Lipid Accumulation Product Index as Visceral Obesity Indicator in Psoriasis: A Case-control Study

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Abstract

Background: Psoriasis has well-known associations with individual components of metabolic syndrome such as hypertension, dyslipidemia, insulin resistance, and obesity. Traditional anthropometric measurements of obesity such as waist circumference (WC) and body mass index (BMI) do not differentiate between subcutaneous fat and visceral fat, the latter being associated with cardiovascular risk factors. Lipid accumulation product (LAP) index is a measure of visceral fat and has been found to be a better predictor of cardiovascular risk. However, LAP index has not been well-studied in psoriasis patients.

Aims and Objectives: Our objective was to find out if LAP index differs significantly between psoriasis patients and controls and whether LAP index shows a correlation with duration and severity of psoriasis.

Materials and Methods: A case–control study was undertaken with 40 chronic plaque psoriasis patients and 42 controls. BMI and LAP index were calculated for all the patients and controls. Psoriasis area severity index (PASI) was calculated for all the psoriasis patients. Mann–Whitney U-test was done for comparing the age, BMI, WC, serum triglyceride, and LAP index between the cases and controls and to compare the LAP index between mild psoriasis and moderate-to-severe psoriasis groups. Spearman’s correlation coefficient was used to assess the correlation of LAP index with duration of psoriasis and with PASI. Logistic regression models were done to assess the risk factors in psoriasis.

Results: A statistically significant difference was observed between the LAP index of controls (23.79 ± 13.02) and that of psoriasis patients (46.42 ± 27.2). LAP index was significantly higher in the moderate-to-severe psoriasis group as compared to the mild psoriasis group. LAP index was a significant risk factor associated with psoriasis (OR = 1.07; 95% CI: 1.03 – 1.11).

Conclusion: Calculation of LAP index in psoriasis patients helps in identification of more individuals at high risk of cardiovascular morbidity than traditional anthropometric measurements of obesity.

Key Words: Cardiovascular disease risk, lipid accumulation product index, obesity, psoriasis, visceral fat

Introduction

Psoriasis is a papulosquamous skin disorder characterized by chronic inflammation. The prevalence of psoriasis varies widely in different parts of the world ranging from 1.5% to 2.8% of the population. Psoriasis is considered to be a systemic disease because of the role of autoimmunity in its pathogenesis. Comorbidities such as cardiovascular disease and metabolic syndrome have been found to be associated with psoriasis. In addition, hypertension, dyslipidemia, insulin resistance, and obesity have been found to be independently related to psoriasis, apart from as components of metabolic syndrome.

Today, obesity is a global pandemic and has been ranked fifth among the causes of worldwide mortality. Although the figures vary in different studies, it has been reported that the prevalence of obesity among psoriatics is >50%.

Traditionally, anthropometric measurements such as waist circumference (WC) and body mass index (BMI) do not differentiate between subcutaneous fat and visceral fat, the latter being associated with cardiovascular risk factors. Lipid accumulation product (LAP) index is a measure of visceral fat and has been found to be a better predictor of cardiovascular risk. However, LAP index has not been well-studied in psoriasis patients.

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circumference (WC) and body mass index (BMI) have been used as a measure of obesity. Central obesity, composed of both visceral fat and subcutaneous fat, is associated with more severe metabolic disturbances compared to general obesity. Of the two components of central obesity, visceral fat has been associated with metabolic syndrome and cardiovascular diseases.\[8\] However, anthropometric measurements such as WC and BMI cannot differentiate between visceral and subcutaneous fat. Computed tomography (CT) and body fat analyzers have been used to quantify visceral fat in psoriasis, but they are expensive and not freely available.\[9,10\] Thus, a simple, easily calculated indicator of visceral obesity is needed for easier and better assessment of obesity among psoriasis patients.

Lipid accumulation product (LAP) index calculated from WC, and serum triglyceride (TG) level is one such marker of visceral fat and has been found to be a better predictor of metabolic syndrome, diabetes mellitus, and cardiovascular risk.\[11-14\] Recently, several studies have shown LAP index to be an accurate marker of adverse cardiovascular profile in patients of polycystic ovarian disease.\[15-17\] However, though obesity has been found to be common among psoriasis, studies linking visceral adiposity to psoriasis are comparatively rare, particularly in the Indian scenario. Studies linking obesity markers, particularly the markers of visceral obesity with severity and duration of psoriasis, are rarer still. To fill this knowledge lacuna, this study was planned to investigate the association between psoriasis and LAP index, which is a marker of visceral fat. The present study also aimed to detect a correlation, if any between LAP index and severity and duration of psoriasis.

**Materials and Methods**

The study was a case–control study conducted between November 2015 and April 2016 at a tertiary care institute in south India. The study was approved by the Institutional Research Committee and Ethics Committee, which follow the guidelines of the Helsinki Declaration. Written informed consent was taken from all study participants.

