Association of Metabolic Syndrome and Hidradenitis Suppurativa

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IMPORTANCE An association between the metabolic syndrome (MetS) and chronic inflammatory diseases, such as psoriasis or rheumatoid arthritis, has been suggested. Hidradenitis suppurativa (HS), a more localized chronic inflammation of the skin, has been speculated to have a similar association. Hidradenitis suppurativa is a substantial burden for the individual and a socioeconomic burden globally. Information about the burden of possible comorbidities is scarce.

OBJECTIVE To investigate the possibility of an association between HS and MetS.

DESIGN, SETTING, AND PARTICIPANTS Cross-sectional population- and hospital-based study of HS and MetS. We identified 32 patients with physician-verified HS from the outpatient clinic at the Department of Dermatology, Roskilde Hospital, and 326 patients with HS and 14,851 individuals without HS from the general population. Individuals with HS were younger, predominantly female, and more often smokers compared with the non-HS group.

EXPOSURE Hidradenitis suppurativa.

MAIN OUTCOMES AND MEASURES Metabolic syndrome and its components of diabetes mellitus, hypertension, dyslipidemia, and obesity.

RESULTS When compared with the non-HS group, the odds ratios (ORs) for the hospital HS and population HS groups were 3.89 (95% CI, 1.90-7.98) and 2.08 (95% CI, 1.61-2.69), respectively, for MetS; 5.74 (95% CI, 1.91-17.24) and 2.44 (95% CI, 1.55-3.83), respectively, for diabetes mellitus; 6.38 (95% CI, 2.99-13.62) and 2.56 (95% CI, 2.00-3.28), respectively, for general obesity; and 3.62 (95% CI, 1.73-7.60) and 2.24 (95% CI, 1.78-2.82), respectively, for abdominal obesity. With regard to dyslipidemia, significant results were found for decreased levels of high-density lipoprotein cholesterol, with ORs of 2.97 (95% CI, 1.45-6.08) and 1.94 (95% CI, 1.52-2.48) for the hospital HS and general population HS groups, respectively, when compared with the non-HS group. With regard to increased triglyceride levels, only the result for the population HS group compared with the non-HS group was significant, with an OR of 1.49 (95% CI, 1.18-1.87). The OR for hypertension, which was only significant for the hospital HS group compared with the non-HS group, was 2.14 (95% CI, 1.01-4.53). Obesity and inflammation acted as possible confounders. The ORs were higher for the hospital HS group compared with the population HS group. The association between HS and MetS was not influenced by the degree of HS severity.

CONCLUSIONS AND RELEVANCE As with more systemic inflammatory diseases, HS appears to be associated with MetS, indicating substantial comorbidities. Because this study is cross-sectional, causality remains to be explored.
Hidradenitis suppurativa (HS) is a chronic, localized inflammatory skin disease producing inflamed nodules in apocrine gland-bearing skin.\(^1,2\) The treatment of HS is often inadequate, and the disease inflicts a significant burden on patients, in whom pain and suppuration from lesions often lead to inactivity, depression, and significantly impaired quality of life.\(^3,4\) Changes in patients’ socioprofessional activity indicate the presence of important disease-related impairment.\(^5,6\) Hidradenitis suppurativa may be more common than hitherto suggested. The disease is often misdiagnosed or underdiagnosed, and prevalence estimates therefore range from 0.05% to 4%.\(^7,10\) An increasing incidence during the last 20 years has been suggested.\(^8\) The comorbidities of HS are poorly described, and the available data are solely hospital based.\(^12,13\) The pandemic cluster of cardiovascular risk factors called the metabolic syndrome (MetS) co-occurs more commonly with chronic inflammatory diseases, such as rheumatoid arthritis and psoriasis.\(^14-18\) In contrast to psoriasis, HS may be considered a more localized inflammation of the skin. An association between HS and MetS has been hypothesized to exist and cause significant comorbidity, negatively influencing the overall burden of disease. We therefore investigated a possible association using population- and hospital-based data in a cross-sectional study to explore the association and assess its possible clinical relevance.

