 2006;20(5):565-572.
20. Querfeld C, Rosen ST, Kuzel TM, et al. Long-term follow-up of patients with early-stage cutaneous T-cell lymphoma who achieved complete remission with psoralen plus UV-A monotherapy. *Arch Dermatol*. 2005;141(3):305-311.
21. Grange F, Beylot-Barry M, Courville P, et al. Primary cutaneous diffuse large B-cell lymphoma, leg type: clinicopathologic features and prognostic analysis in 60 cases. *Arch Dermatol*. 2007;143(9):1144-1150.

22. Jung JM, Won CH, Chang SE, et al. Lymphatic invasion in acral and non-acral melanoma: a comparative, clinicoprognostic study of primary cutaneous melanoma according to tumour site. *Pathology*. 2020;52(6):670-675.

23. Moon IJ, Kim YJ, Won CH, et al. Clinicopathological and survival analyses of primary cutaneous angiosarcoma in an Asian population: prognostic value of the clinical features of skin lesions. *Int J Dermatol*. 2020;59(5):582-589.