BRIEF COMMUNICATION
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Desmoglein ELISA in the Diagnosis of Pemphigus and Its Correlation with the Severity of Pemphigus Vulgaris

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ABSTRACT

Anti-desmoglein 3 and 1 autoantibodies are involved in the pathogenesis of pemphigus diseases. Our objective was to assess the value of ELISA in the diagnosis of pemphigus and its correlation with the severity of pemphigus vulgaris.

Based on clinical presentation and histopathologic confirmation for the diagnosis of the pemphigus, 38 patients took part in the study. Sera of the patients were tested by desmoglein 1 and desmoglein 3 ELISA. Also, direct immunofluorescence was performed for all patients which revealed positive results in 36 patients (94.7%).

ELISA was positive in 37 of 38 pemphigus patients (Sensitivity: 97.3%). The relationship between desmoglein 1 index values and skin severity was statistically significant (p<0.05). Desmoglein 3 index values increased with oral severity although this was not statistically significant. Iranian patients similar to Indian patients had higher positive anti-desmoglein 1 autoantibodies.

Desmoglein-ELISA test is appropriate in the diagnosis of pemphigus. Desmoglein 1 index value is statistically correlated with the severity of pemphigus vulgaris.

Key words: ELISA; Desmoglein 1; Desmoglein 3; Pemphigus vulgaris

INTRODUCTION

Pemphigus Vulgaris (PV) and Pemphigus foliaceus (PF) are characterized by the presence of autoantibodies against desmosomal glycoproteins including desmoglein 3 (Dsg3) and desmoglein 1 (Dsg1).1

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Circulating anti-Dsg1 and/or anti-Dsg3 IgG autoantibodies are present in patients with pemphigus.2 Direct immunofluorescent (DIF) and indirect immunofluorescent (IIF) methods, as well as ELISA are used for the detection of pemphigus auto-antibodies. ELISA is a quantitative method for measuring antibody levels and a useful test for the diagnosis of pemphigus.2,3 This method is more sensitive and specific than IIF. It is also superior to sophisticated immunoblotting techniques.3,4 Furthermore, it has been shown that the sera of patients
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in the active phase of pemphigus contain higher levels of anti-Dsg antibodies including IgG4 and IgG1 antibodies. Moreover it has been reported that the severity of skin and mucosal lesions of pemphigus is related to anti-Dsg1 and anti-Dsg3 antibody levels.

In PV, also the antibody profile correlates with the clinical phenotype of pemphigus, namely cutaneous (C), mucocutaneous (MC), and mucosal (M). In this study, the value of ELISA was determined in the diagnosis of pemphigus disease. Also, we tried to find relationships between the severity of PV and ELISA Dsg3 and Dsg1 index values (as a marker for anti-Dsg antibody levels). The influence of ethnicity on the results of ELISA additionally highlights the importance of such a study among Iranian patients.

PATIENTS AND METHODS

Based on clinical presentation and histopathology, from July 2003 to July 2004, thirty eight pemphigus patients (35 PV, 3 PF) took part in this study. Patients included 25 women and 13 men. Mean age was 46.6 ±16.5 years (17 to 75). Thirty out of 38 patients were new patients and eight patients were in relapse. The 30 new patients included 27 PV and 3 PF patients. At the time of admission, the mean duration of disease in new PV patients was 13.8±11.2 weeks. The eight relapsed patients showed severe flare-up of PV either under treatment of corticosteroid (mean: 23.125 mg/day in 4 patients) or after discontinuation of medications (in 4 patients). Dsg ELISA testing was performed on the sera of 38 patients. Treatment of PV patients was started with 2 mg/kg/day prednisolone plus 2 mg/kg/day azathiprine. Informed consent was obtained from all patients. We classified the severity of the disease according to previous works. The skin severity of pemphigus vulgaris patients was graded according to the involvement of body surface area (BSA) by vesicles, bullae, and erosions as follows: grade 0, no involvement; grade 1, mild disease (up to 10% BSA involvement); grade 2, moderate disease (11 to 30% BSA involvement); grade 3, severe disease (>30% BSA involvement). Also mucosal involvement was graded as follows: grade 0, no mucosal involvement; grade 1, mild disease (only one site with mild involvement); grade 2, moderate disease (only one site but severely involved); grade 3, severe disease (extensive oral erosions).