Methods

Ethical Statement

This study was accepted by the ethics committee of the Zealand region (project numbers SJ-191, SJ-113, and SJ-114) in Denmark. Written informed consent was obtained from all study participants.

Study Design

We performed a cross-sectional study of the association of HS (referred to as the exposure) and MetS (referred to as the outcome). We investigated 2 different groups of individuals with HS. The first group was identified in a general population sample (population HS group); the second was identified in a hospital-based sample (hospital HS group).

Exposure

The population HS group was identified in the Danish General Suburban Population Study (GESUS). GESUS was initiated in January 2010 with ongoing enrollment and is a cross-sectional study of the adult Danish suburban general population in the Næstved municipality (70 km south of Copenhagen).\(^19\) All citizens 30 years and older and a random selection of those aged 20 to 30 years were invited to participate. The population HS group was defined based on whether participants reported boils within the previous 6 months and a minimum of 2 boils (in the following 5 possible locations: axillae, groin, genitals, mammae, or other [eg, perianal, neck, or abdomen]) on a questionnaire. The validation of this HS diagnosis is discussed in a separate report\(^9\) showing a sensitivity of 90% and a specificity of 97%. The overall participation rate in GESUS was 49.3%. Further details about GESUS can be found in Bergholdt et al.\(^19\)

The hospital HS group was recruited from the outpatient clinic at the Department of Dermatology at Roskilde Hospital (serving the region of Zealand, which includes Næstved). Inclusion criteria consisted of the diagnostic code for HS from the International Classification of Diseases, 10th Revision (L73.2) and systemic or laser treatment for HS, which indicated moderate or severe disease. The diagnosis of HS was confirmed by results of a physical examination by a physician from the Department of Dermatology (I.M.M., G.R.V., K.Z., or K.S.I.). Eligible patients were invited to undergo the same examination as the population sample. The participation rate was 33 of 98 eligible patients (33.7%). The distribution of age and sex did not differ between participants and nonparticipants (data not shown).

Non-HS participants were defined as participants from GESUS without HS. This population constituted the non-HS group for this study.

Outcomes

Both HS groups and the population-based non-HS group completed the same questionnaire and physical examinations and contributed blood samples. The definitions of the MetS outcome were based on the methods of GESUS involving the GESUS questionnaire (self-reporting), physical examination, and laboratory evaluation of nonfasting venous blood samples.\(^19\)

The MetS involves the following 4 key components: diabetes mellitus, hypertension, dyslipidemia, and obesity. The methods of this study used to define the outcome are listed in Box 1 and Box 2.\(^20-24\) We used a modified version of the criteria of the National Cholesterol Education Program Adult Treatment Panel III,\(^20\) which also accounts for the harmonized definition of MetS.

Exploring Possible Confounders

We considered the following possible confounders:

1. General obesity defined by body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) measured at the physical examination;
2. Inflammatory load defined by high-sensitivity C-reactive protein level measured in venous blood samples;
3. Self-reported level of physical activity at work and in leisure time;
4. Self-reported intake of atherogenic (ie, saturated) fat, fish, fruit/vegetables, eggs, and alcohol.

Exploring the Severity of HS

The definition of severity of HS for the population HS group was based on self-reported information on numbers and locations of boils and subsequent scarring and was inspired by the Hurley score, which is considered almost static.\(^25\) Mild HS was defined as a minimum of 2 boils and no subsequent scarring; moderate HS, a minimum of 2 boils and subsequent scarring; and severe HS, a minimum of 2 boils in a minimum of 2 locations and subsequent scarring. The
severity of HS for the hospital HS group was assessed by the Sartorius score based on results of the physical examination.25 We also explored the severity of HS in the population and hospital HS groups as the number of boils to constitute a more dynamic scale.

