The Rate and Pattern of Organ Damage in Late Onset Systemic Lupus Erythematosus

PETER MADDISON, VERNON FAREWELL, DAVID ISENBERG, CYNTHIA ARANOW, SANG-CHEOL BAE, SUSAN BARR, JILL BUYON, PAUL FORTIN, ELLEN GINZLER, DAFNA GLADMAN, JOHN HANLY, SUSAN MANZI, OLA NIVED, MICHELLE PETRI, ROSALIND RAMSEY-GOLDMAN, and GUNNAR STURFELT, for the Systemic Lupus International Collaborating Clinics

ABSTRACT. ***Objective.*** To compare the extent and type of damage in patients with late onset and earlier onset systemic lupus erythematosus (SLE) using the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index (SDI).

Methods. A total of 86 SLE patients with disease onset after the age of 54 years were matched for center, sex, and ethnic origin with 155 SLE patients with disease onset before the age of 40 years. SDI scores were obtained at one year and 5 years after the diagnosis of SLE. Analysis was based on conditional logistic regression.

Results. SDI scores were higher in the late onset group than in younger patients at both one [mean 0.7 (range 0–3) vs 0.3 (range 0–3); $p < 0.001$] and 5 years [mean 1.6 (range 0–8) vs 0.9 (range 0–7); $p < 0.001$] after diagnosis. There was also a difference in the pattern of organ damage. While damage to the skin, kidneys, and central nervous system occurred with similar frequency, late onset disease was characterized by significantly more cardiovascular (OR 14.13, $p < 0.001$), ocular (OR 9.38, $p = 0.001$), and musculoskeletal (OR 2.68, $p = 0.016$) damage and malignancy (OR 7.04, $p = 0.046$).

Conclusion. The occurrence of organ damage assessed by the SDI is greater in patients with late onset SLE than in younger patients and, by this criterion, lupus cannot be judged to be more benign in this age group. Also, the pattern of damage is different, but whether this reflects age *per se* or the effect of the disease in the elderly remains to be established. (J Rheumatol 2002;29:913–7)

Key Indexing Terms:
SYSTEMIC LUPUS ERYTHEMATOSUS LATE ONSET LUPUS
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Systemic lupus erythematosus (SLE) encompasses a broad spectrum of presentations and outcomes, and increasingly it is apparent that multiple factors, inherited and environmental, influence both its susceptibility and clinical expression. For example, several studies suggest that the age of onset of lupus is an important factor influencing its presentation and course[1-13]. Compared with younger age of onset, late onset SLE is reported to have characteristic clinical and serological features and to have a more insidious onset. Some[14], but not all[15,16], studies have suggested that late

From the School of Sport, Health and Exercise Science, University of Wales, Bangor, and Department of Rheumatology, Ysbyty Gwynedd, Bangor, UK; Department of Statistical Science and Centre for Rheumatology, Department of Medicine, University College London, London, UK; Division of Rheumatology, SUNY Health Science Center at Brooklyn, Brooklyn, NY, USA; The Hospital for Rheumatic Disease, Department of Medicine, Division of Rheumatology, Hanyang University College of Medicine, Seoul, Korea; Department of Rheumatology, Johns Hopkins University School of Medicine, Baltimore, MD, USA; Department of Rheumatology, Hospital for Joint Diseases and New York University School of Medicine, New York, NY, USA; Arthritis Centre of Excellence and University of Toronto; Center for Prognosis Studies in the Rheumatic Diseases, University Health Network, Toronto Western Hospital, Toronto, Ontario, Canada; Department of Medicine, Division of Rheumatology, Dalhousie University, Halifax, Nova Scotia, Canada; Department of Medicine and Epidemiology, University of Pittsburgh School of Medicine and Graduate School of Public Health, Pittsburgh, PA, USA; Department of Rheumatology, University Hospital of Lund, Lund, Sweden; and Division of Rheumatology, Department of Medicine, Northwestern University Department of Medicine, Chicago, IL, USA.

