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Original Article

Systemic lupus erythematosus and thyroid disease — Experience in a single medical center in Taiwan

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Abstract *Background:* To investigate the association of systemic lupus erythematosus (SLE) with thyroid diseases in a medical center in central Taiwan.
Methods: This is a retrospective cohort of 2796 SLE patients in a tertiary referral medical center from 2000 to 2013. We screened SLE by catastrophic illness registration from national insurance bureau; and thyroid diseases by ICD 9 codes, then confirmed by thyroid function test, auto-antibody, medical and/or surgical intervention. We compared the rate of hyperthyroidism, hypothyroidism and autoimmune thyroid disease (AITD) in SLE patients and the 11,184 match controls. We calculated the rate of these thyroid diseases and positive antibodies to thyroglobulin (ATGAb), thyroid peroxidase (TPOAb) in SLE patients grouped by the presence of overlap syndrome and anti-dsDNA antibody. We also compared the association of thyroid diseases to severe SLE conditions, including renal, central nervous system (CNS) involvement, and thrombocytopenia.
Results: Compared to the matched controls, the cumulative incidence of thyroid disease, including hyperthyroidism, hypothyroidism and AITD, were all higher in SLE patients ($p < 0.0001$). The average age of SLE patients with thyroid diseases patients were older than those without thyroid diseases ($p = 0.002$). Those had euthyroid AITD were younger than other patients with thyroid diseases ($p = 0.02$). Up to 30.3% SLE patients had overlap syndrome and had higher relative risk of thyroid diseases than those without overlap syndrome, in terms of hypothyroidism and AITD, but not hyperthyroidism. SLE patients with thyroid diseases also carry higher risk for severe complications such as renal involvement ($p = 0.024$) central nervous system involvement ($p < 0.0001$).
Conclusion: SLE patients had significantly higher rate of hyperthyroidism, hypothyroidism, and AITD than the matched control. Among lupus patients, the risks of thyroid diseases are even

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higher in the presence of overlap syndrome. SLE patients with thyroid diseases had higher risk of renal and CNS involvement.

Introduction

Systemic lupus erythematosus (SLE) is an autoimmune disease involving chronic inflammation in numerous organs and tissues, including the thyroid gland.[1–6] Previous reports revealed wide range of follow up period and the rate of different thyroid diseases.[4–10] We have recently published a large-scale, nationwide, cohort study regarding prevalence of hyperthyroidism, hypothyroidism and autoimmune thyroiditis amongst SLE patients from the National Health Insurance Research Database (NHIRD) in Taiwan.[11] We found that SLE patients had significantly lower rate of thyroid diseases and hyperthyroidism than matched control; and SLE patients with overlap syndrome had higher rate of hypothyroidism and thyroiditis. However, the limitation of studies from NHIRD is lack of confirmatory data such as thyroid function tests, presence of autoantibodies, or the confirmation of overlap syndrome. Thus, the aim of this study is investigation of the association between SLE and thyroid diseases, as well as the clinical implication, from detailed clinical information in a single medical center.

Materials and methods

From January 2000 to December 2013, 2796 newly diagnosed as SLE and hospitalized patients admitted to Taichung Veterans General Hospital, were retrospectively enrolled in the study. This study was approved by the institutional review board (No. CE34217). These enrollees have all received a catastrophic illness certificate. The applications of these certificates require comprehensive examination of medical records, laboratory and image studies by at least 2 specialists and only those who meet the criteria of these diseases were rendered such certificates. Accordingly, all patients fulfilled the American College of Rheumatology (ACR) 1997 revised classification criteria for definite SLE.

Data on enrollees with hyperthyroidism (ICD-9 code 242.9), hypothyroidism (ICD-9 code 244.8, 244.9) and autoimmune thyroiditis (ICD-9 code 245.1, 245.2, 245.3, 245.8, 245.9), were acquired. Patients identified were demanded to have at least one primary or secondary diagnosis of these diseases in at least one hospital admission or department visit. Medical records of these patients were reviewed with medical or surgical intervention, thyroid function tests and thyroid autoantibody. Patients with any one of low TSH level, high FT4, high TT3 or receiving thyroidectomy; I-131 ablation therapy or anti-thyroid medication including carbimazole and propylthiouracil are categorized to hyperthyroidism group. Hypothyroidism is defined as at least one of following evidence: high serum thyroid-stimulating-hormone (TSH) level, low serum free tetraiodothyronine (FT4), low total triiodothyronine (TT3), or history of receiving thyroxin supplements. In patients diagnosed as autoimmune thyroid disease (AITD), they must have the positive result(s) of peroxidase antibody (TPOAb) and/or antithyroglobulin antibody (ATGAb).