### Statistical Analysis

We compared the HS and non-HS groups using logistic regression adjusting for age, sex, and smoking status, yielding an adjusted odds ratio (OR) for binary outcomes, and linear regression of log-transformed outcomes adjusting for age, sex, and smoking status, yielding an adjusted ratio of means (RM) for continuous outcomes. The binary effects measure (OR) expresses whether an association exists or not and the strength of that association. The continuous effect measure (RM) expresses the difference between the mean values of the HS vs non-HS groups. Thus, the RM provides the expected higher value of an individual with HS compared with a non-HS individual (eg, RM of 1.21 for BMI means that individuals with HS are expected to have 21% higher BMI than those without HS). In comparison, the OR is based on cutoff values and provides the expected higher odds (eg, OR of 2.00 for a BMI > 30 means that individuals with HS have 2 times higher odds of having a BMI > 30). P < .05 was considered to be statistically significant.

<table>
<thead>
<tr>
<th>Continuous Outcome</th>
<th>Binary Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obesity</strong></td>
<td><strong>Diabetes Mellitus</strong></td>
</tr>
<tr>
<td>1. Quantification of obesity based on BMI and WC, based on physical examination findings</td>
<td></td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td><strong>Dyslipidemia</strong></td>
</tr>
<tr>
<td>1. Increased plasma HDL levels of &lt;40 mg/dL for men and &lt;50 mg/dL for women based on results of the physical examination findings</td>
<td></td>
</tr>
<tr>
<td><strong>Continuous Outcome</strong></td>
<td></td>
</tr>
<tr>
<td>1. Quantification of HDL level (mmol/mol) and nonfasting plasma glucose level based on analysis of the blood sample</td>
<td></td>
</tr>
</tbody>
</table>

The ORs and RMs for the population HS group are expressed as OR\textsubscript{pop} and RM\textsubscript{pop}. Similarly, ORs and RMs for the hospital HS group are expressed as OR\textsubscript{hos} and RM\textsubscript{hos}.

We examined the influence of possible confounders on the association between HS and MetS by including these in the regression model and assessing the effect on the OR. We explored the relationship between the severity of HS and MetS.
Results

The data used from GESUS were collected from January 1, 2010, through August 2, 2012. A total of 32 individuals with HS from the hospital, 326 with HS from the general population, and 14,851 non-HS individuals from the general population were identified. The background factors and characteristics of the HS and non-HS groups showed that individuals with HS were predominately younger, female, and smokers (Table).

We investigated the association of HS with the conditions involved in the MetS—diabetes mellitus, hypertension, dyslipidemia, and obesity—and with MetS defined by the criteria of the National Cholesterol Education Program Adult Treatment Panel III. The methods used to define the outcome are described in Box 1 and Box 2. The ORs and RMs adjusted for age, sex, and smoking status are illustrated in Figure 1 and Figure 2.

Association of MetS and MetS Components With HS

When adjusting for age, sex, and smoking status, the association between HS and MetS was significant for the hospital and population HS groups (ORhos, 3.89 [95% CI, 1.90-7.98]; ORpop, 2.08 [95% CI, 1.61-2.69]). Findings for the associations of MetS components with HS are discussed individually. We found a uniform pattern of the hospital HS group having higher ORs than the population HS group.

Diabetes Mellitus

When adjusting for age, sex, and smoking status, a significant association between HS and diabetes mellitus was found for the hospital and population HS groups compared with the non-HS group (ORhos, 5.74 [95% CI, 1.91-17.24]; ORpop, 2.44 [95% CI, 1.55-3.83]). When we explored the type of antidiabetic used (insulin or noninsulin), only the association of noninsulin drugs was significant (ORhos, 2.05 [95% CI, 1.75-2.36]; ORpop, 3.50 [95% CI, 2.05-5.98]). When quantifying the association, only the RMhos was significant, with levels 8% (95% CI, 2%-15%) and 10% (95% CI, 5%-15%) higher for the HS groups compared with the non-HS group.