Since we could not find any studies on LAP index among psoriasis patients, to calculate the sample size, we performed a small retrospective analysis and found mean LAP index in normal individuals as 31.5 ± 14.4 and in psoriasis patients 47.4 ± 21.6. Based on this, the sample size was calculated to be 29 in each group, to achieve 90% power of the study and 5% significance level.

Forty patients of chronic plaque psoriasis who attended the dermatology outpatient section and 42 healthy controls who came for a routine health check to our hospital were included in the study. Patients with liver diseases, diabetes mellitus, on systemic steroids, lipid-lowering drugs, and systemic therapy for psoriasis were excluded from the study. Controls with liver diseases, known systemic illnesses such as diabetes, hypertension, and those on lipid-lowering drugs, systemic steroids, retinoids, and other immunosuppressants were excluded from the study.

General physical examination was done for the cases and controls including height, weight, BMI, and WC. BMI was calculated by the formula: Weight (in kg)/(height in m)\(^2\) and WC was measured using a measuring tape at the level of uppermost part of the iliac crest around the abdomen ensuring that the tape remains horizontal. A detailed cutaneous examination including the type, distribution, and arrangement of primary lesions and secondary changes in patients was undertaken. Severity of psoriasis was assessed by psoriasis area severity index (PSI). Psoriasis patients with PASI \(\leq 10\) were classified as “mild psoriasis group” and those with PASI >10 were classified as “moderate-to-severe psoriasis group.”\[14\]

We included 20 patients each belonging to mild and moderate-to-severe psoriasis group using a stratified random sampling technique.

Under aseptic precautions, 3 ml of fasting blood samples were taken by antecubital venipuncture into plain vacutainer tubes from the healthy controls and psoriasis patients. Samples were centrifuged at 1000 rpm for 10 min within 1 h of collection and separated serum was analyzed. Serum TG was measured using automated clinical chemistry analyzer (Roche Cobas Integra plus) using Roche kits according to supplied kit literature. LAPI Index was calculated for men \(((WC \text{ (cm)}-65) \times TG \text{ [mmol/L]})\) and for women \(((WC \text{ (cm)}-58) \times TG \text{ [mmol/L]})\).\[14\]

**Statistical analysis**

The data were analyzed by SPSS software version 16 and \(P < 0.05\) was considered statistically significant. Since the data were not normally distributed, Mann–Whitney U-test was done for comparing the age, BMI, WC, TG, and LAP index between the cases and controls. To compare, the LAP index between mild psoriasis and moderate-to-severe psoriasis groups, again Mann–Whitney U-test was done. Spearman’s correlation coefficient was calculated to assess the correlation between LAP index and duration of psoriasis and also LAP index and PASI within the psoriasis group. Logistic regression models were done to assess the impact of age, BMI, WC, TG, and LAP index on chronic plaque psoriasis.

**Results**

The baseline characteristics of all the study participants are shown in Table 1. There was no statistically significant difference \((P > 0.05)\) in age, BMI, WC, and serum TG levels between the controls and psoriasis patients.
Figure 1 represents the comparison of LAP index between psoriasis patients and controls. A statistically significant difference ($P < 0.001$) was observed between the LAP index of controls ($23.79 \pm 13.02$) and that of psoriasis patients ($46.42 \pm 27.2$). The comparison of LAP index between mild disease (PASI $\leq 10$) and moderate-to-severe disease (PASI $>10$) among psoriasis patients is represented by Figure 2. LAP index was significantly higher ($P = 0.028$) in the moderate-to-severe psoriasis group ($56.02 \pm 30.09$) as compared to the mild psoriasis group ($36.82 \pm 20.49$).

Figure 3 shows the correlation between PASI and LAP index in psoriasis patients. Within the psoriasis group, there was no correlation between the severity of psoriasis calculated by PASI and LAP index using Spearman’s correlation coefficient. Similarly, there was no correlation between the duration of psoriasis and LAP index by Spearman’s correlation coefficient [Figure 4]. Only LAP index emerged as a significant risk factor for psoriasis (odds ratio = 1.07; 95% confidence interval: 1.03–1.11) on multiple logistic regression analysis.

**Table 1: Comparison of baseline characteristics of the study participants**

| Parameter     | Control group | Psoriasis group | $P$  |
|---------------|---------------|-----------------|------|
|               | (n=42)        | (n=40)          |      |
|               | Mean±SD       | Median          | Mean±SD       | Median          |      |
| Age (years)   | 46.36±10.11   | 45.5            | 44.83±12.83   | 44.5            | 0.574|
| BMI           | 23.75±3.79    | 24              | 24.12±3.48    | 23.65           | 0.817|
| WC (cm)       | 85.17±10.45   | 83              | 86.47±8.9     | 89              | 0.363|
| TG (mg/dL)    | 125.93±53.01  | 111             | 158.4±125.53  | 141             | 0.058|

Difference in age, BMI, WC and TG between psoriasis and control groups is not statistically significant ($P>0.05$). BMI: Body mass index, WC: Waist circumference, TG: Triglycerides, SD: Standard deviation

**Discussion**

Psoriasis, though a dermatological disease, has been associated with a host of metabolic derangements such as obesity, dyslipidemia, hypertension, insulin resistance, and metabolic syndrome. However, central obesity, which has been associated with increased cardiovascular morbidity, has largely been unexplored among psoriasis patients. This factor attains greater significance in the Indian scenario where obesity has reached epidemic proportions. Hence, this study was carried out to investigate the association of central obesity with psoriasis using LAP index as a marker for central obesity.