Among these 2796 SLE patients, we subdivided them to SLE with overlap syndrome and SLE without non-overlap syndrome. The inclusion criteria of overlap syndrome was at least one primary or secondary diagnosis of scleroderma (Scl; ICD-9 code 710.1), Sjögren's syndrome (SS; ICD-9 code 710.2), dermatomyositis (DM; ICD-9 code 710.3), polymyositis (PM; ICD-9 code 710.4), and rheumatoid arthritis (RA; ICD-9 code 714) in at least one hospital admission and then confirmed by chart review. Among SLE with overlap syndrome, SLE without non-overlap syndrome and non-SLE group, the difference related to thyroid disease and its subgroups were analyzed.

We checked the severe conditions of SLE, including renal, central nervous system (CNS) involvement, and thrombocytopenia by SLEDAI score.[12] Those had record(s) fulfilled the manifestation(s) listed in SLEDAI score in the aspect of renal, CNS involvement; and platelet count less than 100,000/mm,[3] were recruited in this study.

The 11,184 age and sex matched controls were randomly sampled by software in the information center of our hospital. In both groups of SLE patients and controls, the number and percentage of age group and sex were determined. We calculated the cumulative incidence of hyperthyroidism, hypothyroidism, and autoimmune thyroiditis during the study period.

The differences between SLE patients and controls or between different SLE patient groups were compared by Chi-square test. We calculated the odds ratio (OR) and 95% confidence interval (CI) to assess the risk of thyroid diseases in different groups of SLE patients by logistic regression models. We also used logic regression model to assess if associated thyroid diseases carried higher risk for CNS involvement, lupus nephritis and thrombocytopenia in SLE patients.

Data retrieval and analysis were performed using SAS version 9.3 (SAS institute Inc., NC, USA), and the significance level was set as $p < 0.05$.

Results

Total 2796 newly diagnosed SLE patients met the inclusion criteria in this study.

Among the 2796 SLE patients, 88.8% were female and 11.2% was male. The female to male ratio was 7.95:1. The mean age of the study group was found to be 33.4 $\pm$ 14.9 years. The average follow-up period was 10.51 $\pm$ 2.51

years. The sex and age distribution of the 2796 newly diagnosed SLE patients and 11184 matched controls are depicted in Table 1. Table 1 also summarizes the cumulative incidence of hyperthyroidism, hypothyroidism and autoimmune thyroiditis among the SLE and control groups from the year 2000 to 2013. There were 27 co-existences of hyperthyroidism and AITD, and 52 co-existences of hypothyroidism and AITD. So the total number of thyroid diseases was 489 (17.5%). The cumulative incidence of hyperthyroidism, hypothyroidism and AITD all revealed higher in SLE than the matched control group (6.4% vs 2.1%, $p < 0.0001$; 8.5% vs 2.2%, $p < 0.0001$; and 5.4% vs 0.7%, $p < 0.0001$, respectively). The only exception was the treatment group of hyperthyroidism, which did not reveal difference from controls.

Table 2 showed the age distribution of thyroid diseases among SLE patients. Patients under year of 20 seldom had thyroid problems. The peak age ranged from 30 to 59. Most thyroid diseases, no matter hyperthyroidism, hypothyroidism or AITD, happened after diagnosis of SLE, ranged from 0 to 10.5 years, the mean period was 3.3 ± 3.7 years. Only 5 hyperthyroidism, and 6 hypothyroidism happened before the diagnosis of SLE. Lupus patients with thyroid diseases were older than those without thyroid diseases (age: 37.17 ± 13.98 vs 34.69 ± 15.28, $p = 0.002$). The age between hyperthyroidism and hypothyroidism was similar (37.01 ± 13.83 vs 38.79 ± 14.2, $p = 0.10$). Among the 151 patients with AITD (age: 34.60 ± 12.66), there were 27 hyperthyroidism (age: 33.84 ± 9.42), 52 hypothyroidism (age: 37.46 ± 14.46), and 74 euthyroid patients (age: 32.78 ± 12.09). Those euthyroid AITD patients were younger than the AITD patients with hypothyroidism ($p = 0.02$).