Hypertension

When adjusting for age, sex, and smoking status, a significant association between HS and hypertension was found only for the hospital HS group (ORhos, 2.14 [95% CI, 1.01-4.53]). When quantifying this association, only the RMhos for diastolic blood

Table. Background Factors, Characteristics, and Distribution of Outcome in Study Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hospital (n = 32)</th>
<th>Population (n = 326)</th>
<th>Non-HS Group (n = 14,851)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (range), y</td>
<td>42 (22-64)</td>
<td>47 (22-78)</td>
<td>56 (20-96)</td>
</tr>
<tr>
<td>Sex, female vs male, No. (%)</td>
<td>25 (78) vs 7 (22)</td>
<td>218 (67) vs 108 (33)</td>
<td>8090 (54.5) vs 6761 (45.5)</td>
</tr>
<tr>
<td>Smoking status, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>17 (53.1)</td>
<td>133 (40.8)</td>
<td>2683 (18.1)</td>
</tr>
<tr>
<td>Past</td>
<td>13 (40.6)</td>
<td>114 (35.0)</td>
<td>5633 (37.9)</td>
</tr>
<tr>
<td>Never</td>
<td>1 (3.1)</td>
<td>70 (21.5)</td>
<td>5684 (38.3)</td>
</tr>
<tr>
<td>Ethnicity, white, No. (%)</td>
<td>31 (96.9)</td>
<td>315 (96.6)</td>
<td>14,624 (98.5)</td>
</tr>
<tr>
<td>CRP level, median (range), mg/L</td>
<td>5.1 (0.2-119.0)</td>
<td>2.1 (0.1-38.0)</td>
<td>1.4 (0.1-136.0)</td>
</tr>
<tr>
<td>HS severity distribution, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>4 (12.5)</td>
<td>165 (50.6)</td>
<td>NA</td>
</tr>
<tr>
<td>Moderate</td>
<td>5 (15.6)</td>
<td>90 (27.6)</td>
<td>NA</td>
</tr>
<tr>
<td>Severe</td>
<td>23 (71.9)</td>
<td>71 (21.8)</td>
<td>NA</td>
</tr>
<tr>
<td>Sartorius score, median (range)</td>
<td>29 (5-176)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>No. of boils, median (range)</td>
<td>12 (1-171)</td>
<td>3 (2-106)</td>
<td>NA</td>
</tr>
<tr>
<td>MetS, No. (%)b</td>
<td>17 (53.1)</td>
<td>105 (32.2)</td>
<td>3192 (21.5)</td>
</tr>
<tr>
<td>Diabetes mellitus, No. (%)c</td>
<td>4 (12.5)</td>
<td>23 (7.1)</td>
<td>728 (4.9)</td>
</tr>
<tr>
<td>Hypertension, No. (%)d</td>
<td>18 (56.3)</td>
<td>157 (48.2)</td>
<td>9007 (60.6)</td>
</tr>
<tr>
<td>Blood sample, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased HDL level</td>
<td>15 (46.9)</td>
<td>108 (33.1)</td>
<td>2687 (18.1)</td>
</tr>
<tr>
<td>Increased TG level</td>
<td>16 (50.0)</td>
<td>159 (48.8)</td>
<td>6428 (43.3)</td>
</tr>
<tr>
<td>Obesity, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General (BMI)</td>
<td>16 (50.0)</td>
<td>107 (32.8)</td>
<td>2799 (18.8)</td>
</tr>
<tr>
<td>Abdominal (WC)</td>
<td>20 (62.5)</td>
<td>168 (51.5)</td>
<td>5524 (37.2)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CRP, C-reactive protein; HDL, high-density lipoprotein cholesterol; HS, hidradenitis suppurativa; MetS, metabolic syndrome; NA, not applicable; TG, triglycerides; WC, waist circumference.

SI conversion factor: To convert CRP to nanomoles per liter, multiply by 9.524.

a Missing data for groups are reported in eTable 5 in the Supplement.

b Indicates a modified Adult Treatment Panel III definition.

c Indicates self-reported or based on results of laboratory analysis of venous blood sample.
d Indicates self-reported or measured during the physical examination.
pressure was significant, with a level 5% (95% CI, 1%-10%) higher in the HS hospital group when compared with the non-HS group.