Obesity has a complex relationship with psoriasis. Studies have consistently shown a strong association between psoriasis and BMI. Obesity was found to be an independent risk factor for psoriasis and HLA-CW6, the most important susceptibility locus for psoriasis has been associated with obesity. In fact, a study has shown a positive correlation of severity of psoriasis calculated by PASI with BMI, WC, and waist-to-hip ratio. Obesity generally precedes the appearance of psoriasis and increases BMI, and increases the risk of development of psoriasis. However, in a recent population-based study, obesity was reported to be a consequence rather than a risk factor for psoriasis. This claim was substantiated by other studies which found that lack of physical exercise due to social stigma, psoriatic arthritis, and alcohol consumption could be responsible for obesity in psoriasis patients. Further, psoriasis patients who are obese were found to be more difficult to treat.

Association between visceral fat and psoriasis has been described, but visceral fat in these studies was measured by CT and body composition analyzer. Since these analytical approaches require technological expertise and expensive equipment, it is not possible to use them for...
routine clinical practice, particularly in a country like India. Hence, LAP index, which can be easily calculated from anthropometry and simple laboratory tests, is a more useful tool in regular clinical practice.

In our study, we did not find any significant difference in age, BMI, WC, and serum TG between cases and controls. The results are comparable to the study done in Turkey where they reported no difference in WC among psoriatics and controls, but a significantly higher BMI in cases. However, the results are in contrast with some other studies which have consistently reported a significantly higher BMI among psoriasis patients as compared to controls. The mean age in our study of psoriasis patients was 44.83 years, which is comparable to the Turkish study correlating visceral fat with psoriasis.

Our study showed a significantly higher LAP index among psoriasis patients compared to controls, indicating a higher visceral fat in psoriasis. Moreover, our study revealed LAP index to be the only significant risk factor strongly associated with psoriasis, as compared to BMI, WC, and TG. This significant difference in visceral fat in spite of similar WC was in concordance with other studies attempting to link visceral obesity with psoriasis. The Turkish study which was done using body composition analyzer found significantly higher visceral fat rating among psoriasis patients compared to controls. The study was in concordance with the Turkish study correlating visceral fat with psoriasis.

In our study, we found a significantly higher LAP index in psoriasis patients with PASI >10 compared to psoriasis patients with PASI ≤10, indicating that the amount of visceral fat is significantly higher in psoriasis patients who need systemic therapy than those who can be managed with topical therapy. However, we failed to find any correlation between LAP index with either PASI or duration of psoriasis, thereby failing to establish a causal relationship between severity of psoriasis and visceral obesity. The results are in accordance with the Turkish study who failed to correlate PASI with visceral fat rating. In contrast, previous studies have proved a causal relation between PASI and obesity though not visceral obesity. Insulin resistance has been showed to provide the causal link between obesity and psoriasis. Thus, our results could lead us to infer that though higher degree of visceral obesity is associated with a more severe form of psoriasis, it is not a linear relationship. This finding assumes greater importance in patients with a PASI >10, as they have a higher probability of high visceral obesity and would be at a greater risk of cardiovascular diseases.

Our study, however, has certain limitations. It was a case–control study conducted with a small sample size. Moreover, it has not taken into account the treatment modalities and treatment status of the psoriasis patients. Further, our study was not designed to answer whether obesity causes severe psoriasis or vice versa. Thus, further large-scale epidemiological studies are needed to confirm the association of LAP index with psoriasis. Furthermore, experimental studies using animal models would be useful to elucidate the molecular mechanism underlying the link between visceral obesity and psoriasis.
Conclusion
Our study suggested a link between high LAP index and psoriasis, thereby linking visceral obesity with psoriasis. Hence, evaluation of visceral fat in psoriasis patients will help in identification of more individuals at high risk of cardiovascular morbidity, even in those patients whose BMI and WC are within normal limits. Therefore, routine measurement of LAP index is indicated in all psoriasis patients, more so in patients with PASI >10 for early diagnosis and management of cardiovascular disease risk.

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Conflicts of interest
There are no conflicts of interest.

What is new?
High LAP index in psoriasis indicates a higher amount of visceral fat and thereby a higher cardiovascular disease risk. LAP index is also higher in moderate-to-severe psoriasis patients.

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