P. Maddison, MD, FRCP, Professor of Joint and Muscle Disorders, University of Wales; V. Farewell, PhD, Professor of Medical Statistics, Department of Statistical Science, University College London; D. Isenberg, MD, FRCP, ARC Diamond Jubilee Professor of Rheumatology, Department of Medicine, University College London; C. Aranow, MD, Associate Professor of Medicine, SUNY Health Science Centre at Brooklyn; S-C. Bae, MD, PhD, MPH, Associate Professor of Internal Medicine, Hanyang University College of Medicine; S. Barr, MD, MSc, FRCPC, Associate Professor of Medicine, Johns Hopkins University School of Medicine; J. Buyon, MD, Professor of Medicine, New York University School of Medicine; P. Fortin, MD, MPH, FRCPC, Senior Research Scholar, The Arthritis Society, Associate Professor of Medicine, Arthritis Centre of Excellence and University of Toronto; E. Ginzler, MD, MPH, Professor of Medicine, SUNY Health Science Centre at Brooklyn; D. Gladman, MD, FRCPC, Professor of Medicine, University Health Network, Toronto Western Hospital; J. Hanly, MD, FRCPC, Professor of Medicine, Dalhousie University; S. Manzi, MD, MPH, Associate Professor of Medicine, University of Pittsburgh School of Medicine and Graduate School of Public Health; O. Nived, MD, PhD, Associate Professor, University Hospital of Lund; M. Petri, MD, MPH, Associate Professor of Medicine, SUNY Health Science Centre at Brooklyn; R. Ramsey-Goldman, MD, DrPH, Associate Professor of Medicine, Northwestern University Department of Medicine; G. Sturfelt, MD, PhD, Associate Professor, University Hospital of Lund.

Address reprint requests to Prof. P.J. Maddison, Department of Rheumatology, Ysbyty Gwynedd, Bangor LL57 2PW, Wales, UK.

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onset disease is milder and has a better prognosis. Thus, Formiga, *et al*[17] showed that scores of disease activity measured by the SLE Disease Activity Index (SLEDAI)[18] were lower in SLE patients with disease onset after age 50 years compared with younger patients both at presentation and during the first year of disease.

However, studies of late onset SLE have been limited by the small number of subjects studied, the presence of both selection and information bias, the lack of appropriate controls, and the absence of universally accepted measures of SLE outcome. We had access to a large population of patients with well characterized SLE followed prospectively in the participating centers of the Systemic Lupus International Collaborating Clinics (SLICC). To determine whether late onset SLE is associated with a benign course or not, we used the SLICC/American College of Rheumatology (ACR) Damage Index (SDI)[19] to assess the accumulation of damage over 5 years from time of diagnosis. Late onset SLE patients were compared with younger patients, using the age of 54 years as the arbitrary cutoff for older patients and 40 years for younger patients.

MATERIALS AND METHODS

Subjects. The subjects consisted of 86 patients with SLE who were diagnosed after the age of 54 years (late onset group) and had been followed for at least 5 years. Drug induced lupus was excluded. All patients had been studied prospectively in one of the participating SLICC centers. The late onset group was compared with 155 patients with disease that was diagnosed before the age of 40 years. For each late onset patient, one or 2 younger controls were randomly selected from the same center, with additional matching for sex and racial background.

Measures. Accumulated damage was assessed by the SLICC/ACR SDI[19], a validated measure of progressive damage in SLE. To obtain a score using the SDI, damage (defined as irreversible impairment since the onset of SLE) must be present continuously for at least 6 months. The items in the SDI have been reported in detail[19]. Damage is assessed in 12 organ systems: ocular (range 0–2), neuropsychiatric (0–6), renal (0–3), pulmonary (0–5), cardiovascular (0–6), peripheral vascular (0–5), gastrointestinal (GI) (0–6), musculoskeletal (0–7), skin (0–3), gonadal (0–1), endocrine (0–1), and malignancy (0–2). Damage over time can only increase, theoretically to a maximum total score of 47. In this study, SDI scores were obtained for each subject one year and 5 years after the diagnosis of SLE.