Dyslipidemia
When adjusting for age, sex, and smoking status, an association between HS and high triglyceride (TG) levels was found, but the association was statistically significant for the population HS group only (OR$_{pop}$, 1.49 [95% CI, 1.18-1.87]). A significant association between HS and low levels of high-density lipoprotein cholesterol (HDL) was found (OR$_{hos}$, 2.97 [95% CI, 1.45-6.08]; OR$_{pop}$, 1.94 [95% CI, 1.52-2.48]). When quantifying the association, the RM$_{hos}$ for TG level was 21% (95% CI, 0%-46%) and the RM$_{hos}$ was 11% (95% CI, 4%-17%), significantly higher than in the non-HS group. The RM$_{hos}$ for HDL level was 14% (95% CI, 5%-22%) and the RM$_{pop}$ was 10% (95% CI, 7%-13%), significantly lower than in the non-HS group.

Obesity
When adjusting for age, sex, and smoking status, we found a significant association between general obesity by BMI and abdominal obesity by waist circumference (WC) for the population and hospital HS groups. With regard to general obesity, the OR$_{hos}$ was 6.38 (95% CI, 2.99-13.62) and the OR$_{pop}$ was 2.56 (95% CI, 2.00-3.28). With regards to abdominal obesity, the OR$_{hos}$ was 3.62 (95% CI, 1.73-7.60) and the OR$_{pop}$ was 2.24 (95% CI, 1.78-2.82).

When we quantified the association, the RM$_{hos}$ for BMI was 21% (95% CI, 14%-29%) and the RM$_{pop}$ was 9% (95% CI, 7%-11%), significantly higher for the HS groups than the non-HS group. The RM$_{hos}$ for WC was 14% (95% CI, 9%-19%) and the RM$_{pop}$ was 7% (95% CI, 6%-9%), significantly higher for the HS groups than the non-HS group.

Role of Obesity, Inflammatory Load, Physical Activity, Diet, and HS Severity
When exploring the possible confounders, we found that adjusting for obesity or inflammatory load reduced the strengths of the associations; however, the associations remained. Thus, obesity and inflammation were identified confounders, whereas level of physical activity and diet were not (eTable 3 in the Supplement). The association between HS and MetS or between HS and the MetS components was not influenced by the degree of HS severity with the exception of general obesity (eTable 4 in the Supplement).

Discussion
This broad population- and hospital-based study suggests an association between HS and MetS and the individual MetS components of diabetes mellitus, low levels of HDL, and general and abdominal obesity. Positive associations were also found with regard to hypertension and dyslipidemia. Hypertension, however, was only statistically significant in the hospital HS group. When we used binary data (with acknowledged cutoff values) for increased levels of TG, only the association for the population HS group was statistically significant. However, statistically significant differences in the TG levels between the hospital HS group and the non-HS group were found when we examined the continuous data.

The hospital HS group had uniformly higher ORs than the population HS group. This result could indicate that differences in HS severity or the recent suggestion of different HS subtypes may play a part. This difference might also be an expression of a dilution of the population-based HS sample due to misclassification bias. The stronger ORs for the hospital HS group may also indicate detection bias; that is, HS patients within the hospital system are more likely to have been diagnosed with the outcome, which influences the self-reported diagnoses. However, detection bias was minimized by the inclusion of self-reported diagnosis and results of the physical examination and laboratory analysis of blood samples.

