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Original Research Article

Body composition in lupus nephritis patients

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ABSTRACT

Background: The assessment of body fat distribution is an important evaluation in patients with lupus nephritis (LN), which does not practice routinely. The objectives of this study were to determine the body composition by using bioelectrical impedance analysis and to identify the effects of age, body mass index, disease activity, and corticosteroid therapy on body composition.
Methods: This was a single-centered, cross-sectional, and observational study conducted at the nephrology unit, National Hospital Kandy, Sri Lanka. Seventy-nine patients with biopsy-proven LN have participated in the study.
Results: There were 79 lupus nephritis patients enrolled in this study. The duration of LN ranged from 8 months to 32 years. The main non-renal clinical manifestations included skin lesions (59%), arthritis (54%), and oral ulcers (48%). The disease activity was low with a mean SLEDAI score of 1.01 (SD=2.3). The body fat (BF) percentage ($p=0.002$) and subcutaneous fat (SF) percentage ($p<0.001$) were significantly low in males compared to females. And, BF percentage was significantly low among patients with SLEDAI-2K 6 ($p=0.03$). Moreover, there were positive correlations found between SLE disease activity with the BMI ($p=0.004$), body fat percentage ($p=0.001$), and visceral fat percentage ($p=0.001$).
Conclusions: Females are more prone to have a high mean value of body composition parameters than males in this study. There is a negative influence of the body composition parameters reported against the disease activity among LN patients in Sri Lanka.

Keywords: Bioelectrical impedance analysis, Body fat, Lupus nephritis, Sri Lanka, Subcutaneous fat, Visceral fat

INTRODUCTION

Systemic lupus erythematosus (SLE) is a chronic autoimmune inflammatory disease that is characterized by autoantibody production, complement activation, and deposition of immune complexes in the body.[1] However, the specific etiopathogenesis of the disease condition is still not defined clearly.[2] The prevalence of SLE is about 20-200 per 100,000 person-years. A higher SLE incidence is reported in middle-aged women in Asian, African, and Hispanic populations and the severity of the disease is reported to be increased with extreme ages of life. Other than that corticosteroid use, disease activity, and duration of the disease are other predictors of poor prognosis in sle.[1,2]

SLE which damages several organ systems of the human body can be diagnosed and classified based on the wide spectrum of clinical and serological manifestations. Among the numerous manifestations reported so far,

lupus nephritis (LN) is one of the most serious manifestations which are associated with high morbidity and mortality.[2] According to the previous literature, nearly 60% of patients among SLE patients develop LN and among them, about 10% eventually develop end-stage renal disease (ESRD).[3,4]

Therefore, when managing ln patients, it is important to take appropriate measures to prevent the disease progression to ESRD. Other than administering medications, the physical activity and nutritional status should be assessed routinely. A multifaceted approach is necessary to enhance their quality of life.

Kidney diseases generally affect nutrient intake, metabolism, and energy expenditure, predisposing patients to the development of malnutrition.[5] Malnutrition is considered one of the major risk factors associated with increased morbidity and mortality.[5,6] On the other hand, malnutrition is also a serious consequence of several chronic diseases.[7] It is also associated with chronic inflammation as well as the development of autoimmunity.[8] Hence it is necessary to assess the body compositions of the ln patients routinely to minimize the complications which might be occurred due to malnutrition. Even though this is a very important aspect of studies, the evidence-based data on this field of study is sparse. Up to date, to the best of our knowledge, this is the first publication in Sri Lanka.

The objectives of this study were to determine the body composition of the patients with LN using the bioelectrical impedance analysis and to study the effect of age, gender, body mass index, disease activity, and corticosteroid therapy on body composition.

METHODS

This was a single-centered, cross-sectional, and observational study conducted at the nephrology unit, National Hospital Kandy, Sri Lanka. Seventy-nine patients aged between 19 to 62 years with biopsy-proven ln attended the renal clinic from June 2019 to June 2020 were recruited. All patients fulfilled systemic lupus international collaborating clinic (SLICC) diagnostic criteria with at least 4 criteria, including at least one clinical criterion and one immunologic criterion.

Demographic and clinical profile data was obtained from Asia Pacific Lupus Collaboration (APLC) database. Data included age, gender, disease duration, SLE clinical manifestations, SLE disease activity index (SLEDAI), immunological profile, drug management, and anti-phospholipid syndrome.

Height was measured to the nearest 0.5cm in the erect position without shoes by using a stadiometer. A bioelectrical impedance analyser (BIA) was utilized to measure the body weight to the nearest 100 gm with wearing clothes and without shoes. Body mass index (BMI) was calculated as weight/height^2 (kg/m^2). Body composition was assessed by performing an eight-electrode BIA, which included total body fat (BF) mass, visceral fat (VF) mass, skeletal muscle mass, and segmental body composition. Before the BIA assessment, patients were advised to be on fasting for at least 6 hours, not to engage in vigorous physical activity for at least 12 hours, and to avoid alcohol, coffee, or tea intake for 4 hours.