There were 849 (30.4%) SLE patients met the inclusion criteria of overlap syndrome in this study. The most commonly associated diagnoses was Sjogren's syndrome (SS), the number was 801 (n = 801), other overlap diseases included rheumatoid arthritis (RA, n = 20), Dermatomyositis (n = 14), polymyositis (n = 6), and scleroderma (n = 8). Table 3 shows the odds ratio (OR) for thyroid diseases in the three groups of matched control, SLE without overlap syndrome and SLE with overlap syndrome. Comparing the non-SLE-matched control group by logistic regression model revealed an increased risk of thyroid diseases with OR of 4.20 and 6.79 [95% confidence interval (CI) 3.59–4.91, 5.69–8.11] in SLE patients without and with overlap syndrome. SLE patients showed significant risks in all three thyroid diseases including hyperthyroidism with OR of 2.76 and 3.18 in those without and with overlap syndrome, respectively (95% CI 2.18–3.50, 2.38–4.24); hypothyroidism with ORs of 4.81 and 8.68 (95% CI 3.95–5.86, 7.03–10.73) and autoimmune thyroiditis with RRs of 4.40 and 10.58 (95% CI: 3.09–6.30, 7.53–14.88), respectively. In addition, Table 3 showed SLE patients with overlap syndrome had even higher risk of thyroid diseases with RR of 1.62 [95% CI: 1.33–1.97, $p < 0.0001$] than SLE patients without overlap syndrome. The overlap group carried higher risks of hypothyroidism (RR = 1.81, 95% CI 1.44–2.27, $p < 0.0001$) and AITD (RR = 2.40, 95% CI 1.66–3.49, $p < 0.0001$) than SLE patients without overlap

Table 1 Comparison of hyperthyroidism, hypothyroidism and autoimmune thyroiditis amongst SLE patients and general population from 2000 to 2013.

Variable	SLE (n = 2796)		Non-SLE (n = 11184)		*P* value for χ^2 test
	n	(%)	n	(%)	
Age at entry, yrs					
Mean ± SD	33.4 ± 14.9		32.4 ± 14.9		0.493
<10	27	0.9	108	0.9	1.000
10–19	350	11.8	1400	11.8	
20–29	797	26.8	3188	26.8	
30–39	661	22.2	2644	22.2	
40–49	476	15.9	1984	15.9	
50–59	263	8.8	1452	8.8	
60–69	140	4.7	560	4.7	
≥70	82	2.7	328	2.7	
Sex					
Female	2483	88.8	9932	88.8	1.000
Male	313	11.2	1252	11.2	
Hyperthyroidism					
Incidence case (2000–2013)	180	6.4	238	2.1	<0.0001
Case number with treatment (2000–2013)	32	1.1	102	0.9	0.3839
Hypothyroidism					
Incidence case (2000–2013)	237	8.5	250	2.2	<0.0001
Case number with treatment (2000–2013)	111	3.3	118	1.1	<0.0001
Autoimmune thyroiditis					
Incidence case (2000–2013)	151	5.4	75	0.7	<0.0001
Case number with treatment (2000–2013)	54	1.6	40	0.4	<0.0001

Table 2 Age distribution of thyroid diseases in SLE patients.

Age (number)	Disease			
	Thyroid disease number (%)	Hyperthyroidism number (%)	Hypothyroidism number (%)	Autoimmune thyroiditis number (%)
<10Y/O (27)	1 (3.7)	1 (3.7)	0 (0)	0 (0)
10–19 (350)	24 (6.9)	12 (3.4)	15 (4.3)	13 (3.7)
20–29 (797)	138 (17.3)	55 (6.9)	55 (6.9)	48 (6.0)
30–39 (648)	128 (19.4)	47 (7.1)	60 (9.1)	46 (6.9)
40–49 (426)	92 (19.3)	26 (5.4)	45 (9.5)	25 (5.3)
50–59 (263)	53 (20.2)	23 (8.7)	37 (14.1)	9 (3.4)
60–69 (140)	19 (13.6)	6 (4.3)	17 (12.1)	6 (4.3)
≥70 (82)	9 (1.1)	5 (6.0)	5 (6.1)	2 (2.4)

syndrome. However, there was no difference in the risk for hyperthyroidism between these two groups (RR = 1.15, 95% CI 0.83–1.97, p = 0.3759).