Statistical analysis. The analysis was based on conditional logistic regression in which each late onset subject was compared with her/his matched early onset control(s) and no assumptions were made about the distribution of the variables being compared. Odds ratios were estimated where an OR of 1 corresponds to no difference between cases and controls with respect to the associated variable, an OR > 1 indicates that high values of the variable are associated with late onset cases, and, conversely, an OR < 1 indicates that low values are associated with late onset cases. Multivariate and univariate analyses were performed.

This analysis provides a robust method of discriminating between early and late onset patients. The variables used for discrimination were the patients' SDI scores at one and 5 years, or equivalently the scores at one year and their difference. In addition, a discrimination based on the pattern of organ involvement at 5 years was done based on the items recorded in the SDI.

RESULTS

Demographic details of the subjects are summarized in Table 1. The mean ages at diagnosis of SLE in the late onset group and the younger group were 61 and 29 years, respectively, and 98% were women. All had been followed prospectively in one or other of the participating SLICC centers for at least 5 years. Patients from different racial backgrounds were included.

Table 2 summarizes the SDI scores in the late onset group and the younger patients. Univariate analysis showed that the SDI scores were significantly higher in the late onset patients at both one year and 5 years after diagnosis. However, as illustrated by the multivariate analysis (Table 3), the rate of accumulating damage over 5 years, represented by the change in SDI scores, is not significantly different between the groups. Thus, for 2 patients with the same SDI at one year, knowledge of their 5 year score, which is equivalent to knowledge of the change in their SDI score, did not distinguish late and early patients (p = 0.294). The mean and range of SDI scores for non-white late onset patients were 1.17 (0–3) at one year and 2.3 (0–8) at 5 years. For white patients the comparable numbers were 0.45 (0–3) and 1.18 (0–7). For non-white early onset patients the one and 5 year values were 0.38 (0–3) and 1.28 (0–7), while for white early onset patients they were 0.31 (0–2) and 0.74 (0–5). Thus higher SDI scores were observed in non-white

Table 1. Demographic details of the subjects.

Group	Age of Onset of SLE, yrs mean (range)	F:M	Racial Group
Late onset, n = 86	61 (55–83)	84:2	65% White 29% Black 3% Hispanic 3% Asian
Younger onset, n = 155	29 (15–40)	153:2	62% White 32% Black 3% Hispanic 3% Asian

Table 2. Univariate analysis of SDI scores at Year 1 and Year 5 after diagnosis of SLE.

Group	SDI at 1 Year, mean (range)	SDI at 5 Years, mean (range)	Change in SDI Score
Late onset	0.7 (0–3)	1.6 (0–8)	0.9 (0–7)
Younger onset	0.3 (0–3)	0.9 (0–7)	0.6 (0–4)
Estimated OR	2.264	1.431	1.279
p	< 0.001	< 0.001	0.062

Table 3. Multivariate analysis of SDI scores at Year 1 and the change in score 5 years after diagnosis of SLE.

Variable	OR (95% CI)	p
SDI at 1 yr	2.161 (1.38, 3.380)	< 0.001
Change in SDI	1.164 (0.88, 1.54)	0.294

patients and there were smaller differences between late and early onset cases for whites than non-whites. The most marked difference is in the one-year values, with a difference of 0.79 for non-whites and 0.14 for whites. However, there is not strong evidence for an interaction between the Year 1 SDI scores and race (p = 0.114), although, reflecting the differences above, the estimated OR associated with Year 1 scores for non-whites is 3.37 and for whites it is 1.54.