Anti-desmoglein autoantibodies were detected by ELISA method (kits from Medical and Biological Laboratories Co Ltd. Nagoya, Japan) and index values were calculated based upon manufacturer's instructions using 100-fold serum dilution. The index value of positive reactions was considered greater than 7 and 14 for Dsg3 and Dsg1, respectively. ELISA results of (Dsg3+, Dsg1±) and (Dsg3-, Dsg1+) are compatible with the diagnosis of PV and PF, respectively. Index values up to 150 have linear correlation with anti-Dsg antibody levels. In case of negative ELISA or incompatible test with histopathology, the test was repeated. According to manufacturer, the sensitivity and specificity of ELISA kits were 96.1% and 86.3% for Dsg1 versus 100% and 70.6% for Dsg3, respectively. Direct immunofluorescence similar to procedure by Aithal et al. was performed on skin specimens of all patients.

Kruskal-Wallis test was used to evaluate correlation of disease severity with desmoglein index values. New PV and recurrent patients as well as severity groups (0-4) were compared using Mann-Whitney test.

RESULTS

Dsg ELISA was positive in 37 patients (97.3%) and DIF in 36 patients (94.7%). In 32 out of 35 patients histologically diagnosed as PV, anti-Dsg antibody profile was compatible with PV. In two patients histologically diagnosed as PV, anti-Dsg antibody was in favor of PF. Only in a 38 year-old woman with 6 month history of oral involvement, ELISA was negative incompatible with histopathological and DIF findings in favor of PV. In the 3 patients diagnosed by histopathology as PF, anti-Dsg antibody profile was also in favor of PF. In 8 recurrent PV patients (one M, two C and five MC), concordant with histopathology, anti-Dsg1 and anti-Dsg3 were positive in all patients (100%). The phenotypic distribution of 27 new PV patients and ELISA results are shown in Table 1.

Table 1. ELISA results in different clinical phenotypes of 27 new PV patients

<table>
<thead>
<tr>
<th>Clinical phenotype</th>
<th>No. of patients</th>
<th>No. (%) of patients with Anti-Dsg1*</th>
<th>Anti-Dsg3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucosal</td>
<td>3</td>
<td>0 (0)</td>
<td>2 (66.66)</td>
</tr>
<tr>
<td>Cutaneous</td>
<td>5</td>
<td>4 (80)</td>
<td>4 (80)</td>
</tr>
<tr>
<td>Mucocutaneous</td>
<td>19</td>
<td>15 (78.94)</td>
<td>18 (94.73)</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>19 (70.37)</td>
<td>24 (89)</td>
</tr>
</tbody>
</table>

* Dsg: desmoglein.
Skin and oral severity of 27 new PV patients and 8 recurrent patients according to Dsg1 and Dsg3 index values shown in table 2. Dsg1 index values increased significantly in accordance with skin severity \( (P=0.038) \). There was no statistically significant relationship between Dsg3 index values and skin severity \( (P=0.211) \).

The mean index value of Dsg3 increased insignificantly with oral severity \( (P=0.241) \).

There was no statistically significant relationship between severity of disease and mean index values of Dsg1 and Dsg3 in eight recurrent patients.

Mean levels of Dsg 1 and Dsg 3 index values in new and recurrent PV patients were not statistically different (111.22±122.04 to 118.50±106.49 for Dsg1 and 174.30±26.82 to 259.75±37.67 for Dsg 3 in new and recurrent PV patients, respectively).

**DISCUSSION**

Histopathology is still used as the routine diagnostic test for pemphigus. Though DIF is essential in the diagnostic work-up of pemphigus diseases, its sensitivity is not 100% \( (10, 11) \). In our study, the sensitivity of Dsg ELISA (97.3%) was comparable with previous studies \(^\text{1,2} \) and higher than DIF (94.7%). Results for Dsg ELISA, similar to pathology, was in favor of PF in three PF patients.