From Table 4a, the positive rate of ATGAb and TPOAb in SLE patients with hyperthyroidism was similar (p = 0.18, 0.13, respectively) no matter they were associated with overlap syndrome or not. There was either no difference between the SLE with or without overlap syndrome in terms of the positive rate of these two anti-thyroid autoantibodies (p = 0.40 and 0.21, respectively) in the condition of hypothyroidism. Table 4b compared the positive rate of anti-dsDNA Ab in hyperthyroidism, hypothyroidism, and AITD in SLE patients. The results showed no difference in the presence of anti-dsDNA Ab in thyroid diseases in SLE patients. Either no difference was noted in this aspect even after grouping them to overlap and non-overlap syndrome.

Considering the severe complications of SLE—renal, CNS involvement, and thrombocytopenia, those with thyroid diseases had higher risk of lupus nephritis (35.6% vs 27.9%, RR = 1.27, 95% CI: 1.03–1.57, p = 0.024), CNS involvement (21.7% vs 14.2%, RR = 1.67, 95% CI: 1.30–2.03, p < 0.0001); but not thrombocytopenia (6.7% vs 4.7%, RR = 1.42, 95% CI: 0.92–2.19, p = 0.11), as shown in Table 5. The risks of these 3 complications between those with and without overlap syndrome were similar. Comparing to SLE patients without overlap syndrome, the relative risks for renal, CNS involvement and thrombocytopenia in SLE patients with overlap syndrome were 0.91 (95% CI 0.76–1.09), 1.08 (95% CI 0.87–1.35) and 1.01 (95% CI 0.67–1.53), respectively.

Discussion

In this study, we found SLE patients had higher rate of hyperthyroidism, hypothyroidism and AITD than the non-SLE matched control group. In our study, the average 10.5-year follow-up showed the cumulative incidence of thyroid diseases in SLE patients was as high as 17.5%, including hyperthyroidism 6.4%, hypothyroidism 8.5% and AITD 5.4%. The SLE patients with overlap syndrome had even higher risks for hypothyroidism and AITD, but not hyperthyroidism in comparison to those SLE patients without overlap syndrome. Only 11 cases (0.4%) had thyroid disease before the diagnosis of SLE. After diagnosis of SLE, thyroid disease can happen anytime during follow up. The range of interval between the diagnosis of SLE and thyroid disease was 0–10.5 years, with the mean of 3.3 ± 3.7 years. In terms of the severe complications of SLE, those had thyroid diseases carried higher risks for lupus nephritis and CNS involvement.

The incidences of thyroid diseases in SLE patients were compatible to previously reported clinical studies,[3–10] though they showed a wide range of hyperthyroidism (0–5.8%), hypothyroidism (3.9–17.4%), and AITD (14–46.7%). The high variability in previous data was the result from limited case number, as well as the diversity in study methods. To date, it is still an arguable issue of whether hyperthyroidism or hypothyroidism is more frequent in SLE. Most studies revealed overt or subclinical hypothyroidism was more frequent,[1,5–10] while still a few studies found hyperthyroidism was more common.[13,6] The case number in this study is much more than previous studies. Our results showed hypothyroidism is more frequent than hyperthyroidism; and up to 46.8% of hypothyroidism patients needed thyroxin supplement even under the immune-suppressant(s) treatment for their SLE.

To date, the only available direct comparison of the prevalence of thyroid disease in SLE and general population is the study from NHIRD of Taiwan[11] published in 2014. It showed no difference in cumulative incidence of hypothyroidism or AITD between SLE patients and matched control; and lower prevalence of hyperthyroidism in SLE patients. The results were quite different from this study. As authors mentioned the limitation of NIHRD study in the article, the laboratory results such as thyroid function and autoantibody titers, or image studies were not available, not to say Schirmer's test for dry eye, or self-pay drugs, such as artificial saliva and tear. Another possibility was the NIHRD study retrieved thyroid diseases from at least one primary or secondary diagnosis in at least one hospital admission or three outpatient department. To include the ICD 9 code in at least one hospital admission or three outpatient department is a widely used inclusion criteria in insurance database studies.[14–16] Nevertheless, in a complex disease entity such as SLE, thyroid involvement can be listed not as prior as the first two diagnoses, and consequently missed some real thyroid problems. Reviewing the diagnosis code in our database, thyroid diseases were seldom listed as the primary or secondary diagnosis. These results imply the unique results from NHIRD studies would better be confirmed by clinical data before its application to physicians' practice.