The pattern of organ damage registered by the SDI at one year and at 5 years is summarized in Table 4. More than half the patients of both groups showed damage 5 years after diagnosis (a total SDI score > 0), but the proportion of late onset patients with damage was significantly higher than the younger group. Damage to the skin, kidneys, central nervous system (CNS), lungs, and GI tract occurred with a similar frequency in both groups. However, the late onset patients seemed to have a different pattern of involvement, with more ocular, musculoskeletal, and cardiovascular damage and a greater number of malignancies. The multivariate analysis (Table 5) confirmed that there is strong evidence for large differences in cardiovascular and ocular involvement between late and early onset cases, with estimated OR of 14.13 and 9.38, respectively. There was also strong evidence for a smaller difference in musculoskeletal damage (estimated OR 2.68). A difference was also seen in the occurrence of malignancies, but evidence for this was weaker. In the late onset group, 2 patients had carcinoma of the colon and there was one case each of cancer of the breast, gall bladder, prostate, and skin as well as one case of leukemia. In the younger patients there was one case of carcinoid of the appendix and one non-Hodgkin's B cell lymphoma.

As summarized in Table 6, the increase in cardiovascular damage recorded in late onset patients was predominantly due to coronary artery disease (CAD). In the younger patients, cardiovascular damage related more to chronic pericardial disease. The pattern of cardiovascular damage and damage in the other organ systems in the late onset patients was similar regardless of racial background (data not shown).

DISCUSSION

While it is well recognized that SLE predominantly affects young women and is diagnosed most frequently between the second and fourth decades of life, several reports, making an arbitrary division between "old" and "young" patients at some age usually between 50 and 60 years, have shown that late onset SLE comprises between 10% and 20% of the lupus population[1-13]. Further, in an epidemiological study of SLE in Southern Sweden, the highest incidence rates of lupus occurred in the sixth decade[20]. Although studies of late onset lupus have been based up to now on rather small numbers of patients, the consensus has been that the age of onset of lupus influences the expression and course of the disease. Thus, in a metaanalysis of studies of late onset SLE up to 1988, Ward and Polisson[14] concluded that, compared to younger onset, late onset disease is more insidious in onset and less severe. However, this study was undertaken before an internationally agreed damage index for lupus had been produced and validated. Indeed, the conclusions of clinical studies of SLE have, until the last decade, been

Table 5. Multivariate analysis of the pattern of organ involvement shown by the SDI 5 years after diagnosis of SLE.

Variable	OR (95% CI)	p
Cardiovascular	14.13 (3.61, 55.20)	< 0.001
Ocular	9.38 (2.47, 35.72)	0.001
Musculoskeletal	2.68 (1.20, 6.01)	0.016
Malignancy	7.04 0.016 (1.04, 47.76)	0.046

Table 4. The pattern of organ involvement shown by the SDI 5 years after diagnosis of SLE by univariate analysis. Damage is defined as a score greater than 0.

Variable	% of Late Onset Patients with Score > 0		% of Younger Patients with Score > 0		p*
	Year 1	Year 5	Year 1	Year 5	
Ocular	8	19	1	14	< 0.001
Neuropsychiatric	10	16	9	17	0.947
Renal	7	10	4	10	0.856
Pulmonary	1	2	2	5	0.453
Cardiovascular	7	24	3	5	< 0.001
Peripheral vascular	3	9	4	5	0.147
Gastrointestinal	1	6	1	3	0.377
Musculoskeletal	12	29	3	12	0.002
Skin	10	14	6	10	0.381
Gonadal	NA		0	5	
Diabetes	1	6	1	3	0.134
Malignancy	0	8	0	1	0.007
SDI score > 1	48.8	66.3	29.6	50.3	0.013

* Comparing SDI assessments at Year 5.

Table 6. The occurrence and pattern of ocular, musculoskeletal, and cardiovascular damage 5 years after diagnosis of SLE.