Exclusion criteria includes disabled patients who cannot stand on the BIA machine, ages younger than 18 or older than 65 years, patients who did not give consent, and patients with underlying malignancy and chronic infection, and pregnancy.

Sample size calculation:

$$n = \frac{z^2 P\,(1-P)}{1 + \frac{Z^2 P\,(1-P)}{e^2 N}}$$

n = sample size

z = Z score of 95% confidence interval

e = margin of error

P = Prevalence of SLE cases in Asia

N = Available SLE population size

$$n = \frac{(1.96)^2 * 5 * 10^{-4}\,(1-0.9995)}{1 + \frac{(1.96)^2 * 5 * 10^{-4}\,(1-0.9995)}{0.05^2 * 90}}$$

n = 74 (minimum sample size for the study)

We used the World Health Organization (WHO) Asian Body Mass Index (BMI) classification to assess the BMI, according to a BMI less than 18.5 kg/m^2 is considered underweight, BMI between 18.5 and 23.0 kg/m^2 is in the normal range, between 23.1 and 27.5 kg/m^2 is considered as overweight and BMI over 27.5 kg/m^2 is obese.

Total body mass of more than 25% in males and more than 32% in females were considered as high. Visceral fat percentage over 13% in both genders was taken as high. Skeletal muscle mass above 30% in males and above 23% in females was regarded as good.

Written informed consent was obtained from all participants and the study was approved by the Institutional Ethics Committee National Hospital, Kandy. Continuous variables were analysed using Mean±standard deviation. A p value of <0.05 was considered statistically significant and a p value <0.01 was considered very significant. Statistical Package for the Social Sciences (SPSS) 23 (trial version) software was used for data analysis.

RESULTS

Seventy-nine lupus nephritis patients were enrolled in this study. Among those 79 patients, the male:female ratio was 1:8.9. The duration of LN ranged from 8 months to 32 years. The main non-renal clinical manifestations included skin lesions (59%), arthritis (54%), and oral ulcers (48%). The disease activity was low with a mean SLEDAI score of 1.01 (SD=2.3). Seventy-five patients (94%) had immunological abnormalities at the baseline assessment. In the study group, hydroxychloroquine (HCQ), mycophenolate mofetil (MMF), azathioprine, tacrolimus, and cyclophosphamide usage were 69%, 55%, 33%, 12%, and 1% respectively. Five (6%) patients were already diagnosed with antiphospholipid syndrome. The demographic and clinical characteristics of patients are presented in Table 1.

Table 1: Demographic and clinical characteristics of patients with SLE (n=79).

Characteristics	SLE patients (n=79)
Age, years±SD	37.45±10.6
Gender, Female N (%)	71 (89)
Disease duration, years, mean	10.01
SLEDAI	1.01±2.3
SLE manifestations, N (%)	
Skin involvement	47 (59)
Oral ulcers	38 (48)
Arthritis	43 (54)
Serositis	0
Haematological disorders	12 (15)
Cerebral involvement	14 (17)
Immunological disorders, N (%)	
ANA (+)	75 (94)
anti-ds DNA (+)	48 (60)
Hypocomplementemia	36 (45)
SLE activity, N (%)	
Remission (SLDEAI-2K=0)	64 (81)
Low (SLDEAI-2K=1-5)	11 (14)
Moderate (SLDEAI-2K=6-10)	3 (3)
High (SLDEAI-2K=11-19)	1 (1)
Treatment	
Glucocorticoid therapy (GC) usage, N (%)	65 (82)
Daily dose of GC, mg±SD	6.86±7
Hydroxychloroquine (HCQ) usage, N (%)	55 (69)
Daily dose of HCQ, mg±SD	146.66±89.03
Mycophenolate mofetil (MMF) usage, N (%)	44 (55)
Daily dose of MMF, mg±SD	560±545
Azathioprine usage, N (%)	26 (33)
Cyclophosphamide usage, N (%)	1 (1)
Tacrolimus usage, N (%)	10 (12)
Antiphospholipid syndrome, N (%)	5 (6)

The BF (%) and SF (%) were significantly low in males compared to females (p=0.002; p=0.000). The comparison of age, BMI, and body composition parameters with gender is shown in Table 2.

Differences in the age, body composition parameters, and steroid dose in the patients based on disease activity are presented in Table 3. In addition, no significant differences were found in body composition parameters according to the presence and absence of skin involvement, oral ulcers, arthritis, haematological disorders, cerebral involvement, positive ANA, positive ds-DNA, and hypocomplementemia. However, BF (%) was significantly low among patients with SLEDAI -2K 6 (p=0.031).

There were positive correlations between SLE disease activity with the BMI (p=0.004), body fat percentage (p=0.001), and visceral fat percentage (p=0.001). Moreover, no statistically significant associations were found with the age, BMI, and GC dose among the study

participants. The overall correlations between SLE disease activity with the age, body composition parameters, and corticosteroid usage are shown in Table 4.

Table 2: Comparison of age, BMI and body composition parameters between males and females.