Table 3 Logistic regression analysis of SLE and overlap syndrome predicting total thyroid disease adjusted for age and gender.

Variable	N	Total thyroid disease (n = 489)				Hyperthyroidism (n = 180)				Hypothyroidism (n = 237)				Autoimmune Thyroiditis (n = 151)			
		OR	95% CI Lower	95% CI Upper	P	OR	95% CI Lower	95% CI Upper	P	OR	95% CI Lower	95% CI Upper	P	OR	95% CI Lower	95% CI Upper	P
Non-SLE	11184	1	–		–	1	–		–	1	–		–	1	–		–
SLE non-overlap syndrome	1947	4.20	3.59	4.91	<0.0001	2.76	2.18	3.50	<0.0001	4.81	3.95	5.86	<0.0001	4.40	3.09	6.30	<0.0001
SLE overlap syndrome	849	6.79	5.69	8.11	<0.0001	3.18	2.38	4.24	<0.0001	8.68	7.03	10.73	<0.0001	10.58	7.53	14.88	<0.0001
SLE non-overlap syndrome	1947	1				1				1				1			
SLE overlap Syndrome	849	1.62	1.33	1.97	<0.0001	1.15	0.83	1.97	0.3759	1.81	1.44	2.27	<0.0001	2.40	1.66	3.49	<0.0001

CI = confidence interval; OR = odds ratio; SLE = systemic lupus erythematosus.

Table 4a Prevalence of anti-thyroid autoantibody in SLE patients with hyperthyroidism and hypothyroidism.

	ATGAb+ number (%)	p	TPOAb+ number (%)	p
Hyperthyroidism	25/180 (13.9)		17/180 (9.4)	
Overlap+	17/100 (17.0)	0.18	12/96 (11.1)	0.13
Overlap−	8/80 (10.0)		5/84 (5.9)	
Hypothyroidism	39/237 (16.5)		35/237 (14.8)	
Overlap+	27/150 (18.0)	0.40	25/147 (17.0)	0.21
Overlap−	12/87 (13.8)		10/90 (11.1)	

Table 4b Prevalence of anti-dsDNA antibody in SLE patients with or without thyroid disease.

SLE patients	Anti-dsDNAAb+	Anti-dsDNAAb−	p
Hyperthyroidism+	38	137	
Hyperthyroidism−	538	2078	0.86
Hypothyroidism+	34	108	
Hypothyroidism−	542	2112	0.38
Autoimmune thyroiditis+	34	101	
Autoimmune thyroiditis−	542	2119	0.18

SLE is a prototype of autoimmune diseases characterized by its multi-organ involvement. The complex pathogenesis mechanisms of SLE mainly involve the dysregulation of self-reactive T and B lymphocytes leading to multiple autoantibody production, subsequent type 2 and 3 hypersensitivity reactions and complement activation with tissue damage.[3] In 2011, FDA proved Belimumab—the monoclonal antibody to B lymphocyte stimulator (BLys), for SLE patients.[17] Belimumab binds to secreted BLys and thus prevents BLys from binding to B cells. Lacking BLys, B cells commit suicide, and no more contribute autoimmune damage to SLE.[18] So, the autoimmune B cell, one of the core participants in SLE, is now further confirmed by the efficacy of Belimumab. Through multiple autoantibody production, various organs are involved, including thyroid gland. Clustering of multiple autoimmune diseases has been reported by some studies.[11,15] Increased frequency of thyroid autoimmunity was reported among SLE, RA, SSc, SS, and mixed connective tissue disease (MCTD) patients, especially MCTD and SS.[16–18] The rate of overlap syndrome was reported to be 39.7%–41% of SLE patients, among which SS was the most commonly coexisting autoimmune disease in SLE. One report ever specially considered SLE, SS and AITD as "chaperones",[19] this phenomenon was also significant in our study. This can explain the data from the present study. First, the SLE patients had risks for thyroid diseases than the matched controls; second, 801 out of the 849 overlap syndrome SLE patients had SS, carried even higher rate of AITD and hypothyroidism, the commonly immune-mediated thyroid diseases.

The systemic and organ-specific autoimmune diseases are associated with each other. There were discrepancies between serologically autoimmunity and clinical symptoms,

Table 5 Logistic regression analysis of renal, CNS involvement, and thrombocytopenia between SLE with thyroid diseases and SLE without thyroid diseases.