Organ Damage	Occurrence in Late Onset Group, %	Occurrence in Younger Group, %
Ocular		
Cataract	19	2
Retinopathy	2	2
Musculoskeletal		
Atrophy/weakness	6	2
Deforming or erosive arthritis	14	2
Osteoporosis with fracture	13	1
Avascular necrosis	5	8
Cardiovascular		
Angina/myocardial infarct/ coronary artery bypass	15	1
Ventricular dysfunction	7	0
Valvular disease	2	1
Pericarditis	0	5

greatly limited by the absence of universally accepted measures to assess the effects of the disease and its outcome. At a conference on prognosis studies in SLE in Toronto in 1985, it was concluded that to assess the prognosis of lupus adequately, 3 aspects of the disease needed to be addressed: disease activity, accumulated damage, and health status[18]. Since then a number of validated disease activity measures have been described[21] as well as the SDI[19] that was developed and subsequently validated to measure cumulative damage in SLE. Since death has become a less useful measure in lupus outcome studies, this index is considered to be a more relevant outcome measure, particularly since the degree of SLE related organ damage is often the most important factor associated with poor prognosis[22]. Therefore, we used the SDI in this study to compare the accumulation of damage in patients with late onset lupus with that in younger patients.

The SDI records permanent damage in 12 organ systems occurring after the diagnosis of SLE regardless of its cause. Damage can thus be due to the disease itself or complications due to medication such as avascular necrosis or diabetes mellitus. It also records damage from concurrent illness such as CAD or cancer. The SDI has been shown to have good interobserver reliability[23] and is therefore appropriate to use in multicenter studies of lupus such as this.

The main conclusion of this study is that, in contrast to a previous view, the occurrence of organ damage as assessed by the SDI is greater in late onset SLE than in younger patients and, by this criterion, lupus cannot be judged to be more "benign" in this age group. This finding agrees with other studies that conclude that late onset lupus is not a benign subgroup[15,16]. Perhaps the differing racial background of the patients accounts for the contradictory conclusions of outcome studies of late onset lupus. Certainly, accumulation of organ damage measured by the SDI is greater in non-white than white patients[24]. Our study population was multiracial, and although the SDI scores were in the region of those reported in other studies[25], the scores were higher in the non-white patients, in both the late onset and the younger group. However, our analysis showed no strong evidence for an effect of race on differences between late onset and younger patients in their accumulation of organ damage.

We cannot comment on the disease activity of our patients, but the findings of Formiga, *et al*[17], who showed that late onset patients had lower SLEDAI scores at onset and during the first year of disease than younger SLE patients, are at odds with our own results. However, previous studies[25,26] have shown only a low association between SDI scores and measures of disease activity in SLE, indicating that they measure 2 distinct, although related, constructs. Further, in a longitudinal study[27], SDI scores were observed to rise in patients with mildly active disease, suggesting additional causes of morbidity and damage.

An additional observation in this study was that the pattern of organ damage recorded by the SDI was different in late onset and younger patients. While the occurrence of damage to the kidneys and CNS was similar in the 2 groups, late onset patients had significantly more ocular, musculoskeletal, and especially cardiovascular damage (Tables 5 and 6).

While ocular damage was mainly cataract formation in both groups (Table 6), musculoskeletal damage in late onset patients was mainly deforming arthritis and osteoporosis, while in the younger patients a greater proportion had one or more episodes of aseptic necrosis. The cardiovascular damage was predominantly due to CAD, in contrast to the predominantly pericardial disease in the younger patients. Also, late onset patients had more malignancies, although the evidence for a significant difference was weaker.

Because of the simple design of this study, the conclusions we can draw from these interesting observations are limited. For example, we do not know whether these results reflect the aging process *per se* or the specific effect of SLE in older people.