Parameters Mean±SD	Males	Females	P value
Age (years)	34.12±6.72	37.83±10.99	0.198
BMI (kg/m^2)	21.63±2.93	24.05±5.08	0.066
BF (%)	21.77±6.68	32.65±5.17	0.002**
VF (%)	5.68±3.44	6.52±4.93	0.550
SF (%)	15.96±5.63	27.85±5.71	0.000**

Table 3: Comparison of age, BMI and body comparison parameters in LN patients based on SLEDAI.

Parameters Mean±SD	SLE patients (n=79)		P value
	SLEDAI<6 (n=75)	SLEDAI≥6 (n=4)	
Age (years)	37.42±10.87	38±6.68	0.880
BMI (kg/m^2)	23.56±4.87	28.45±4.71	0.128
BF (%)	31.29±6.27	36.52±3.05	0.031*
VF (%)	6.21±4.71	10.62±5.03	0.178
SF (%)	26.30±6.65	33.2±4.75	0.997
GC dose (mg/d)	6.86±7.18	6.87±3.75	0.056

Table 4: Correlation of SLEDAI with the age, BMI, body composition parameters in SLE patients.

Parameters r (p)	SLE patients (n=79)	P value
Age (years)	-0.35	0.760
BMI (kg/m^2)	0.321	0.004**
BF (%)	0.297	0.001**
VF (%)	0.353	0.001**
GC dose (mg/d)	0.013	0.914

DISCUSSION

Assessment of body composition is very important in a variety of clinical and research contexts. It is useful in the assessment of endocrine, metabolic and nutritional disorders. Moreover, it can be used to determine the relationships of clinical characteristics and monitor the effectiveness of interventional programs. Alterations in body composition, particularly depletion of fat-free mass, are known to occur in several disorders including rheumatoid arthritis (RA).[9] In RA, elevated cytokines and corticosteroid treatment contribute to changes in body composition, and similar mechanisms may play in SLE.[10]

Bioimpedance analysis is a practical method to assess body composition (BC) based on differences in the electrical conductivity in different body compartments. It is identified as the most popular method for determining BC due to accuracy and high reproducibility of the measurements, portability of the equipment, low cost, and comfortable measurement procedure for the patient. Since it is not accompanied by radiation exposure, can be performed repeatedly under dynamic observation.[11]

The influence of body composition among LN patients in Sri Lanka has not been studied previously. Hence, in this study, we assessed the body composition of the LN patients using the bioelectrical impedance analysis and studied the effect of age, gender, body mass index, disease activity, and corticosteroid therapy on their body composition.

When considering the gender difference, variations in body composition between males and females were reported in several studies.[12] A recent study was conducted among 1649 healthy children-adults (6-18 years) and 925 adult-elders (19-92 years) using bioelectrical impedance analysis and dual-energy x-ray absorptiometry (DXA) found that for all age ranges, males have less fat mass and more fat-free mass than females. Similar results were reported in this LN population with a significantly lower BF percentage (p=0.002) and SF percentage (p=0.000) in males compared to females. Moreover, BMI (p=0.066) and VF percentage (p=0.550) was lower among males than females but it is not statistically significant. Mainly, these variations can occur due to the higher estrogen hormone concentration among females, which induce the human body to store fat.[13]

Roubenoff et al found that reduced fat-free mass present in 67% of RA patients, was significantly associated with RA disease activity.[9] In this study, there were not any statistically significant differences reported in body composition parameters according to the presence and absence of skin involvement, oral ulcers, arthritis, haematological disorders, cerebral involvement, positive ANA, positive ds-DNA, and hypocomplementemia.

However, there was a statistically significant difference found between BF percentage (p=0.031) and the disease activity except for VF percentage, SF percentage, BMI (p=0.128), and GC dose (p=0.056). Nevertheless, there were positive correlations found between SLE disease activity with the BMI (p=0.004), BF percentage (p=0.001), and VF percentage (p=0.001). This result shows that the disease activity has a significant effect on the body composition of LN patients in Sri Lanka. However, according to a study from Iran, there were no differences were found between body composition parameters (BMI, body muscle, and BF), basal metabolic rate, and daily corticosteroid dosage in the LN patients based on their disease activity.[14]

Corticosteroid usage is a major treatment method for SLE patients.[15] A previous research study found that age and total corticosteroid dose were identified as the significant predictors of reduced fat-free mass. Therefore,

researchers suggest that the total corticosteroid dose is a surrogate marker of SLE disease severity.[10] But in this LN cohort, there was not any significant association reported between GC dose and the disease activity (p=0.914).

In this study, we didn't evaluate the dietary pattern of the patients which can indirectly affect their disease activity.

CONCLUSION

In conclusion, this study demonstrates high mean values of BMI, BF percentage, VF percentage, and SF percentage among females than males. There was a statistically significant difference reported between BF percentage and the SLE disease activity and positive correlations were found between SLE disease activity with the BMI, BF percentage, and VF percentage. Hence, this finding clearly shows the influence of the body composition parameters on the disease activity among LN patients in Sri Lanka.

Recommendations

Since this is the first study on body composition analysis among LN patients in Sri Lanka, there is a need for further studies to identify the other important factors which can affect the SLE disease activity.

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