On the other hand, in two patients with the clinicopathologic setting of PV, ELISA antibody profile was compatible with PF. Although transition of PV to PF has been reported \(^\text{12} \), clinical and histopathologic features were not suggestive for this assumption because of the incompatible results in the first patient with mucocutaneous phenotype. To describe the incompatibility in the second PV patient with cutaneous phenotype, we suggest that Anti-Dsg3 autoantibody level might be too low to cause mucosal lesions \(^\text{6,13} \). According to previous reports, some patients with the diagnosis of PV or PF may have anti-Dsg autoantibody levels below the cut-off value \(^\text{7} \). This fact could explain the only negative ELISA result in our study. Although the diagnosis of pemphigus is mainly based on histopathologic examinations and immunofluorescence tests \(^\text{14} \), our study confirmed that the addition of Dsg ELISA to the above-mentioned tests increases the diagnostic yield.

**Table 2. Skin and oral severity in 27 new and 8 recurrent PV patients according to Dsg1/3 index values**

<table>
<thead>
<tr>
<th>Degree of severity</th>
<th>No. of patients</th>
<th>Mean of Dsg1 index value +SD*</th>
<th>P value</th>
<th>Mean of Dsg3 index value +SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin Severity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Patients</td>
<td>0</td>
<td>1.53±4.22</td>
<td></td>
<td>23.57±23.16</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>93.95±117.68</td>
<td>0.038</td>
<td>173.50±133.48</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>81.16±68.78</td>
<td></td>
<td>220.00±153.53</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>192.22±154.96</td>
<td></td>
<td>169.04±124.32</td>
<td></td>
</tr>
<tr>
<td>Oral Severity</td>
<td>0</td>
<td>140.76±97.56</td>
<td></td>
<td>104.00±112.51</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>117.68±154.59</td>
<td>NS</td>
<td>146.39±179.40</td>
<td>NS</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>97.00±115.82</td>
<td></td>
<td>215.36±115.96</td>
<td></td>
</tr>
<tr>
<td>Recurrent Patients</td>
<td>0</td>
<td>47.00±0.00</td>
<td></td>
<td>310.00±0.00</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>28.00±0.00</td>
<td>NS</td>
<td>227.00±0.00</td>
<td>NS</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>113.50±119.50</td>
<td></td>
<td>183.00±24.04</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>161.50±121.60</td>
<td></td>
<td>293.75±140.14</td>
<td></td>
</tr>
<tr>
<td>Oral Severity</td>
<td>0</td>
<td>113.00±120.21</td>
<td></td>
<td>213.50±19.09</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>29.00±0.00</td>
<td>NS</td>
<td>166.00±0.00</td>
<td>NS</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>71.00±0.00</td>
<td></td>
<td>108.00±0.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>155.50±127.98</td>
<td></td>
<td>344.25±69.48</td>
<td></td>
</tr>
</tbody>
</table>

* Standard Deviation ** Statistically not significant
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Eighty-nine percent of the new PV patients had anti-Dsg3 antibody. This finding is similar to previous studies. On the other hand anti-Dsg1 autoantibody was positive in 70.3% of new PV patients. This finding showed that Iranian PV patients similar to Indian patients (75%) have higher frequency of positive anti-Dsg1 autoantibody compared with patients of north European origin. Although all recurrent patients showed raised anti-Dsg1 and anti-Dsg3 autoantibodies, the number of patients was not enough to draw a conclusion.

Harman and his colleagues have reported a relationship between anti-Dsg1 and 3 autoantibody levels measured by Dsg ELISA and the severity score of cutaneous and oral involvement in pemphigus vulgaris, respectively. Our results showed that index values of Dsg1, similar to findings by Sharma et al. had statistically significant correlation with skin severity. There was an increasing trend of Dsg3 index values by the oral severity but in contrast to Sharma’s findings, this correlation was not statistically significant. It may be due to the small sample size of our series.

Previously, Harman and colleagues showed that the presence of anti-Dsg1 autoantibodies could be suggestive of a more severe type of PV. Thus, it appears that the anti-Dsg3 and specially anti-Dsg1 autoantibody levels could be good indicators of severity of PV and may be of great benefit in the management and monitoring of patients with PV and PR.

In conclusion, the use of ELISA in combination with routine histopathology and immunofluorescence tests may be considered a helpful diagnostic tool in pemphigus. In addition to being helpful in differentiating pemphigus subgroups, it may increase the sensitivity of our diagnostic work-up.

REFERENCES