Variable	N	Renal involvement				CNS involvement				Thrombocytopenia			
		OR (N) (%)	95% CI		P	OR (N) (%)	95% CI		P	OR (N) (%)	95% CI		P
			Lower	Upper			Lower	Upper			Lower	Upper	
SLE without thyroid diseases	2307	1 (n = 643) (27.9%)	–		–	1 (n = 328) (14.2%)	–		–	1 (n=109) (4.7%)	–		–
SLE with thyroid diseases	489	1.27 (n = 174) (35.6%)	1.03	1.57	0.024	1.67 (n = 106) (21.7%)	1.30	2.03	<0.0001	1.42 (n=33) (6.7%)	0.92	2.19	0.11

CI = confidence interval; OR = odds ratio; SLE = systemic lupus erythematosus; CNS = central nervous system.

as previous reports.[10,16,17] This phenomenon can be explained by the simple presence of thyroid auto-antibody, the simultaneous therapy for SLE to alleviate the inflammation in thyroid, and/or the relatively short follow-up period. In our series, 27 out of the 151 AITD patients had hyperthyroidism (17.9%); and 52 had hypothyroidism (37.8%); and among these 79 patients, 68.3% needed therapy for their thyroid dysfunction. There was a lag period between the presence of anti-thyroid autoantibody and the diagnosis of hypothyroidism. The average age of diagnosing AITD and hypothyroidism in our series was 32.78 and 37.46 years old in our series. Although AITD and hypothyroidism were often diagnosed at the same time, some hypothyroidism was not diagnosed until 2—11 years after the diagnosis of AITD.[19—21]

It is still unknown whether SLE patients have higher prevalence in anti-thyroid autoantibodies in Asian population.[22] In a systemic review and meta-analysis published in 2015, the cumulative positive rate of ATGAb and TPOAb was higher in SLE patients than health controls. There was only one small scale study in China showed higher rate prevalence of ATGAb in SLE patients.[23] Our study cannot provide the comparison in terms of the prevalence of anti-thyroid autoantibodies in SLE patients or health control. We can only check the difference anti-thyroid antibody presence in SLE patients with thyroid diseases. From the present data, the overlap syndrome group did not have higher prevalence in ATGAb or TPOAb, though they did carry higher risks in hypothyroidism and AITD. The pathogenesis of AITD cannot be explained by the presence of autoantibody alone. Besides, the presence of anti-dsDNA Ab cannot predict higher risk for thyroid diseases, either.

The association of thyroid disease and severe complications in SLE was seldom investigated. In our series, 174 among 489 thyroid involvement patients had renal involvement, the relative risk was higher than those lupus patients without thyroid involvement (35.6% vs 27.9%, $p = 0.024$). There was a report from China revealing higher rate of subclinical hypothyroidism in lupus nephritis patients (13.4%) than those without lupus nephritis (7.3%).[2] Those subclinical hypothyroidism patients showed higher 24 h urine protein and serum creatinine levels, however, no data about the rate of renal involvement in the study.

The studies about the association of thyroid problem and CNS involvement were also scarce. CNS involvement implies severe SLE condition, as evidenced by SLEDAI score.[12] Vincent A. et al. mentioned the association of systemic and nervous system autoimmunity.[24] Shahin AA et al. demonstrated the association of primary and secondary hypothyroidism to nervous system involvement.[25] ACR proposed a standard nomenclature and set of case definitions for 19 neuropsychiatric syndromes known to occur in SLE in 1999.[26] Previous reports showed wide range of CNS involvement rate from 37 to 91%,[27—29] according to different definitions. In out series, based on the items from SLEDAI score, the CNS involvement rate was 15.7%, patients with thyroid diseases showed higher risk (OR = 1.67, $p < 0.0001$). It warrants attention in clinical practice.

The limitation of this study is its retrospection. We cannot check the prevalence of ATGAb, TPOAb, or subclinical hyper/hypothyroidism. We can only analyze those SLE patients diagnosed as thyroid diseases to provide some relevant information in caring SLE patients.

In conclusion, from this 2796 case study, the cumulative incidence of thyroid diseases in SLE patients was 17.5% in 10.5 years follow-up, which is higher than controls. Lupus patients having overlap syndrome are more susceptible to thyroid diseases than those without overlap syndrome. Thyroid diseases in lupus patients carry higher risk for renal and CNS involvement.

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