One interpretation is that these results reflect an important interaction between age and SLE, and that lupus accelerates processes such as CAD in these patients. Indeed, it is emerging that SLE is one of the most potent risk factors for CAD. The prevalence of atherosclerosis is increased in SLE and CAD is a major cause of morbidity and mortality in this condition. In several SLE cohorts, the prevalence of clinical CAD ranges from 6 to 10% and, compared to control populations, the risk of clinical CAD in women with SLE is increased overall by 5 to 8-fold[28,29]. As well as the standard risk factors for atherosclerosis, there appear to be additional risk factors due to SLE itself, including immunological abnormalities, the result of disease complications such as hypertension and nephrotic syndrome and its treatment, for example, corticosteroids[30-32]. While concern has focused quite rightly on the premature CAD developing in younger

women with lupus, with a 52-fold risk estimated for women in the 35–44 age group, previous studies have shown that increasing age is one of the principal risk factors for development of carotid atheroma in SLE[33]. This is in keeping with the results reported here.

However, another interpretation is that the results reflect that people in their 60s are more likely to get cataracts, arthritis, osteoporosis, CAD, and cancer than people in their 20s and 30s whether they have SLE or not. Although the SDI records damage occurring after the diagnosis of SLE, it does include the effects of comorbidity that is expected to a greater extent in older people. This raises the question whether the SDI is a less valid outcome measure for SLE in late onset patients. To answer this requires a study using the SDI with a different design in which patients with late onset SLE are appropriately matched with randomly selected individuals from a family practice register and patients with another chronic inflammatory disease such as rheumatoid arthritis.