When we examined the MetS components individually, the ORs for diabetes mellitus indicated a positive association, mainly due to type 2 diabetes mellitus. Quantification analysis demonstrated that nonfasting glucose level was 1% to 8% higher, and hemoglobin A$_1c$ level was 1% to 10% higher in the HS groups compared with the non-HS group. Previous studies have suggested that an approximately 1% reduction in hemoglobin A$_1c$ level may decrease the risk for myocardial infarction by 14% to 16%, indicating that the abnormalities seen in the HS patients have clinical significance. Further indirect support for this association is provided by the observation that metformin hydrochloride treatment may ameliorate HS.
Furthermore, the ORs for general and abdominal obesity were significant. When quantified, BMI was 9% to 21% greater, and WC was 7% to 14% larger in the HS groups than the non-HS group. Trimming of the WC by 4.4 cm from 102 cm (ie, a 4.3% reduction) may reduce the risk for diabetes mellitus by 58%, similarly indicating clinical relevance and a substantial potential for prevention in this generally neglected disease.29

The association of an atherogenic lipid profile (ie, increased TG levels and decreased HDL levels) was significant with regard to the decrease in HDL levels in both HS groups, but only significant with regard to the increase in TG levels in the population HS group. When quantified, the HS groups had an 11% to 21% higher TG level and a 10% to 14% lower HDL level than the non-HS group. A follow-up study of the effects of statins in 17 802 healthy individuals showed a significant reduction of cardiovascular events when TG levels were reduced by 17% and HDL levels were increased by 4%.30

Having hypertension was only significant with regard to the hospital HS group. When quantifying the hospital HS group, only the diastolic blood pressure was significantly increased by 5%. A recent meta-analysis of preventive treatment of hypertension suggested that lowering diastolic blood pressure from 90 to 85 mm Hg (ie, a 6% reduction) would reduce the risk for cardiovascular heart disease and stroke by approximately 20% and 30%, respectively.31

Our findings are in concordance with and expand the findings of 2 previous hospital-based studies.28,32 In aggregate, these data therefore suggest that the comorbidities of HS are clinically significant and that an increased clinical awareness of the HS diagnosis and its comorbidities might be warranted in this potentially substantial group of patients.

Obesity and inflammatory load were identified as possible confounders, partly but not exclusively explaining the associations and indicating a complex and overlapping relationship. Surprisingly, we found that physical activity level, diet and alcohol consumption, and the severity of HS did not influence the associations. The latter is in contrast to our supposition that the hospital HS group had higher ORs because of more severe disease, implying detection bias as previously discussed or an insufficiently sensitive measure of disease severity. Therefore, one can speculate that HS subtypes may influence the association with MetS more strongly than HS severity.

The association of MetS has also been shown in the chronic generalized inflammatory disease rheumatoid arthritis and the skin disease psoriasis, for which the ORs for MetS are approximately 2.00 compared with almost 6.00 in HS.8 Furthermore, the associations in psoriasis have been suggested to be significant only with regard to a hospital-based HS cohort,8 implying that the burden of these comorbidities is greater for HS than for psoriasis. Therefore, the common etiological factors between inflammatory skin disease and MetS more strongly than HS severity.

The major strengths of our study are the large population-based HS group and the inclusion of individuals with HS from hospital- and population-based groups. The broad recruitment reduced selection bias with a broader range of disease severities and thereby aided the generalization of the results. To explore misclassification bias of individuals with HS, we vali-

Figure 2. Hidradenitis Suppurativa (HS) and the Components of the Metabolic Syndrome

<table>
<thead>
<tr>
<th>Component</th>
<th>RM (95% CI)</th>
<th>Negative Association</th>
<th>Positive Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonfasting blood glucose level</td>
<td>1.08 (1.02-1.15)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HbA1c level (IFCC)</td>
<td>1.10 (1.05-1.15)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>1.05 (1.01-1.10)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>1.02 (0.97-1.07)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TG level</td>
<td>1.21 (1.00-1.46)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HDL level</td>
<td>0.88 (0.78-0.95)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LDL level</td>
<td>0.94 (0.84-1.06)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TC level</td>
<td>0.96 (0.90-1.06)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>General obesity, BMI</td>
<td>1.21 (1.14-1.29)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Abdominal obesity, WC</td>
<td>1.14 (1.09-1.19)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
dated the HS definition with a sensitivity of 90% and a specificity of 97%. Because the self-reported questions used to identify HS patients refer to symptoms (ie, boils) rather than the actual diagnosis (ie, do you have HS?), we strove to optimize the inclusion of individuals with undiagnosed and misdiagnosed HS in the population, which is particularly pertinent for undiagnosed diseases. The diagnosis of HS among hospitalized participants was physician verified. The combined methods of self-reporting, laboratory analysis of blood samples, and physical examination aimed to reduce false-negative findings with regard to the outcome (MetS). Finally, essential possible confounders were recognized and explored systematically.

Potential limitations merit consideration. First, one must recognize that, because this study is cross-sectional, we cannot prove causality between HS and MetS. Furthermore, the population is suburban, most of the participants were white, and the group aged 20 to 30 years was underrepresented, which may limit the generalizability of our findings. In addition, an age bias was found between the HS and non-HS groups. However, we accommodated this age bias by age adjustments. The low participation rate of the hospital HS group increased variation and reduced power. The low participation rate may be an expression of the limited resources of HS patients due to the physical and mental burden of the disease. Nonfasting blood samples were used. However, differences in fasting and nonfasting lipid levels have been shown to be minimal. Furthermore, we did not include information on HS medical treatment, which might confound the results. Last, as with any questionnaire survey, the risk for recall bias was present.

Conclusions

The data suggest an association between HS and the MetS in the hospital and population HS groups. This allegedly increased disease burden due to comorbidities indicates that HS patients require general medical attention beyond the skin.

Future longitudinal studies with similar methods are needed to explore the temporal relationship of these associations. These studies should be large, include individuals with HS from the general population and hospital, and explore the differences between these groups and additional possible confounders.

REFERENCES

NOTABLE NOTES

Apple of the Dermatologist’s Eye

Deshan F. Sebaratnam, MBBS(Hons)

Dermatology is an intrinsically visual specialty, with pattern recognition a vital skill for clinical practice. It therefore follows that many of the classic descriptions of cutaneous pathologic abnormalities draw on parallels from the natural world, particularly the realm of botany. Trees, leaves, fruits, and flowers have all lent themselves to morphological descriptions over the centuries.

The distribution of the papulosquamous plaques of pityriasis rosea has been compared to a fir tree and the hair shaft changes of trichorrhexis nodosa to bamboo. The figurate polycyclic plaques of erythema gyratum repens have been described as resembling wood grain and the jagged forked lesions of livedo racemosa tree branches. The induration associated with scleroderma is classically described as woody, and the neurofibromas of neurofibromatosis are said to have a rubbery consistency. Lichenification derives its name from lichen (a composite organism of fungi and algae living symbiotically), and the tumors of mycosis fungoides were initially thought to be fungal growths (though strictly speaking, the kingdom of Fungi is separate from that of plants).

The ovate shape of the hypopigmented macules of tuberous sclerosis has been compared to ash leaves, and the color of Zoon balanitis has been described as resembling that of fallen autumn leaves.

Fruits have inspired a range of dermatological descriptions, including peau d’orange, tapioca vesicles in pompholyx, and cayenne pepper spots in pigmented purpuric dermatoses. The berries are particularly well represented through strawberry birthmarks, mulberry xanthomas, and cherry angiomas.

Flowers have also given rise to dermatological descriptions, such as the heliotrope rash of dermatomyositis, which originates from the lilac color of flowers of the genus Heliotropium. Perhaps the plant that has inspired the greatest number of wordsmiths within dermatology and beyond is the rose. Varicella zoster virus gives rise to “dew drops on a rose petal,” human herpes virus is associated with roseola infantum, and Salmonella typhi produces rose spots. The rose is one of the most recognized signs reported in a range of descriptions: clinically, as linear IgA disease; dermoscopically, as in squamous cell carcinoma; and pathologically, as in cylindromas.

The visual nature of dermatology lends itself to comparisons between cutaneous pathologic abnormalities and those seen in the botanical world, with several classical descriptions firmly “implanted” into the dermatological canon.

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