REFERENCES

1. Foad BS, Sheon RP, Kirsner AB. Systemic lupus erythematosus in the elderly. Arch Intern Med 1972;130:743-6.
2. Baker SB, Rovira JR, Campion EW, Mills JA. Late onset systemic lupus erythematosus. Am J Med 1979;66:727-32.
3. Wilson HA, Hamilton ME, Spyker DA, et al. Age influences the clinical and serologic expression of systemic lupus erythematosus. Arthritis Rheum 1981;24:1230-5.
4. Gossat DM, Walls RS. Systemic lupus erythematosus in later life. Med J Aust 1982;1:297-9.
5. Ballou SP, Khan MA, Kushner I. Clinical features of systemic lupus erythematosus: differences related to race and age of onset. Arthritis Rheum 1982;25:55-60.
6. Catoggio LJ, Skinner RP, Smith G, Maddison PJ. Systemic lupus erythematosus in the elderly: clinical and serological characteristics. J Rheumatol 1984;11:175-81.
7. Hochberg MC, Boyd RE, Ahearn JM, et al. Systemic lupus erythematosus: a review of clinico-laboratory features and immunogenetic markers in 150 patients with emphasis on demographic subsets. Medicine 1985;64:285-95.
8. Hashimoto H, Tsuda H, Hirano T, Takasaki Y, Matsumoto T, Hirose S. Differences in clinical and immunological findings of systemic lupus erythematosus related to age. J Rheumatol 1987;14:497-501.
9. Jonsson H, Nived O, Sturfelt G. The effect of age on clinical and serological manifestations in unselected patients with systemic lupus erythematosus. J Rheumatol 1988;15:505-9.
10. Font J, Pallares L, Cervera R, et al. Systemic lupus erythematosus in the elderly: clinical and serological characteristics. Ann Rheum Dis 1991;50:702-5.
11. Costallat LTL, Coimbra AMV. Systemic lupus erythematosus: clinical and laboratory aspects related to age at disease onset. Clin Exp Rheumatol 1994;12:603-7.
12. Koh ET, Boey ML. Late onset lupus: a clinical and immunological study in a predominantly Chinese population. J Rheumatol 1994;21:1463-7.
13. Ho CTK, Mok CC, Lau CS, Wong RWS. Late onset systemic lupus erythematosus in southern Chinese. Ann Rheum Dis 1998;57:437-40.
14. Ward MM, Polisson RP. A meta-analysis of the clinical manifestations of older-onset systemic lupus erythematosus. Arthritis Rheum 1989;32:1226-32.
15. Mak SK, Lam EKM, Wong AKM. Clinical profile of patients with late-onset SLE: not a benign subgroup. Lupus 1998;7:23-8.
16. Pu SJ, Luo SF, Wu YJJ, Cheng HS, Ho HH. The clinical features and prognosis of lupus with disease onset at age 65 and older. Lupus 2000;9:96-100.
17. Formiga F, Moga I, Pac M, Mitjavila F, Rivera A, Pujol R. Mild presentation of systemic lupus erythematosus in elderly patients assessed by SLEDAI. Lupus 1999;8:462-5.
18. Bombardier C, Gladman DD, Urowitz MB, Charron D, Chang CH, and the Committee on Prognosis Studies in SLE. The development and validation of the SLE Disease Activity Index (SLEDAI). Arthritis Rheum 1992;35:630-40.
19. Gladman D, Ginzler E, Goldsmith C, et al. The development and initial validation of the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index for systemic lupus erythematosus. Arthritis Rheum 1996;39:363-9.
20. Jonsson H, Nived O, Sturfelt G, Silman A. Estimating the incidence of systemic lupus erythematosus in a defined population using multiple sources of retrieval. Br J Rheumatol 1990;29:185-8.
21. Gladman DD, Goldsmith CH, Urowitz MB, et al. Cross-cultural validation and reliability of three disease activity indices in SLE. J Rheumatol 1992;19:608-11.
22. Abu-Shakra M, Urowitz M, Gladman D, Gough J. Mortality in systemic lupus erythematosus: results from a single center. I. Causes of death. J Rheumatol 1995;22:1259-64.
23. Gladman DD, Urowitz MB, Goldsmith CH, et al. The reliability of the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index in patients with systemic lupus erythematosus. Arthritis Rheum 1997;40:809-13.
24. Sutcliffe N, Clarke AE, Gordon C, Farewell V, Isenberg DA. The association of socio-economic status, race, psychosocial factors and outcome in patients with systemic lupus erythematosus. Rheumatology 1999;38:1130-7.
25. Stoll T, Stucki G, Malik J, Pyke S, Isenberg DA. Association of the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index with measures of disease activity and health status in patients with systemic lupus erythematosus. J Rheumatol 1997;24:309-13.
26. Gladman DD, Urowitz MB, Ong A, MacKinnon A. Lack of correlation among the 3 outcomes describing SLE: disease activity, damage and quality of life. Clin Exp Rheumatol 1996;14:305-8.
27. Nossent JC. SLICC/ACR Damage Index in Afro-Caribbean patients with systemic lupus erythematosus: changes in and relationship to disease activity, corticosteroid therapy, and prognosis. J Rheumatol 1998;25:654-9.
28. Petri M, Spence D, Bone LR, Hochberg MC. Coronary artery disease risk factors in the Johns Hopkins lupus cohort: prevalence, recognition by patients, and preventive practices. Medicine 1992;71:291-303.
29. Manzi S, Meilahn EN, Rairie JE, et al. Age-specific incidence rates of myocardial infarction and angina in women with systemic lupus erythematosus: Comparison with the Framingham Study. Am J Epidemiol 1997;145:408-15.
30. Petri M, Perez-Gutthann S, Spence D, Hochberg MC. Risk factors for coronary artery disease in patients with SLE. Am J Med 1992;93:513-9.
31. Rahman P, Urowitz MB, Gladman DD, Bruce IN, Genest J Jr. Contribution of traditional risk factors to coronary artery disease in patients with systemic lupus erythematosus. J Rheumatol 1999;26:2363-8.
32. George J, Harats D, Gilburd B, Levy Y, Langevitz P, Shoenfeld Y. Atherosclerosis-related markers in systemic lupus erythematosus patients: The role of humoral immunity in enhanced atherogenesis. Lupus 1999;8:220-6.
33. Manzi S, Selzer F, Sutton-Tyrell K, et al. Prevalence and risk factors of carotid plaque in women with systemic lupus erythematosus. Arthritis Rheum 1999;42:51-60.